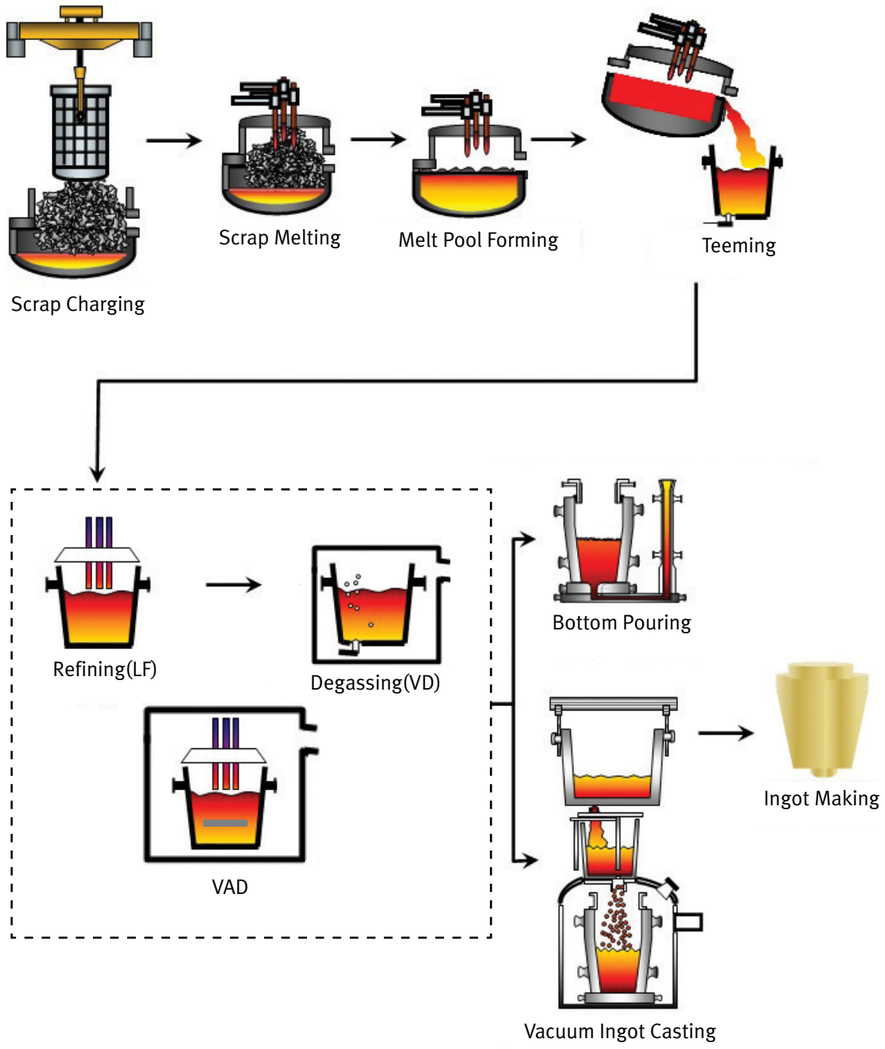
Manufacturing Process



Facilities

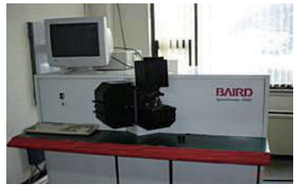
Plant	40T		50T	
	Facility	Spec	Facility	Spec
Steel Making	40T Electric Arc Furnace	40T	50T Electric Arc Furnace	50T
	Vacuum Arc Degassor	40T 0.5Torr	Ladle Furnace	50T
			Vacuum Degassor	50T 0.1Torr
Ingot Making	Vacuum ingot casting	85T	Vacuum ingot casting	200T
	Ingot Mold	2.7~85T	Ingot Mold	10~200T
	Pouring Pit	10 units	Pouring Pit	8 units
Heat Treatment	Heat Treatment Furnace	Max. 150T	Heat Treatment Furnace	Max. 200T
	Portable Cooling Vessel	13 units	Portable Cooling Vessel	10 units
	Slow Cooling Pit	8 units	Slow Cooling pit	9 units
Others	Overhead Crane	Max. 100T	Overhead Crane	Max. 150T
	Tong System	65, 85T	Tong System	65, 200T
	Weighing System	ABB/ Crane	Weighing System	ABB/ Crane

Quality Control

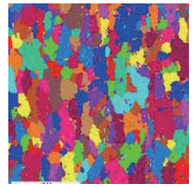
Our company makes great efforts to manufacture a product which meets our customer needs in a stable environment.

We are equipped with strict quality control systems in all process from product design to manufacturing to final products analysis.

