INTERIM REPORT NO. 2 CIDECT RESEARCH PROJECT

STATIC STRENGTH OF HIGH STRENGTH STEEL TUBULAR JOINTS

August 1995

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A. Verheul

Contract No. 5BD

Responsibility: Mannesmann Röhren-Werke AG, Mülheim.
(Joints Behaviour and Fatigue Resistance Group).

Location:
1. Delft University of Technology, The Netherlands
2. TNO Delft, The Netherlands
3. Billington Osborne Moss Engineering Ltd., United Kingdom

Key words: High Strength Steel HSS
Static
Tubular Joints

Theme: 0.23.05.0

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CONTENTS

1. Aim of the project

The aim of the project is to determine the influence of high strength steel mechanical parameters on the capacity and ultimate response characteristics of tubular nodes to enable design guide lines for the safe and economic use of these steels to be written.

2. Test Programme

Tests of tubular joints of nominally identical geometry are to be undertaken for three different material grades with yield stress levels at 355, 450, 700 $N/_{mm^2}$.

The detailed design of the test specimens is interlinked with the steel plate selection and the available rolling and fabrication facilities.

The detailed geometry of the joints is given in fig. 1.

3. Progress report

During the last period the plate material has been ordered and the order was given for the fabrication the the specimens.

3.1. Delivery of steel plates

Unfortunately we have had to wait until the beginning of April for the delivery of the HSS-plate material for the specimens.

3.2. Rolling of the tubes

The minimum tube diameter which can be reached by rolling depends on the diameter of the rollers, the plate thickness and the yield strength.
In our case the rolling machine had rollers with a diameter of 280 mm. The steel plate had a thickness of 10 mm and a steel grade of Fe700.

With a test rolling we found that the minimum diameter of the tube which could be reached was 370 mm (see fig. 2.1 and 2.2).
The rolling and seam welding of the specimens has been carried out in May. For each of the three material qualities the following tubes have been delivered:

2 Ø 450 x 10 x 2700 chord
4 Ø 370 x 10 x 1420 braces
1 Ø 37 x 10 x 700 for material test.

3.3. Welding procedure

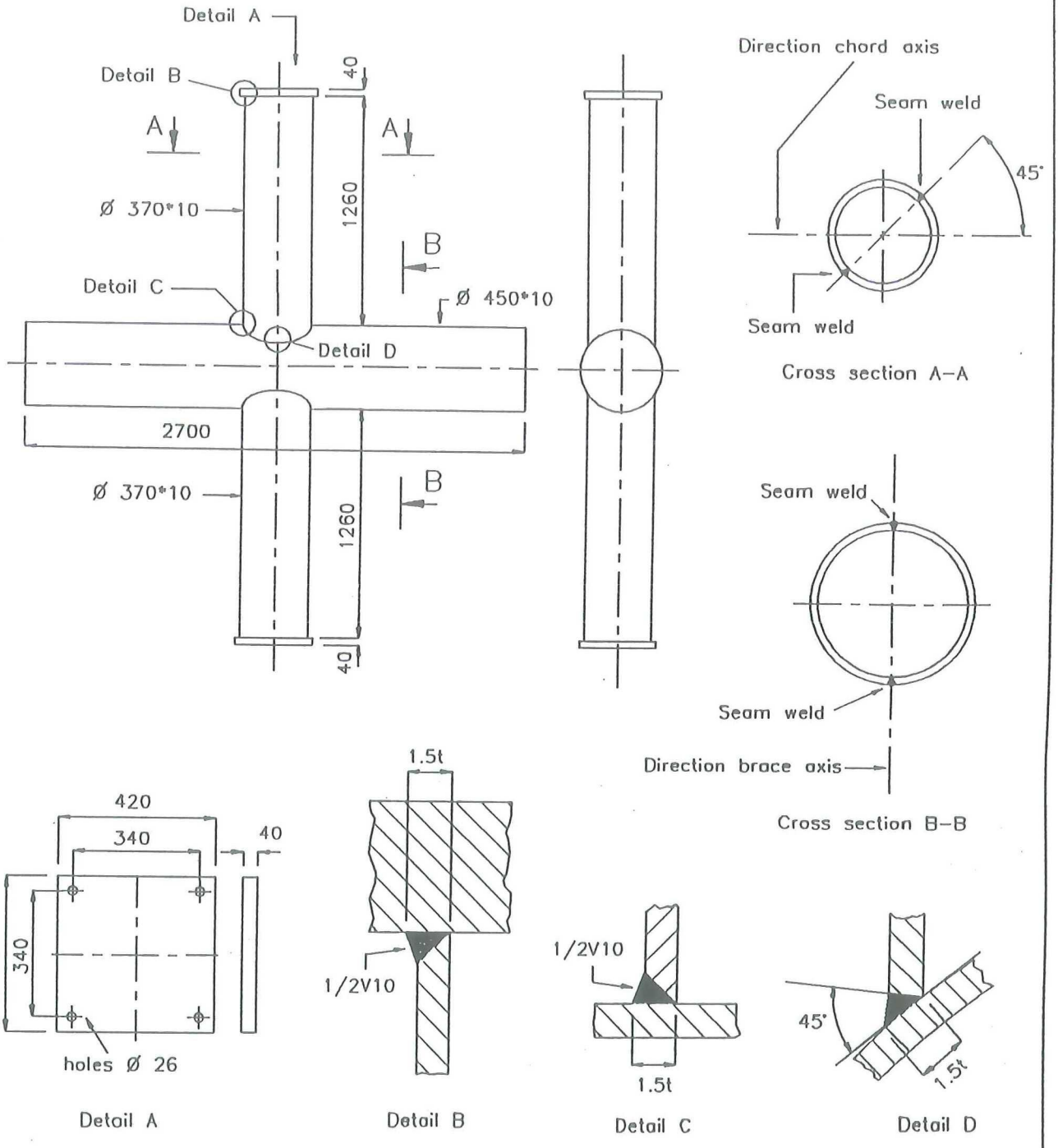
Welding tests have been carried out to determine the welding procedure for the three material qualities. The choosen welding procedures are given in appendix 1.1 and 2.1.
The specimens are welded in June and have been delivered at the Stevin Laboratory.

