5-5 TEST RESULTS OF NK-EH-500

5.5 Test Results of NK-EH-500

(1) Chemical Composition

Table 32 Chemical Composition (Heat analysis, %)

Thickness mm	C	Si	Mn	P	S	Cr	Ti	B	Ceq
19	0.32	0.23	1.07	0.005	0.002	0.49	0.010	0.0015	0.61
40	0.32	0.21	1.11	0.020	0.007	0.50	0.010	0.0010	0.61

$$Ceq = C + Mn/6 + Si/24 + Cr/5 + Mo/4 + V/15$$

(2) Tensile and Charpy Impact Tests

Table 33 Mechanical Properties

Thickness mm	Direction	Tensile Test[1]			Charpy Impact Test[2]
		Yield Point N/mm² (kgf/mm²)	Tensile Strength N/mm² (kgf/mm²)	Elongation %	Absorbed energy 0 ℃ J (kgf-m)
19	L	1298 (132.4)	1491 (152.0)	18.3	30 (3.1)
	C	1297 (132.3)	1449 (147.8)	17.7	26 (2.7)
40	L	1290 (131.5)	1526 (155.6)	11.9	17 (1.7)
	C	1309 (133.5)	1500 (153.0)	11.4	16 (1.6)

1) Test specimen

t ≦ 20mm : JIS No. 5 (GL = 50mm, W = 25mm, Total thickness)

t > 20mm : JIS No. 4 (GL = 50mm, d = 14mm, 1/4 of thickness)

2) Test specimen

JIS No. 4 (2 mm V notch)

t ≦ 20mm : 1/2 of thickness

t > 20mm : 1/4 of thickness

(3) Hardness Test

(3.1) Surface hardness test

Table 34 Surface Hardness Test Results (Brinnell Hardness 10/3000)

Thickness mm	Individual hardness	Mean hardness
19	499, 507, 518, 514, 503	508
40	514, 534, 518, 547, 514	525