Spectrometer
- Chemical composition analysis

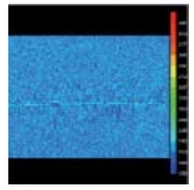


SEM(Scanning electron microscope)
- Micro structure analysis



O_2, N_2 analyzer
- Residual O_2, N_2 analysis

EPMA(Electron probe X-ray micro analyzer)
- Chemical segregation analysis



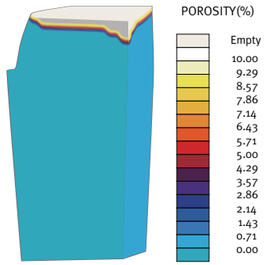
H_2 analyzer
- Residual H_2 analysis

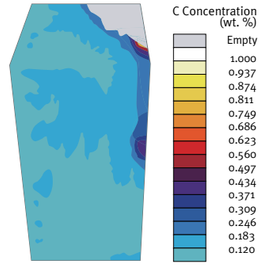
OM + Image analyzer
- Clearness analysis

Research & Development

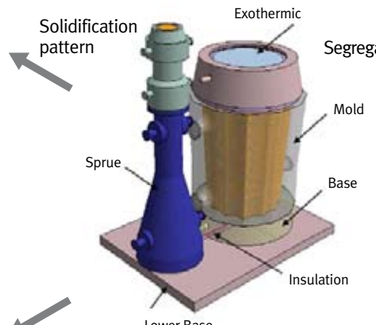
Our research center introduces the newest analysis eqiupments, programs to verify manufacturing methods and to enhance the product quality.

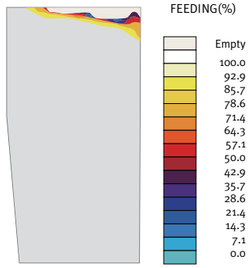
Especially, when they developed new and big sized new product(over 100T), They used the solidification analysis program to expect product solidification pattern in relation with mould shape and pouring condition.

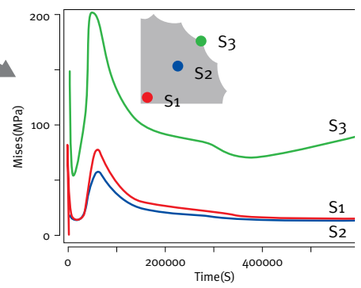




Analysis program



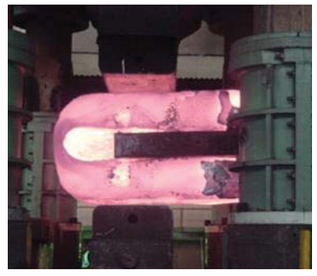




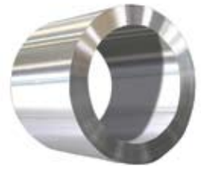
Application of Ingot

Ingot

Crankthrow



Forging



Forged Shell

Rotor Shaft

Plastic Mold

Applicable Material Spec. of Ingot

Application		Main Steel group
Ship Building	Low Carbon	HF601, HF600, HF450, SF590, SF490, S34MnV
	Low Alloy	SCM440,HFCM6, HFNCM6, 42CrNiMo4
Wind Power Plant	Low Alloy	34CrNiMo6, 42CRMO4
Chemical Industry	Shell	SA350MLF2, SA336MF22, SA336F22V
Mold &Tool steel	Mold Steel	S55C, SCM440, SNCM
Others	Low Alloy	21CrMoV5, 40CrMnMo7, SKT4

Available Size & Weight of Ingot

Ingot for Forging
Size: 2.7~200 ton(conical shape)
Material: Carbon Steel/Low Alloy Steel
Annual Production Capacity: 420,000 ton
Maximum Unit Weight: 200 ton