3.4. Testing of the specimens

All items for the test rig have been prepared and the test rig has been built (see fig. 3).

4. Future Work

During the next period the six specimens will be tested.



Number	3	STEVIN LABORATORIUM
Steel grade tubes	1*Fe355 1*Fe450 1*Fe700	
Steel grade endplates	Fe 355	TUDELFT
Tolerances	Max. angular divergence= 1/4°	
	Max. distance center lines= 1mm	

Date : 19–10–94

Fig. 1: Configuration and weld details for X–joints under compression loading.

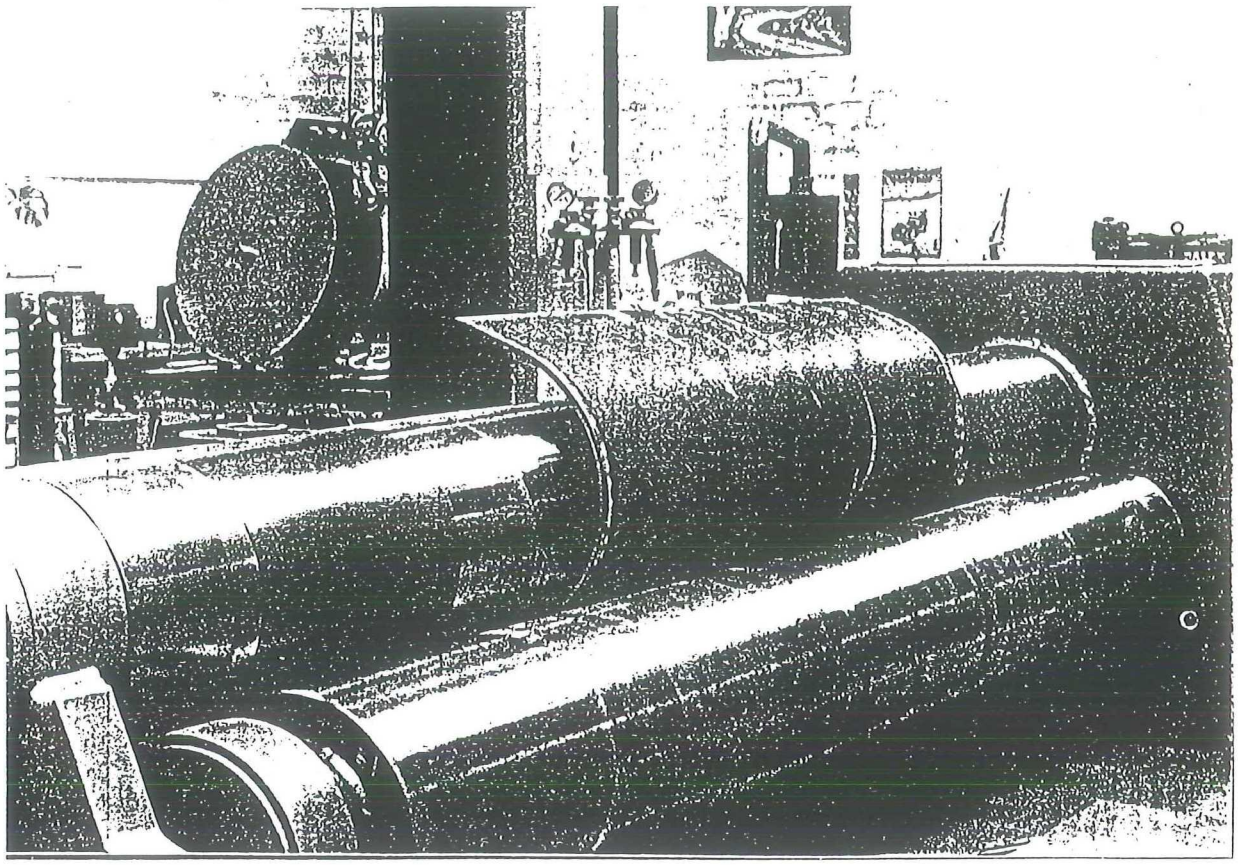


Photo 2.1: Rolling of a plate (FeE 690) by rollerdiameter 280 mm

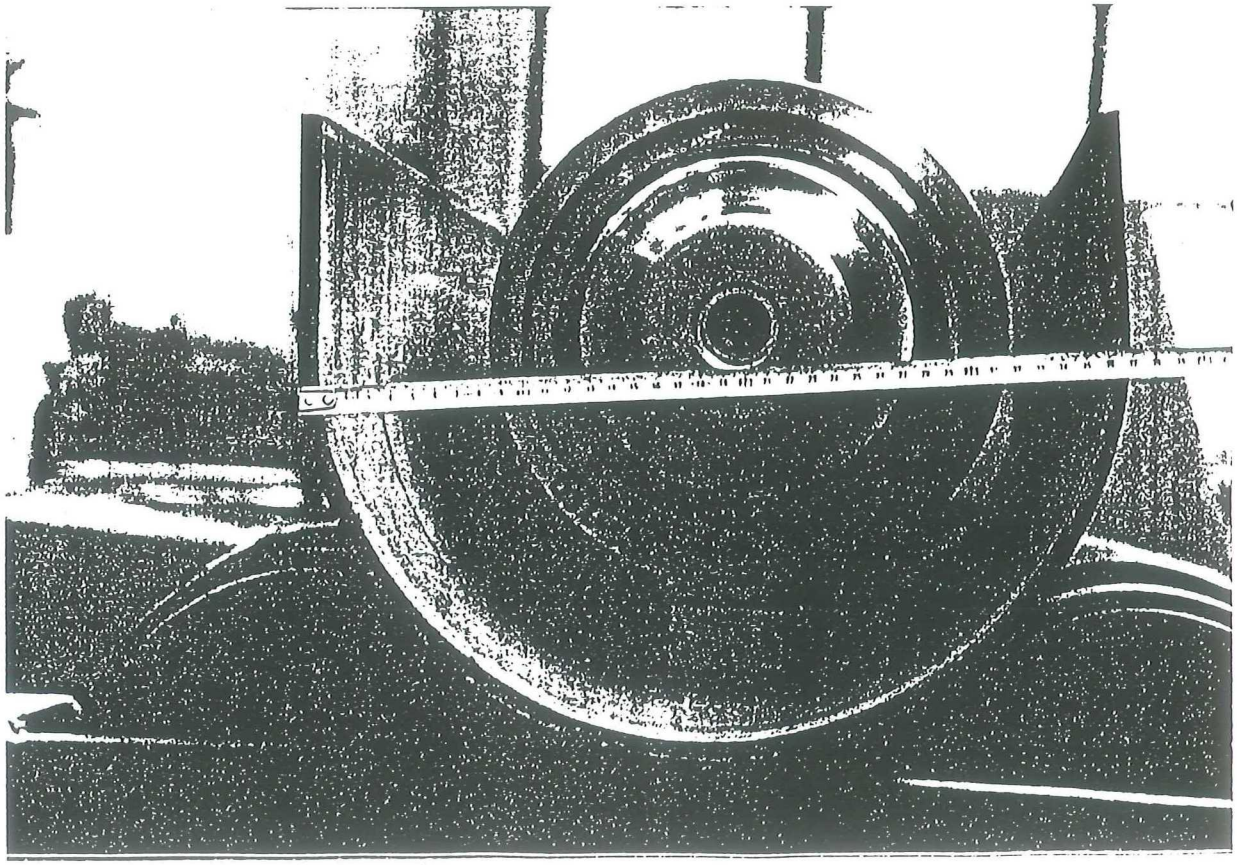


Photo 2.2: Feasible diameter (370 mm) after rolling the plate (FeE 690)