(3.2) Hardness distribution in thickness direction

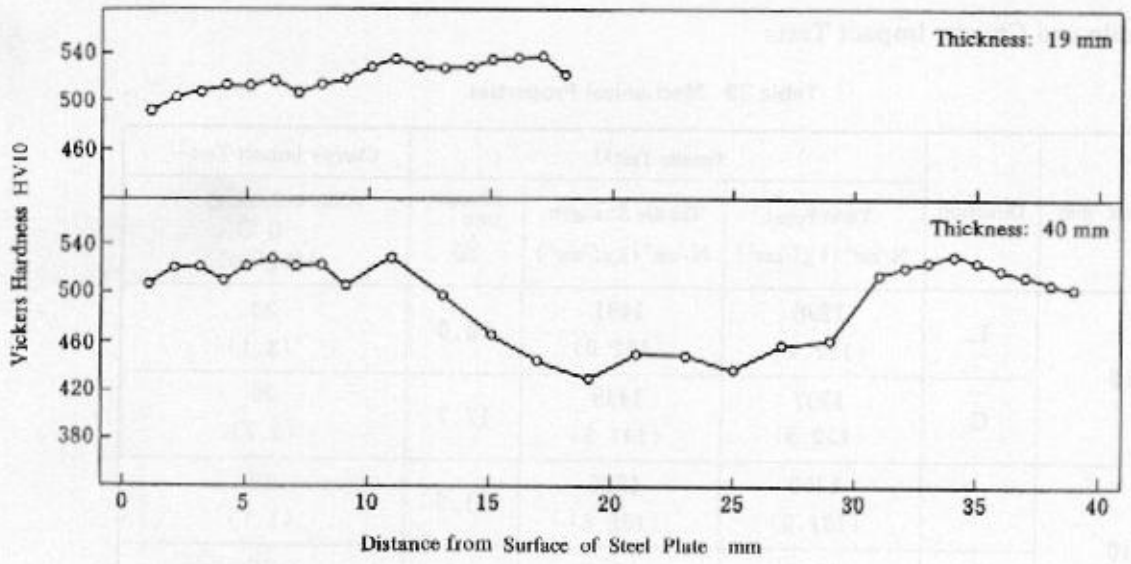


Fig. 20 Hardness Distribution in Thickness Direction

(4) Bending Test

(4.1) Standard JIS bending test

Table 35 JIS Bending Test Results

Thickness mm	Direction	Test specimen		Bending radius (t: Thickness)[3]				
		No.	Width mm	3.0t	2.5t	2.0t	1.5t	1.0t
19[1]	L	JIS No. 1	40	○	○	×	—	—
	C	JIS No. 1	40	○	×	×	—	—
40[2]	L	JIS No. 1	50	—	○	○	△	×
	C	JIS No. 1	50	○	×	×	—	—

○ : No cracks △ : Slight cracks × : Cracks

1) Test specimen: Total thickness

2) Test specimen: t = 35mm

3) Bending angle: 180°

(4.2) Wide specimen bending test

Table 36 Wide Specimen Bending Test Results

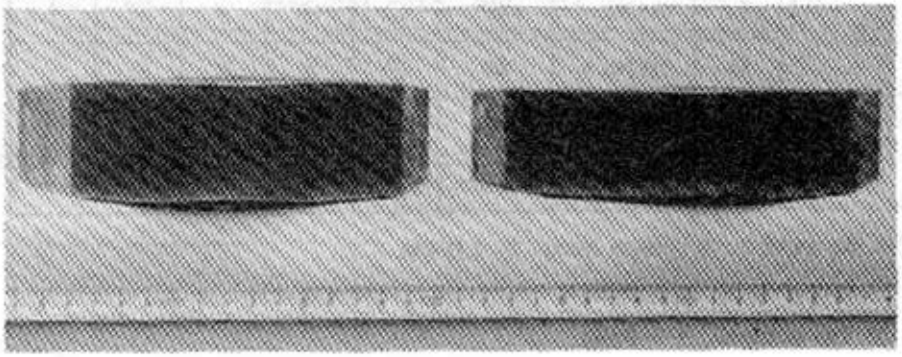
Thickness mm	Direction	Width of test specimen[1] mm	Bending radius (t: Thickness)[2]		
			4.0t	3.5t	3.0t
19	L	150	○	×	×

○ : No cracks △ : Slight cracks × : Cracks

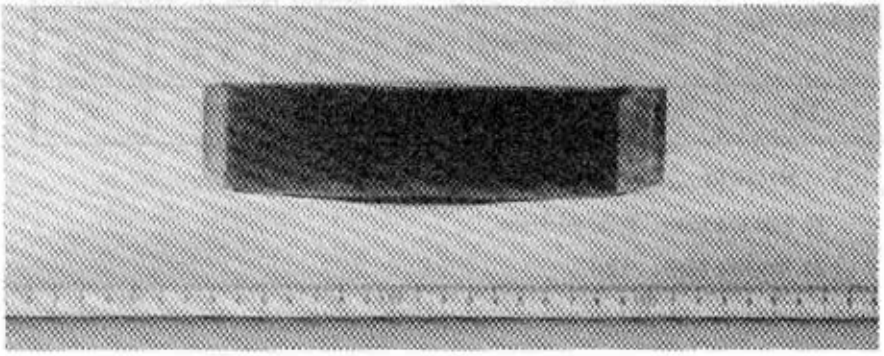
1) Test specimen: Total thickness

2) Bending angle: 180°

R=2.5t



R=3.0t

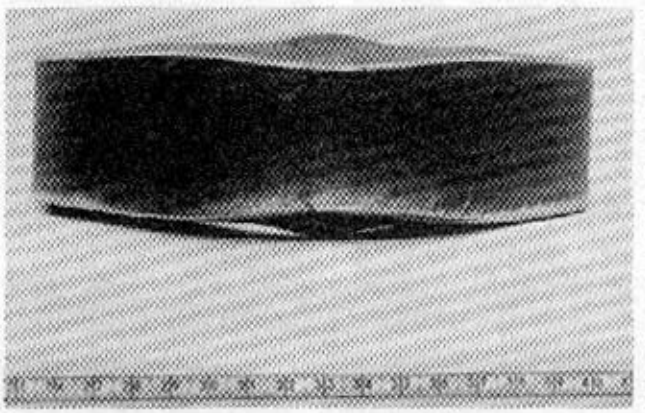


1) Test specimen: JIS No. 1 (19 mm thick x 40 mm wide)

