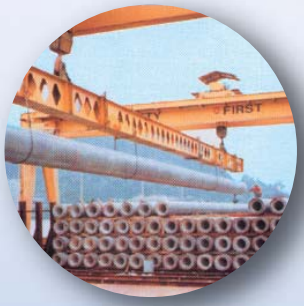
ICP PILES

HIGH PERFORMANCE PRETENSIONED SPUN CONCRETE PILES



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QUALITY SYSTEM SIRIM

UKAS QUALITY MANAGEMENT 074-A

MS ISO 9001 : 2008 REG. NO. AR0122

Introduction

INDUSTRIAL CONCRETE PRODUCTS SDN. BHD. (ICP) is the first commercial manufacturer of **HIGH PERFORMANCE PRETENSIONED SPUN CONCRETE PILES (ICP PILES)** in Malaysia. Presently, ICP is the largest manufacturer in Asia.

The company was incorporated in Malaysia on 6 April 1977 and commenced business in September 1977.

ICP Piles are circular in cross-section and are manufactured in sizes ranging from diameter 250mm to 1,200mm with standard lengths vary from 6m to 46m in single pieces. ICP Piles can be easily joined to any combination of length as per design requirement. All ICP Piles are manufactured with steel end plates for splicing.

ICP Piles have been used extensively as foundation piles for power stations, highrise buildings, civil engineering works, bridges, marine structures and harbors etc.

ICP Piles have now been exported to not less than 15 countries across the world including North America.

ICP constantly improves the quality of its products and services. All ICP factories were awarded with the prestigious Quality System MS ISO 9001 : 2008 certification.

Price Smart Foods, Vancouver, Canada

330 Third Street South Condominium,
St Peterburg, Florida

Coal Fired Power Plant, Negeri Sembilan, Malaysia

Marina Bay, St. Petersburg, Florida, USA

General Specification for ICP Piles

Standards
ICP Piles comply with MS 1314:Part 4:2004 and also generally comply with JIS A 5337:1993. ICP Piles are modified to suit ACI 543R-74(80) - Recommendation for Design, Manufacture and Installation of Prestressed Concrete Piles, BS 8004:1986 - Foundations and BS 8110:1997 - Structural Use of Concrete. Concrete batching plant comply with SS EN 206-1 : 2009 – specification of concrete.

In particular, the method of manufacture, the dimensional tolerances and requirements for bending strength of the main body and joint comply with JIS A 5337:1993.

Materials
Aggregates
Coarse aggregates shall be 20mm granite. Fine aggregates shall be clean river sand or washed mining sand.
Cement
Ordinary Portland cement to MS 522:2007 or ASTM C150-72.
Prestressing Steel Bar
High frequency induction heat treated bars manufactured to JIS G 3137:2008 or equivalent.
Spiral Wire
Hard drawn wire to BS 4482 or ASTM A82-97A.

Concrete Strength
Minimum concrete cylinder strength at transfer of prestress (demolding) - 27 MPa(3.92 ksi), 28 days - 70 MPa (10.15 ksi).

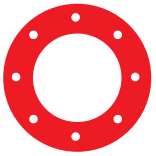
Joint
The joint is constructed to have the same performance as the main body particularly in respect of bending strength. All ICP Piles will be supplied with steel extension plates for splicing.

Lifting Points
Two lifting points will be marked on all piles exceeding 12m. No special lifting bolt or wire rope is cast into the piles. Lifting is by wrapping wire rope round the piles at specified points.

Pile Shoe
All ICP Piles will be supplied either open ended, with a flat shoe or with an X-pointed shoe.

Curing
After manufacture, the piles are steam cured. When the concrete reaches the specified transfer strength, the piles are demolded, marked and checked for quality. When the cylinder strength reaches the required strength the piles can be transported and installed.

Identification
All ICP Piles have the typical markings as follows:



Logo as trade mark

ICP	Company's initials
MS 1314 : Part 4	Malaysian Standard
111220	Date of cast (yy/mm/dd)
001KI	Serial number and factory code
40C880	Pile size and class
12E	12m long, extension (open ended)

Other markings if used, S for Starter (flat shoe or X-pointed shoe).

Standard Lengths
ICP Piles are available in lengths of 6m to 46m subject to certain limitations.

Technical Data
Technical data of piles are given in the table on the next page. They refer to our standard products. Please note that the axial loads represent the structural capacities of the piles. Whether the driven piles can safely carry these loads depend on the soil conditions and the pile slenderness ratio. Appropriate reduction should be applied for
(a) marine structures,
(b) piles subjected to bending,
(c) high upstand,
(d) piles driven through very poor top stratum,
(e) raking piles, etc.

