PHC Pile/Pole Manufacturing Plant

Small & Medium Plant Proposal

KOAMI
Korea Association of Machinery Industry
www.koami.or.kr
Introduction
The PHC pile stands for pre-tensioned spun high strength concrete pile made by spinning with pre-tension system that is very strong compressive strength pile over 78.5 N/mm² (800 kgf) against 49.0 N/mm² for P.C. Pile.

This PHC Pile is now widely used in construction site for civil foundation work as an essential step of work process to increase bearing capacity. One of strong points of the PHC pile includes excellent bearing capacity having very high allowable compressive strength with bigger axial load than normal PC pile. In addition, there are handful advantages of the PHC pile such as very strong against a blow, excellent bending moment, and very low creep and shrinkage.
Typical Product Specifications

<table>
<thead>
<tr>
<th>Outside Diameter (mm)</th>
<th>Thickness (mm)</th>
<th>Cracking Mcr (tf.mm)</th>
<th>Breaking Mcr (tf.mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>60</td>
<td>A. 2.5</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. 3.5</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. 4.0</td>
<td>8.0</td>
</tr>
<tr>
<td>350</td>
<td>60</td>
<td>A. 3.5</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. 5.0</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. 6.0</td>
<td>12.0</td>
</tr>
<tr>
<td>400</td>
<td>65</td>
<td>A. 5.5</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. 7.5</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. 9.0</td>
<td>18.0</td>
</tr>
</tbody>
</table>

Various products not shown above can be manufactured by proposed Plant hereto. Also, the larger pile such as 700, 800 and 1,000 mm in Out diameter of can be produced for specific purpose based on Clients requirement, using other facilities.

Technical Data and Information

Process Description

Wire Caging
The PHC wires with coil form are straightened and cut into the correct lengths and formed into cages, after rivets are formed at both ends.

Mold Setting
The End plates and extension plates are fitted into the cage by threaded anchor nuts. The whole cage is then lifted and placed on the bottom half of the mold.

Mixing Concrete
The mixed concrete is prepared from the batching plant to meet the design of the concrete mix.

Pouring Concrete
The mixed concrete from the batching plant is poured into a feeding hopper, and fed into the mold.

Stretching and Spinning
The pre-stressed concrete wires are stressed against the mold through a central and stressing plate. The mold placed on the centrifugal spinning process compacts the cement, and removes excess water.

Curing and Demolding
The Steam curing of piles in the moulds is to be held for 8 hours at least, and then, are de-moulded using proper machinery.

Auto-Claves
The piles de-moulded from the moulds are held in the Auto-Claves for 12 hours or more.
Natural Curing and Inspection

The inspection is held on the outer looking, shapes, dimension, concrete strength and pile bending strength. All specifications are based on the Korean Standards of KS F-4360 and Japanese Industrial Standards of JIS A-5337 for PHC pile, KS F-4033 for PC pile and KS F-4304 for PC Pole.

Process Flow Diagram

Equipment and Machinery

Concrete Production

- Chute Gates & Hoppers in the Stock Bins
- Horizontal & Inclined Belt Conv
- Over-Size Screen in the Terminal Building
- Inlined Belt Conv W/legs and take-up Devices, 600W
- Concrete Batching Plant, 1m3 Twin-shaft Mixer
- Cement Silo, 100tons
- Screw Conveyor for Silica, 7.5HP Motor
- Silica Silo, 50tons
- Agg Stock Bins, and Concrete made Tunnels
- Conveyor Terminal Building
- Bucket Elevator for Cement
- Screw conveyor for Cement, 5HP Motor

Concrete Pouring Devices

- Concrete Auto-pouring Machine Two-way Conveyor, Weighed
- Concrete Auto-pouring Cart, 1mWx 17.0ML, Enless-winich Driven
- Pouring Cart Rails, 22K, W/wire Rope Guide and Take-up Devices
Mould Fabricating Machinery
- 4-Line Chain Conveyors
- Mould Fastening Chain Conveyor

Pre-tensioning Machinery
- Pre-Tensioning Stand, 16ML
- Pre-Tension-Jack, 300tons W/ Hydraulic Unit
- Pre-Tension-Jack, 200tons W/ Hydraulic Unit
- Jack Transferring Cart W/ rails

Spinning Machinery
- Spinning Machine, 300φ-600φ×16ML W/50HP D.C Motors and Control Box

Steam Curing Machinery
- Steam Chamber Covers W/ Insulation and Lifting Devices Using Slinger
- Mould Seats & Mould Guides
- Auto-Temperature Controllers W/ Sensors and valves
- Spuu Mould Waiting Devices