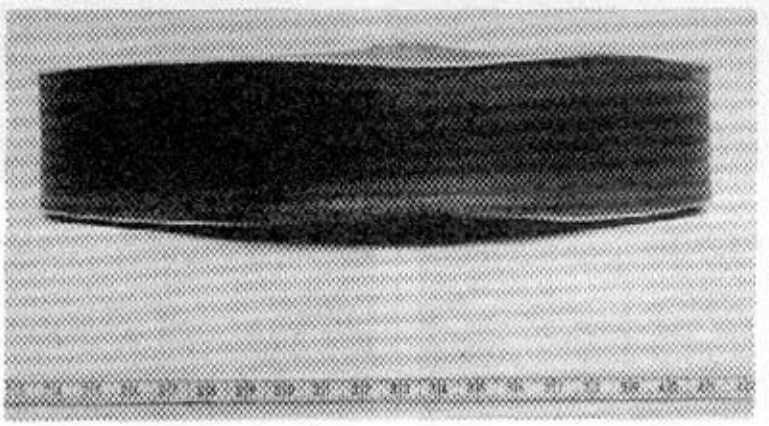
2) Sampling direction of test specimen: Rolling direction

Photo 14 Bending Test Results (Thickness: 19 mm)

R=1.5t



R=2.0t

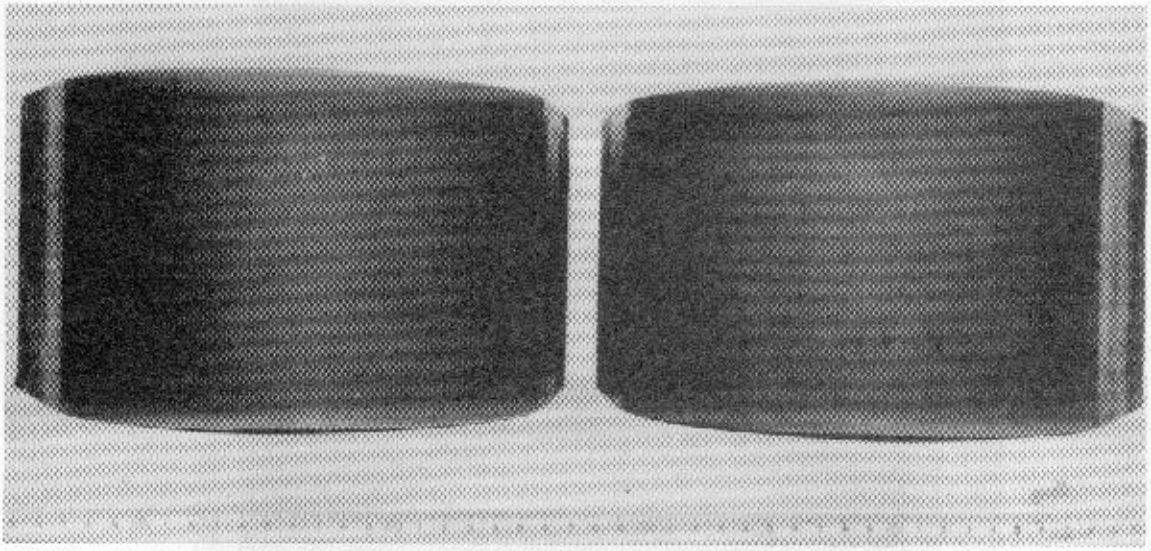


1) Test specimen: JIS No. 1 (35 mm thick x 50 mm wide)