Mould Type		A 01 6/9T			A 02 10/13T			A 03 14/17T			A 04 18/22T			A 05 23/29T			A 06 N30/40T			A 07 N40/50T			A 08 65T			A 09 80T		
Weight		6.9~9.4T			11.0~13.6T			14.6~17.2T			17.9~22.7T			23.6~30.6T			32.0~40.5T			41.5~54.1T			64.1~75.0T			75.0~85.0T		
Variation	kg	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total
	%																											
a	kg	6,037	863	**6,900**	9,312	1,708	**11,020**	12,303	2,257	**14,560**	15,103	2,877	**17,980**	19,760	3,880	**23,640**	26,712	5,288	**32,000**	34,646	6,804	**41,450**	54,540	9,510	**64,050**	62,250	12,750	**75,000**
	%	87.5	12.5	100	84.5	15.5	100	84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.5	16.5	100	83.6	16.4	100	85.2	14.8	100	83.0	17.0	100
b	kg	6,716	1,004	**7,720**	9,836	1,804	**11,640**	12,861	2,359	**15,220**	15,691	2,989	**18,680**	20,776	4,074	**24,850**	28,385	5,595	**33,980**	35,701	7,019	**42,720**	54,540	11,000	**65,540**	65,588	14,412	**80,000**
	%	87.0	13.0	100	84.5	15.5	100	84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.5	16.5	100	83.6	16.4	100	83.2	16.8	100	82.0	18.0	100
c	kg	7,525	1,125	**8,650**	10,199	1,871	**12,070**	13,360	2,450	**15,810**	16,187	3,083	**19,270**	21,894	4,316	**26,210**	29,202	5,718	**34,920**	36,636	7,234	**43,870**	58,450	11,550	**70,000**	69,700	15,300	**85,000**
	%	87.0	13.0	100	84.5	15.5	100	84.5	15.5	100	84.0	16.0	100	83.5	16.5	100	83.6	16.4	100	83.5	16.5	100	83.5	16.5	100	82.0	18.0	100
d	kg	7,847	1,173	**9,020**	10,630	1,950	**12,580**	13,790	2,530	**16,320**	16,732	3,298	**20,030**	22,922	4,488	**27,410**	29,987	5,873	**35,860**	37,743	7,387	**45,130**	62,250	12,750	**75,000**	73,800	16,200	**90,000**
	%	87.0	13.0	100	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.6	16.4	100	83.6	16.4	100	83.6	16.4	100	83.0	17.0	100	82.0	18.0	100
e	kg	8,118	1,322	**9,440**	11,086	2,034	**13,120**	14,137	2,593	**16,730**	17,235	3,395	**20,630**	23,966	4,734	**28,700**	30,604	6,016	**36,620**	38,637	7,563	**46,200**				77,900	17,100	**95,000**
	%	86.0	14.0	100	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.5	16.5	100	83.6	16.4	100	83.6	16.4	100				82.0	18.0	100
f	kg				11,458	2,102	**13,560**	14,500	2,660	**17,160**	17,840	3,540	**21,380**	25,180	4,980	**30,160**	31,719	6,231	**37,950**	39,534	7,826	**47,360**						
	%				84.5	15.5	100	84.5	15.5	100	83.4	16.6	100	83.5	16.5	100	83.6	16.4	100	83.5	16.5	100						
g	kg										18,333	3,637	**21,970**	25,518	5,042	**30,560**	32,674	6,446	**39,120**	40,508	8,002	**48,510**						
	%										83.4	16.6	100	83.5	16.5	100	83.5	16.5	100	83.5	16.5	100						
h	kg										18,956	3,734	**22,690**				33,859	6,661	**40,520**	42,446	8,354	**50,800**						
	%										83.5	16.5	100				83.6	16.4	100	83.6	16.4	100						
i	kg																			43,290	8,530	**51,820**						
	%																			83.5	16.5	100						
j	kg																			44,024	8,706	**52,730**						
	%																			83.5	16.5	100						
k	kg																			45,208	8,882	**54,090**						
	%																			83.6	16.4	100						