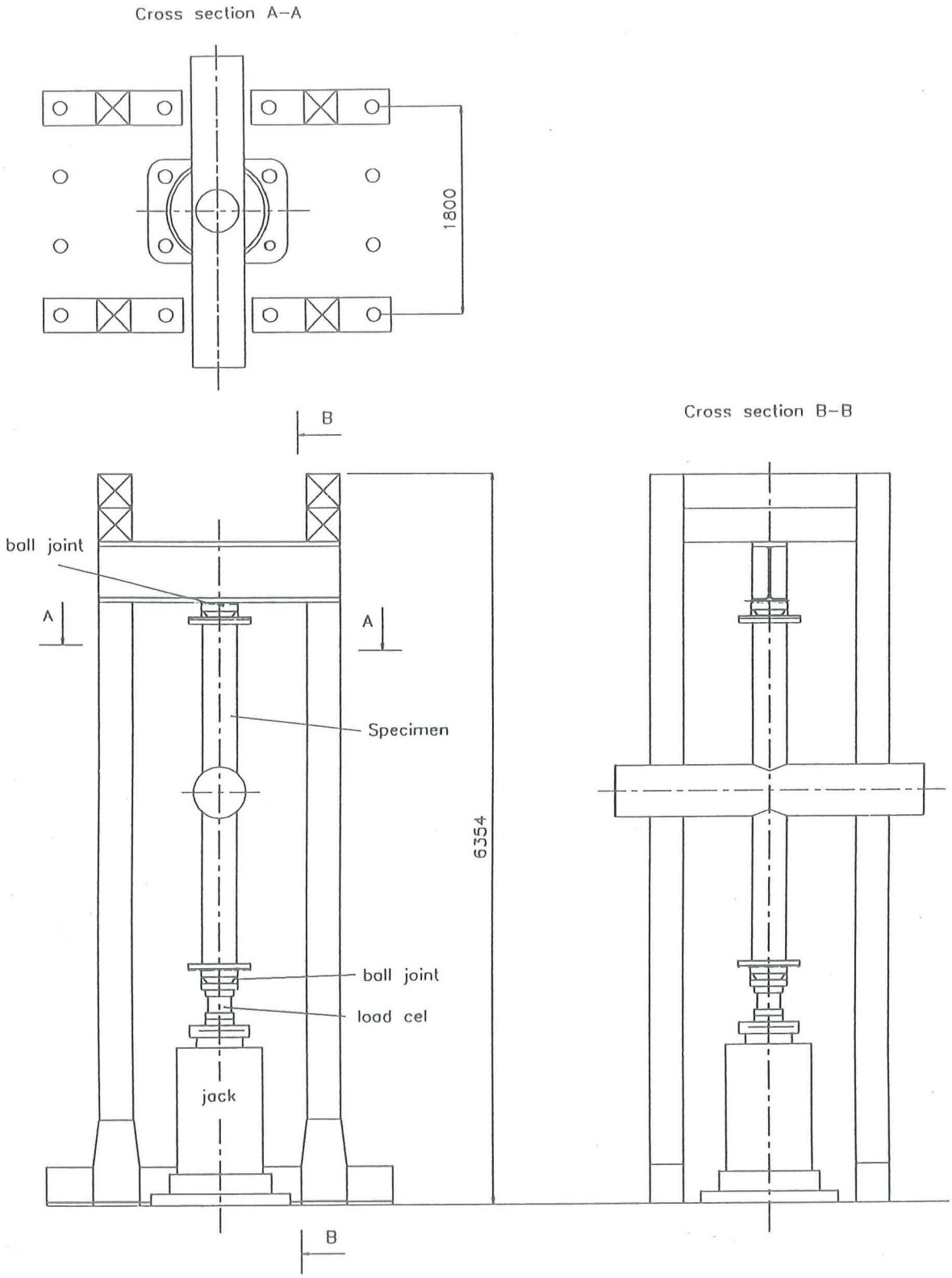


Fig. 3: Test set up for DT joint compression specimens

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APPENDIX 1.1

Job no : S94537
Chapter : Structural
Procedure no : 1870
Revision : B

WELDING PROCEDURE SPECIFICATION

Proposal for W.P.Q.R.	
Production Welding	**

„B„	Qualified material	: FE700	
	Welding process	: SMAW	
	Manual or Machine	: MANUAL	
	Position of welding	: 5GU	
„B„	Filler metal spec.	: CONARC 80	CONARC 85
	Filler metal class	: E11018M	E12018G
	Flux	:	NA
	Shielding gas	: NA	
	Backing gas	: NA	
	Welding current	: AC	AC
	Polarity	:	
„B„	Preheat	: 100 °C	
„B„	Max interpass	: 150 °C	
	Check method temperature	: TEMPILSTIK	
	P.W.H.T.	: NA	
	Diam range in mm	: NA	
	Weldthickness range in mm	: NA	
	Continuous member range in mm:	NA	
	Qualified joint	: BRACING AND 1/2VT	
	Qualified welding position	: 5GU	
	Tackwelding procedure	: NA	