2) Sampling direction of test specimen: Rolling direction

Photo 15 Bending Test Results (Thickness: 40 mm)

R=4.0 t



1) Test specimen: 19 mm × 150 mm wide

2) Sampling direction of test specimen: Rolling direction

Photo 16 Wide Specimen Bending Test Results (Thickness: 19 mm)

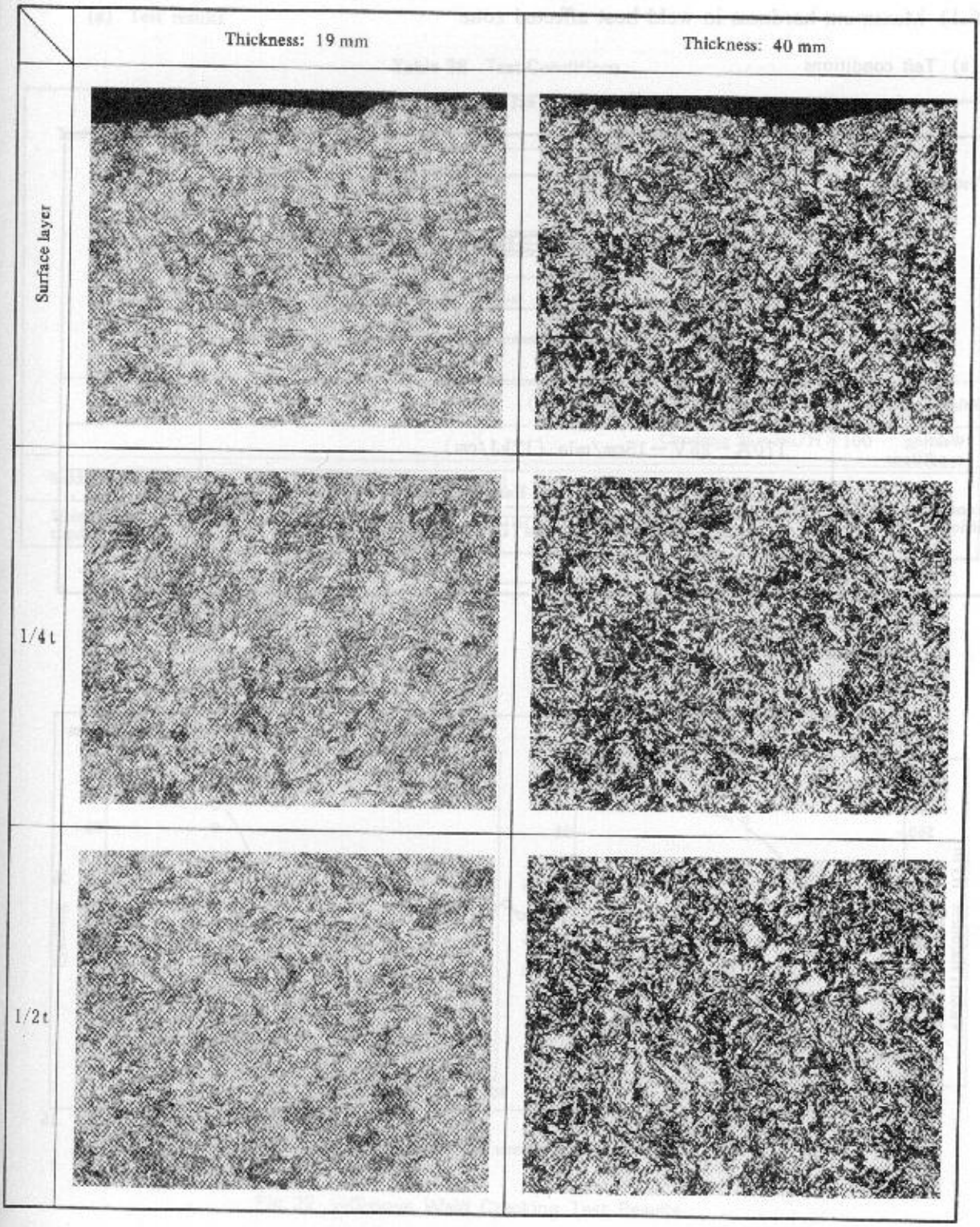


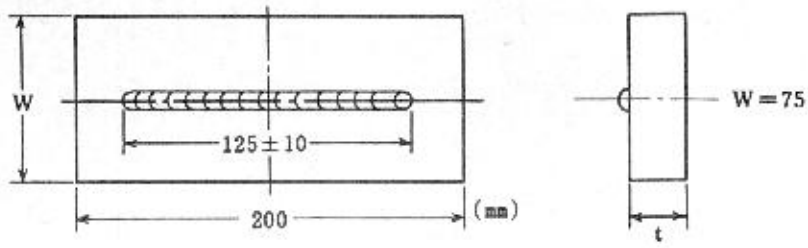
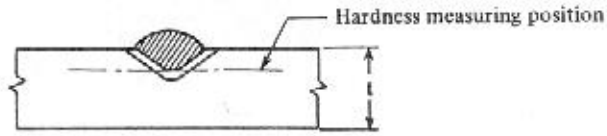
Photo 17 Microstructure (x200)

(6) Weldability

(6.1) Maximum hardness in weld heat affected zone

(a) Test conditions

Table 37 Test Conditions

Test specimen	
Welding material	LB62 (AWS E9016−G), 4 mm ϕ
Welding conditions	170A−25V−15cm/min (17kJ/cm)
Hardness measuring position	

