

Production of Heavy-Gauge Steel Plates Suitable for High-Heat Input Welding in the Arctic Region*



Synopsis:

For application to the ...

2. Study on Basic Composition System

using test pieces having different contents of Ti and N.

>1400°C
(2552°F)



~1350°C

REM(O.S)

400

Fusion line
H.I.:100kJ/cm

2 mm

1.22

60
Synthetic HAZ
 $T_p = 1350^\circ\text{C}$
40
SAW (1.0 mm SAW) (1/cm)

55
Plate thickness 70 mm

Table 2 Aimed composition of steel for VD 36 Loff

Table 4, Range of properties

										(wt %)		Steel	Loca- tion	Direc- tion	Tensile properties			Absorbed energy $\sqrt{E_{-50}}$ (kgf·m)	CVN 50% FATT (°C)
C	Si	Mn	P	S	Al	Nb	N	Others*	C_{eq}^{**}	P_{cm}^{***}									
0.08	0.30	1.40	≤0.018	≤0.003	0.025	0.015	≤35 ppm	REM-Ti treatment	≤0.36	0.16									
* For plate thickness over 40 mm, Cu and/or Ni should be added. ** $C_{eq} = C + \frac{Mn}{7} + \frac{Ni}{14} + \frac{Nb}{10} + \frac{V}{6} + \frac{Ti}{5}$ *** $P_{cm} = C + \frac{Mn}{7} + \frac{Ni}{14} + \frac{Nb}{10} + \frac{V}{6} + \frac{Ti}{5}$																28.0			

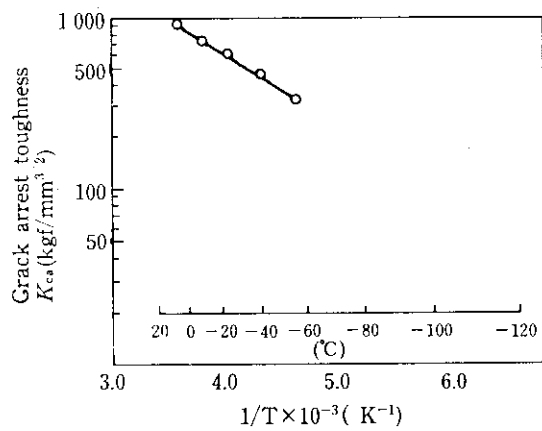


Fig. 11 Results of ESSO test for crack arrest toughness

3.3 Properties of Welded Joints

Table 8 Results of Charpy impact test at high heat input welding joint of steel plates

Notch location		Absorbed energy (kgf·m)			50% FATT (°C)
		vE_{-40}	vE_{-60}	vE_{-80}	
Finishing side	WM	19.1	17.1	8.6	-75
	Bond	18.3	11.8	6.7	-63
	HAZ 2	17.6	14.4	8.5	-66
Backing side	WM	22.4	20.2	12.7	-82
	Bond	22.3	17.2	6.7	-71
	HAZ 2	21.9	20.3	14.8	-86

impact properties.

Table 6 shows the conditions of an each-side one-welding by the VY method⁵⁾ with welding heat

Specimens described in Sec. 3, of both base metal and weld metal, proved to well satisfy the required proper-

input 127.5 kJ/cm. The adoption of this process makes it possible to reduce a considerable number of steps in

ties. The commercial production was carried out on the basis of these results.

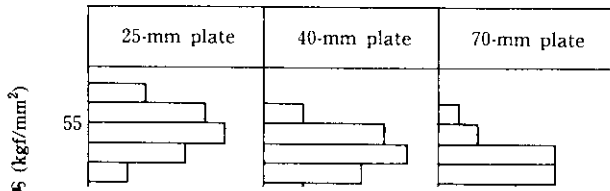


Table 11 Production records of steel plates for off-shore structure

	Case 1	Case 2
Type of structure	Caisson	Semi-submersible rig