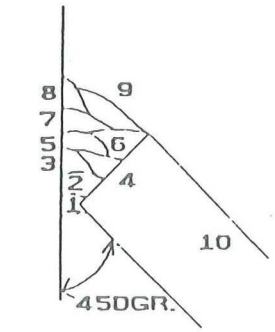
SMAW range diam +0 mm as WPS.
SMAW range Amp see supplier's recommendation on electrode package.
SMAW max. weaving 2,5 * diam.

Preheat method gas or electrical
Method of preperation Cutting by Oxy/Gas-Plasma+Grind. or Mach.
Heat input (Amp * Volt * 60): cm/min : 10000 F=1
„B„ Material used for WPQR: NA WPQR: NA

	Proposed	Checked	Revision
Date	07-10-94	19.05.95	B 190595
Name	CHR.LOS		
Signed	CHR. LOS CO. DEPT.	T.U. DELFT CO. DEPT.	

Rootface: 0-1 mm Gap: 3-4,5 mm Bevel: 45 ° -5 °/+10°

„B„



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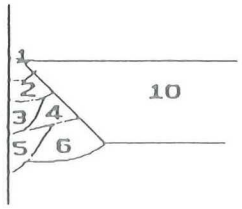

Pass no.	Elec size	AMP	VOLT	Run out cm.	Speed cm/min.			kJ/mm.
1	2.5	80	24	7.0	7.0		CO80	1.6
2	2.5	85	24	8.0	8.0		CO85	1.5
3-..	3.2	125	25	12.0	12.0		CO85	1.6

The welds were prepared with the requirements of: NA

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APPENDIX 1.2

Job no : S94537
Chapter : Structural
Procedure no : 1228
Revision : 0

WELDING PROCEDURE SPECIFICATION

Proposal for W.P.Q.R.	
Production Welding	**

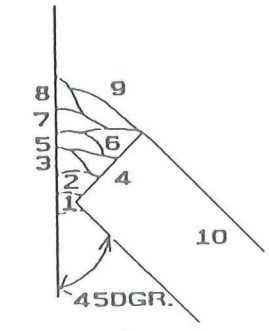
Qualified material	: FE355 FE450
Welding process	: SMAW
Manual or Machine	: MANUAL
Position of welding	: 5GU
Filler metal spec.	: KRYO1
Filler metal class	: E7018G
Flux	: NA
Shielding gas	: NA
Backing gas	: NA
Welding current	: AC
Polarity	: -
Preheat	: 100 °c
Max interpass	: 250 °c
Check method temperature	: TEMPILSTIK
P.W.H.T.	: NA
Diam range in mm	: NA
Weldthickness range in mm	: NA
Continuous member range in mm:	NA
Qualified joint	: BRACING AND 1/2VT
Qualified welding position	: 5GU
Tackwelding procedure	: NA

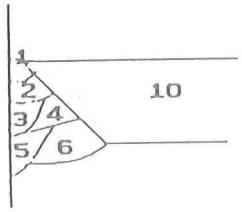
SMAW range diam +1 mm as WPS.
SMAW range Amp see supplier's recommendation on electrode package.
SMAW max. weaving 2,5 * diam.

Preheat method gas or electrical
Method of preperation Cutting by Oxy/Gas-Plasma+Grind. or Mach.
Heat input (Amp * Volt * 60): cm/min : 10000 F=1
Material used for WPQR: X52 WPQR: 1228-1366

	Proposed	Checked	Revision
Date	07-10-94	10-10-94	
Name	CHR.LOS	G.v.Dalen.	
Signed	CHR. LOS QC DEPT.		

Rootface: 0-1 mm Gap: 3-4,5 mm Bevel: 45 ° -5 °/+10°





Pass no.	Elec size	A M P	V O L T	Run out cm.	Speed cm/ min.			kJ/ mm.
1	2.5	80	25	5.0				2.3
2-5	3.2	145	26	11.0				2.0
6-...	4.0	150	26	15.0				1.8
..-24	3.2	135	24	15.0				1.3

The welds were prepared with the requirements of: NA