De-Moulding Machinery
- De-Moulding Stand, H, and Shaped Steel made
- Pole Moulds Turning Machines Before Demoulding W/ Hydraulic Unit
- Mould Feeding Machine W/ Reduced Geared Motor
- Mould Shock Absorber & Rotating M/C for Horizontal Seating
- Demoulding Chan Conveyor and Mould Turning Devices
- Products Transferring Chain Conveyor with Individual Rollers Rotating by Chains
- Upper Moulds Stand, 16ML, Before Turning
- Upper Mould Turning Machine W/ Hydraulic Unit

O/H Cranes with Slingers
- Spinning Yaro O/H Crane, (7.5t+7.5t), Hoist Type
- Curing Yard O/H Crane, (7.5t+7.5t), Hoist Type
- Products Carrying O/H Crane, (5t+5t), Hoist Type
- Demoulding O/H Crane, (7.5t+5t),(7.5t+5t) Capacity 3-Girders Type, W/ Vacuum Lifter
- Pouring Yaro O/H Crane, (7.5t+7.5t), Hoist Type
- Cage Crane, (3t+3t) Cap, Hoist Type

Cage Production Machinery
- P.C Coils
- P.C Heading Machine, Warm Header, W/ Air Compressor
- Cut PC, Bar Treating Machine
- Pile Caging M/C, W/84KVA Trans.300φ-600φ
- Pole Gaging M/C, W/84KVA Trans, 140φ-190φ

Auto-Claves
- Auto-Claves, 3300φ×33ML
- Boiler, 10kg/cm2, 10tons Cap
- Piles Carrying Cart with Rails
Proposed Standard Plant

Production Capacity

- 32,400 Pieces Piles and Poles/year

<table>
<thead>
<tr>
<th>Products</th>
<th>Specifications</th>
<th>Pieces/150 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>- PHC Piles or PC Piles</td>
<td>- 300~ 600 Dia mm x 7~ 16 M</td>
<td>- 15,600 (13pcs x 8 hrs/day)</td>
</tr>
<tr>
<td>- PC Poles</td>
<td>- 140~ 220 Dia mm x 7~ 16 M</td>
<td>- 16,800 (14pcs x 8 hrs/day)</td>
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</table>

- Operating condition: 8 hrs/day and 300 days/year.

Raw Materials and Utility Consumption/Year

<table>
<thead>
<tr>
<th>Raw Materials</th>
<th>Consumption</th>
<th>Utilities</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cement</td>
<td>12,000 ton</td>
<td>- Water</td>
<td>40,000 ton</td>
</tr>
<tr>
<td>- Steel Wire</td>
<td>400 ton</td>
<td>- Electricity</td>
<td>1,000,000 kwh</td>
</tr>
<tr>
<td>- Silica</td>
<td>1,200 ton</td>
<td>- Fuel Oil</td>
<td>1,000,000 L</td>
</tr>
<tr>
<td>- Sand</td>
<td>22,000 ton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Gravel</td>
<td>26,500 ton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- PC wire</td>
<td>18,000 ton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Electricity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel Oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Bunker C)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Land and Buildings

- Land: 66,000 m²
- Buildings: 5,400 m²

Construction Schedule

About 12 months after receipt of down payment after signing the Contract for basic engineering/detail design, supply of equipment and machinery, ocean/inland transportation to site, civil and buildings, field installation and commissioning and start-up. However, this proposed construction period is subject to change by the business circumstance.

Operation Manpower

<table>
<thead>
<tr>
<th>Classification</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Plant Manager</td>
<td>1</td>
</tr>
<tr>
<td>- Engineer (Foreman)</td>
<td>5</td>
</tr>
<tr>
<td>- Production Operator</td>
<td>2</td>
</tr>
<tr>
<td>- Technician</td>
<td>2</td>
</tr>
<tr>
<td>Total (based on Korean)</td>
<td>10 per shift</td>
</tr>
</tbody>
</table>

Recommended Work Division

<table>
<thead>
<tr>
<th>Work Activities</th>
<th>Owner</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>- All Approvals / Permits</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- Basic Engineering/Design</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>- Equipment/Machinery</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>- Ocean Transportation</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>- Custom Clearance/Tax</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- Inland Transportation up to Site</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- Civil/Buildings</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- All Site Construction</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- Site Supervision</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>- Commissioning/Start-Up under Company’s Supervision</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>- Field Training</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>
Technology Transfer with Training Program

The Company will provide Owner with latest technology and operational know-how for the effective management of the Plant in addition to the training of Owner’s engineers and skilled workers at Plant site as well as in Korea if required.
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