(b) Test Results

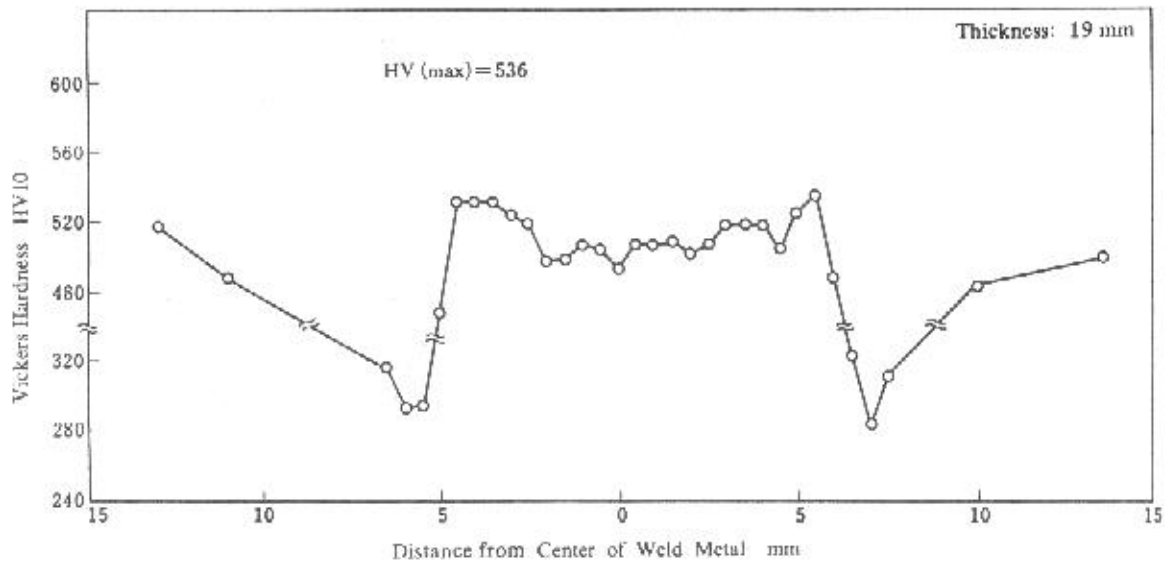


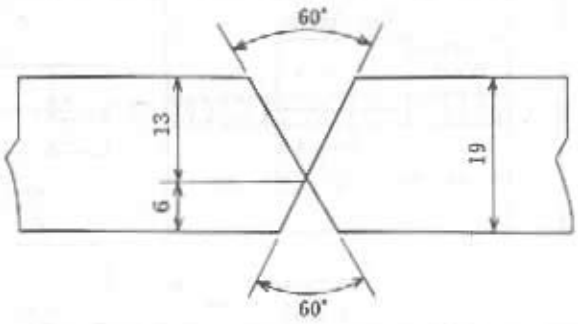
Fig. 21 Maximum Hardness in Weld Heat Affected Zone

(7) Shielded Metal Arc Welded Joint Test

Sample steel plate thickness: 19 mm

(7.1) Welding conditions

Table 39 Welding Conditions

Groove shape mm		
Electrode	LB62 (AWS E9016-G)	
Preheating temperature	150℃	
Interpass temperature	≤250℃	
Pass	1 pass	Other passes
Welding current	170 A	220 A
Arc voltage	25 V	25 V
Welding speed	15cm/min	15cm/min
Welding heat input	17.0kJ/cm	22.0kJ/cm