Definitions
ICP Piles : High Performance Pretensioned Spun Concrete Piles
MS : Malaysian Standard
JIS : Japanese Standard
ACI : American Concrete Institute
BS : British Standard
ASTM : American Standard for Testing Material
CSA : Canadian Standard Association
SS : Singapore Standard
EN : European Standard

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QUALITY SYSTEM SIRIM UKAS QUALITY MANAGEMENT 074-A
MS 1SO 9001 : 2008 REG. NO. AR0122

Properties of ICP Piles

Nominal Diameter		Nominal Wall Thickness		Length		Nominal Weight		Prestress Bar Dia			Area of Concrete		Section Modulus		Effetive Prestress f_{pc} or f_{ce}		CSA				ACI							
								7.1mm (.28")	9.0mm (.35")	10.7mm (.42")							Cracking Moment M_{cr}	Factored Moment $\varnothing M_{ro}$	Service Axial Load N	Factored Axial Load $\varnothing P_{ro}$	Cracking Moment Capacity M_{cr}		Nominal Moment Capacity $\varnothing M_n$		Service Axial Load N		Nominal Axial Load $\varnothing P_n$	
mm	in	mm	in	m	ft	kg/m	lb/ft	No.	No.	No.	mm^2	in^2	$x1000mm^3$	in^3	N/mm^2	psi	kN-m	kN-m	kN	kN	kips-ft	kN-m	kips-ft	kN-m	kips	kN	kips	kN
250	9.8	55	2.2	6-12	20-39	88	59	7			33,694	52.2	1,435	87.6	7.08	1,027	17	29	814	910	13	18	25	34	160	712	273	1,214
300	11.8	60	2.4	6-15	20-49	118	79	10			45,239	70.1	2,394	146.1	7.08	1,027	30	49	1,072	1,215	23	31	43	58	214	952	366	1,628
350	13.8	70	2.8	6-15	20-49	160	108		8		61,575	95.4	3,786	231.0	7.05	1,022	46	75	1,487	1,662	34	46	65	88	293	1,303	499	2,219
400	15.7	80	3.1	6-15	20-49	209	140		10		80,425	124.7	5,701	347.9	7.03	1,020	67	108	1,968	2,178	51	69	93	126	385	1,711	655	2,912
450	17.7	80	3.1	6-18	20-59	242	163		12		92,991	144.1	7,679	468.6	7.03	1,020	93	149	2,250	2,511	70	95	127	172	443	1,970	755	3,358
500	19.7	90	3.5	6-18	20-59	301	202			10	115,925	179.1	10,579	645.5	6.91	1,002	123	195	2,856	3,145	92	125	166	225	555	2,468	944	4,198
600	23.6	100	3.9	6-18	20-59	408	274			14	157,080	243.5	17,761	1,083.8	7.1	1,030	210	330	3,835	4,252	158	214	281	381	751	3,339	1,278	5,684
700	27.6	110	4.3	6-46	20-151	530	356			20	203,889	316.0	27,498	1,678.0	7.5	1,088	345	542	4,832	5,478	259	351	468	635	966	4,296	1,650	7,341
800	31.5	120	4.7	10-46	33-151	667	448			24	256,354	397.3	39,966	2,438.9	7.3	1,059	488	759	6,167	6,913	366	496	649	880	1,220	5,425	2,080	9,253
900	35.4	130	5.1	10-46	33-151	818	550			28	314,473	487.4	55,622	3,394.2	7.1	1,030	659	1,015	7,679	8,476	494	670	862	1,169	1,503	6,685	2,558	11,379
1000	39.4	140	5.5	10-46	33-151	983	661			36	378,248	586.3	75,188	4,588.2	7.4	1,073	926	1,435	9,052	10,187	695	942	1226	1,662	1,797	7,992	3,067	13,641
1200	47.2	150	5.9	10-36	33-118	1,286	865			46	494,801	766.9	119,966	7,320.8	7.12	1,033	1,517	2,323	11,685	13,280	1,091	1,480	1,915	2,597	2,355	10,479	4,017	17,870

NOTE: We can redesign to suit customer's requirement, if quantity is sufficient.

(Subject to change without prior notice)

CSA code formula:

N = 0.45 f'_c A_c - $f_{pc}A_p$

$\varnothing P_{ro}$ = 0.85 [$\alpha_1\varnothing_c f'_c$ (Ac - Ap) - f_{pr} A_p]

M_{cr} = (f_{ce} + f_r)S_b where $f_r = 0.6\lambda\sqrt{f'_c}$

$\varnothing M_{ro}$ = 0.85 ($\alpha_1\varnothing_c f'_c$ A_c d_c - Σf_{pi} A_{pi} d_{pi})

ACI code formula:

N = $(0.33f'_c - 0.27f_{pc})A_g$

$\varnothing P_n$ = $0.85[0.75[0.85f'_c (Ac - Ap) - f_{pr} A_p]]$

M_{cr} = $(f_{pc} + f_r)S_b$ where $f_r = 7.5\lambda\sqrt{f'_c}$

$\varnothing M_n$ = $0.90(0.85f'_c$ A_c d_c - Σf_{pi} A_{pi} d_{pi})

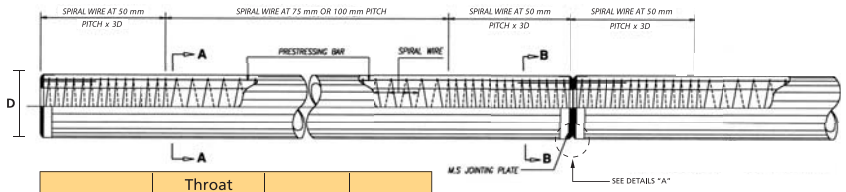
f'_c = 70 MPa (10.15 ksi)

f_{pu} = 1420 MPa (205.9 ksi)

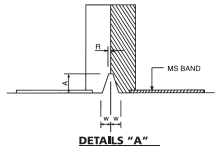
f_{pr} = $(0.60f_{pu} - \epsilon_c E_{ps})$

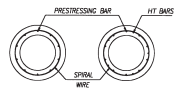
Axial resistance based on short column structural capacity only.

Sectional Details Of ICP Piles



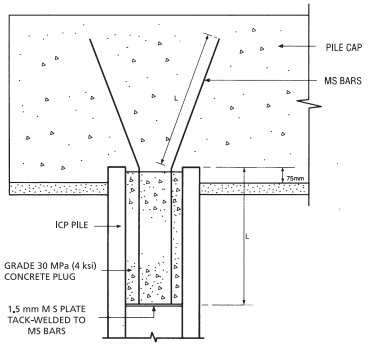
Dia of Pile D	Throat Thickness A	W	Root R
mm	mm	mm	mm
250	8.5	4.0	1.5
300	8.5	4.0	1.5
350	8.5	4.0	1.5
400	10	4.5	1.5
450	10	4.5	1.5
500	12	5.0	1.5
600	12	5.0	1.5
700	12	5.0	1.5
800	14	6.0	2.0
900	14	6.0	2.0
1000	18	6.0	2.0
1200	20	6.0	2.0





Bonding ICP Piles Into Pile Cap

As the PC bars are bonded with concrete, ICP Piles may be cut off at any Point. The piles need not be stripped down to expose the bars, and can be bonded to the pile cap as shown in the following sketch. If the piles are not subjected to tensile loads, the recommended m.s. bars are considered adequate.



Dia of Pile	MS Bars		
	Quantity	Dia.	L
mm	mm	mm	mm
250	4	12	500
300	4	12	500
350	5	12	550
400	5	12	700
450	5	15	800
500	6	15	900
600	8	15	1000
700	8	18	1200
800	8	20	1400
900	10	25	1500
1000	12	25	1500
1200	20	25	2000

Manufacturing Process Of ICP Piles

1. Cage Making / Mold Setting

PC bars in coil form are straightened and cut to correct lengths. The ends are warm-headed to form button heads. The bars are passed through the cage forming machine where spiral wire is automatically spot-welded at the correct spacings. End plates are fitted to the cage. The whole cage is then placed onto the bottom half mold.

2. Concrete Feeding

Concrete from the computerised batching plant is pumped into the mould by using the concrete pumping system.

3. Stressing

The PC bars are stressed against the mold through a central shaft and stressing plate. The stressing being carried in a single operation ensures uniformity of stress in all the PC bars and hence straightness of the pile.

4. Pile Spinning

The filled mold is then placed on the centrifugal spinning machine to be spun automatically in four stages. Spinning results in high compaction and squeezes out excess water. The resulting decrease in final water cement ratio increases the concrete strength in pile.

5. Curing

Steam curing enables the piles to be demolded earlier.

6. Delivery

When the cylinder strength reaches the required strength the piles can be transported and installed.

Special Features Of ICP Piles

Areas of Application

- Bridges
- Building Foundations
- Civil Engineering Works
- Marine Structures
- Piled Embankments

Product Attributes

- Spinning process results in more durable concrete with high resistance to corrosion.
- Grade 80 concrete enables the piles to be driven through hard strata.
- Can be manufactured up to dia. 1200mm and a maximum single length of 46 metres.
- Environmentally friendly installation by hydraulic jacking equipment which are free of noise, air pollution and vibration.

Westport Marina, Victoria, Canada

Tortola Cruise Ship Terminal Building

One Madison Avenue, Vancouver, Canada

330 Third Street South Condominium,
St Peterburg, Florida

Sultan Abdul Halim Muadzam Shah Bridge
(Second Penang Bridge, Penang, Malaysia)
Picture courtesy of Jambatan Kedua Sdn Bhd

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