Available Size & Weight of Ingot

Mould Type		B 01 M10T			B 02 M15T			B 03 M20T			B 04 M30T			B 05 M40T			B 06 M50T			B 07 M60T			B 08 M120T			B 09 M150T			B 10 M160T		
Weight		11.0~14.6T			15.2~19.3T			20.0~26.2T			27.4~34.9T			35.9~43.9T			45.1~54.1T			57.8~62.1T			100~140T			150/170/180T			160/180/190/200T		
Variation	kg	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total
	%																														
a	kg	9,312	1,708	**11,020**	12,861	2,359	**15,220**	16,732	3,298	**20,030**	22,922	4,488	**27,410**	29,987	5,873	**35,860**	37,743	7,387	**45,130**	48,232	9,558	**57,790**	79,978	20,022	**100,000**	119,960	30,040	**150,000**	128,000	32,000	**160,000**
	%	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.6	16.4	100	83.6	16.4	100	83.6	16.4	100	83.5	16.5	100	80.0	20.0	100	80.0	20.0	100	80.0	20.0	100
b	kg	9,836	1,804	**11,640**	13,360	2,450	**15,810**	17,235	3,395	**20,630**	23,966	4,734	**28,700**	30,604	6,016	**36,620**	38,637	7,563	**46,200**	50,103	9,857	**59,960**	87,959	22,041	**110,000**	136,000	34,000	**170,000**	144,000	36,000	**180,000**
	%	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.5	16.5	100	83.6	16.4	100	83.6	16.4	100	83.6	16.4	100	80.0	20.0	100	80.0	20.0	100	80.0	20.0	100
c	kg	10,199	1,871	**12,070**	13,790	2,530	**16,320**	17,840	3,540	**21,380**	25,180	4,980	**30,160**	31,719	6,231	**37,950**	39,534	7,826	**47,360**	51,895	10,155	**62,050**	96,109	23,891	**120,000**				152,000	38,000	**190,000**
	%	84.5	15.5	100	84.5	15.5	100	83.4	16.6	100	83.5	16.5	100	83.6	16.4	100	83.5	16.5	100	83.6	16.4	100	80.1	19.9	100				80.0	20.0	100
d	kg	10,630	1,950	**12,580**	14,137	2,593	**16,730**	18,333	3,637	**21,970**	25,518	5,042	**30,560**	32,674	6,446	**39,120**	40,508	8,002	**48,510**				104,000	26,000	**130,000**				160,000	40,000	**200,000**
	%	84.5	15.5	100	84.5	15.5	100	83.4	16.6	100	83.5	16.5	100	83.5	16.5	100	83.5	16.5	100				80.0	20.0	100				80.0	20.0	100
e	kg	11,086	2,034	**13,120**	14,500	2,660	**17,160**	18,956	3,734	**22,690**	26,712	5,288	**32,000**	33,859	6,661	**40,520**	42,446	8,354	**50,800**				112,000	28,000	**140,000**						
	%	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.5	16.5	100	83.6	16.4	100	83.6	16.4	100				80.0	20.0	100						
f	kg	11,458	2,102	**13,560**	15,103	2,877	**17,980**	19,760	3,880	**23,640**	28,385	5,595	**33,980**	34,646	6,804	**41,450**	43,290	8,530	**51,820**												
	%	84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.5	16.5	100	83.6	16.4	100	83.5	16.5	100												
g	kg	12,303	2,257	**14,560**	15,691	2,989	**18,680**	20,776	4,074	**24,850**	29,202	5,718	**34,920**	35,701	7,019	**42,720**	44,024	8,706	**52,730**												
	%	84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.6	16.4	100	83.6	16.4	100	83.5	16.5	100												
h	kg				16,187	3,083	**19,270**	21,894	4,316	**26,210**				36,636	7,234	**43,870**	45,208	8,882	**54,090**												
	%				84.0	16.0	100	83.5	16.5	100				83.5	16.5	100	83.6	16.4	100												

Available Size & Weight of Ingot

Mould Type		C 01 2.7T			C 02 4T			C 03 4.7T			C 04 6.3T			C 05 7.7T			C 51 H10/13T			C 52 H14/17T			C 53 H30/40T			C 54 H40/50T		
Weight		2.7T			4.0T			4.7T			6.3T			7.7T			11.0~13.6T			14.6~17.2T			30.6~41.5T			42.7~50.8T		
Variation	kg	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	Hot Top	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total	Body	HotTop	Total
	%																											
a	kg	2,302	398	**2,700**	3,400	600	**4,000**	3,971	679	**4,650**	5,337	913	**6,250**	6,560	1,160	**7,720**	9,312	1,708	**11,020**	12,303	2,257	**14,560**	25,518	5,042	**30,560**	35,701	7,019	**42,720**
	%	85.3	14.7	100	85.0	15.0	100	85.4	14.6	100	85.4	14.6	100	85.0	15.0	100	84.5	15.5	100	84.5	15.5	100	83.5	16.5	100	83.6	16.4	100
b	kg																9,836	1,804	**11,640**	12,785	2,435	**15,220**	26,712	5,288	**32,000**	36,636	7,234	**43,870**
	%																84.5	15.5	100	84.0	16.0	100	83.5	16.5	100	83.5	16.5	100
c	kg																10,199	1,871	**12,070**	13,280	2,530	**15,810**	28,385	5,595	**33,980**	37,743	7,387	**45,130**
	%																84.5	15.5	100	84.0	16.0	100	83.5	16.5	100	83.6	16.4	100
d	kg																10,630	1,950	**12,580**	13,709	2,611	**16,320**	29,202	5,718	**34,920**	38,637	7,563	**46,200**
	%																84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.6	16.4	100
e	kg																11,086	2,034	**13,120**	14,053	2,677	**16,730**	29,987	5,873	**35,860**	39,534	7,826	**47,360**
	%																84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.5	16.5	100
f	kg																11,458	2,102	**13,560**	14,414	2,746	**17,160**	30,604	6,016	**36,620**	40,508	8,002	**48,510**
	%																84.5	15.5	100	84.0	16.0	100	83.6	16.4	100	83.5	16.5	100
g	kg																						31,719	6,231	**37,950**	42,446	8,354	**50,800**
	%																						83.6	16.4	100	83.6	16.4	100
h	kg																						32,674	6,446	**39,120**			
	%																						83.5	16.5	100			
i	kg																						33,859	6,661	**40,520**			
	%																						83.6	16.4	100			
j	kg																						34,646	6,804	**41,450**			
	%																						83.6	16.4	100			