(7.2) Macrostructure of welded joint

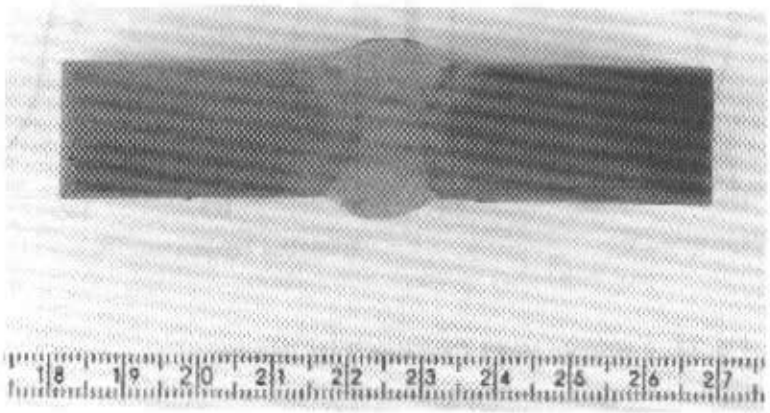


Photo 18 Macrostructure of Welded Joint

(7.3) Welded joint hardness distribution test

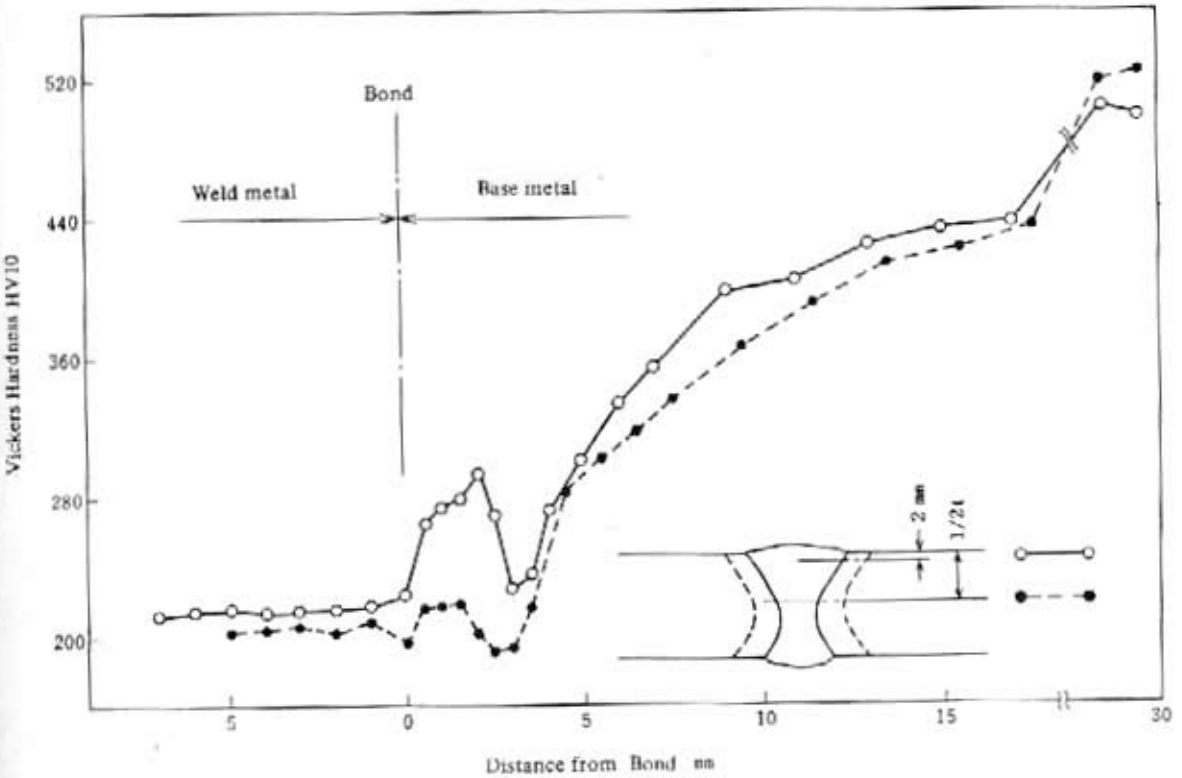
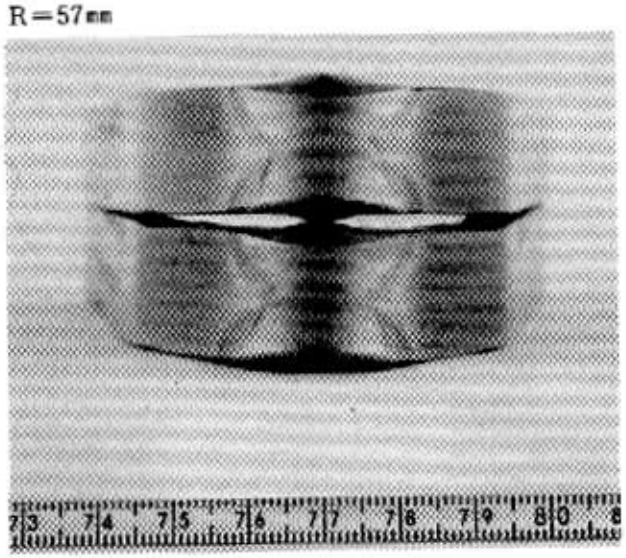


Fig. 23 Welded Joint Hardness Distribution

(7.4) Weld joint side bending test



Bending Test Results: Good

Photo 19 Welded Joint Side Bending Test

(7.5) Welded joint impact test

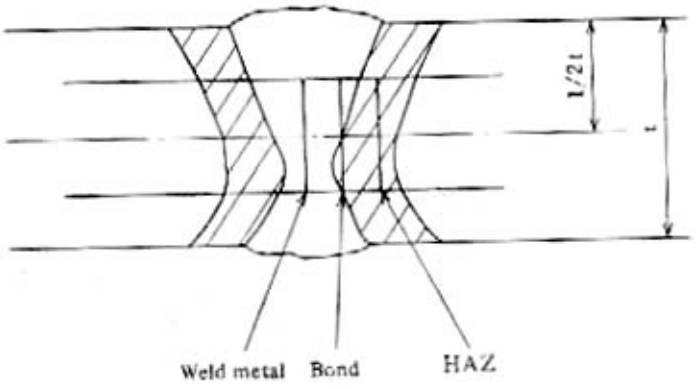


Fig. 24 Test Specimen Sampling Position

Table 40 Welded Joint Impact Test

Notching position	Absorbed energy J (kgf-m)
	0 ℃
Weld metal	155 (15.8)
Bond	150 (15.3)
HAZ	196 (20.0)