

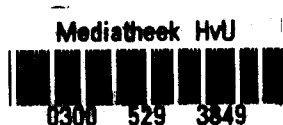
# **Final thesis**

**Feasibility of Chinese offshore market**

**Hogeschool van Utrecht**

**IHC HOLLAND**

**Supervisor: Mr R.kok**



**IHC Mr Ir. R.J. de Vries**

# **ABSTRACT**

## **1. INTRODUCTION**

<b>1.1 Company profile.....</b>	<b>1</b>
<b>1.2 Thesis definition.....</b>	<b>11</b>
<b>1.3 Problem approach.....</b>	<b>13</b>

## **2. DESCRIPTION OF IHC PRODUCTS**

<b>2.1 LMU.....</b>	<b>14</b>
<b>2.2 Hydrohammer.....</b>	<b>14</b>
<b>2.3 Swivels.....</b>	<b>21</b>
<b>2.4 Handling systems.....</b>	<b>24</b>

## **3. DESCRIPTION OF THE MARKET**

<b>3.1company profile.....</b>	<b>32</b>
<b>3.2Strategy and philology.....</b>	<b>34</b>
<b>3.3Project research.....</b>	<b>37</b>
<b>3.4Prospective plan.....</b>	<b>43</b>
<b>3.5European cooperation companies.....</b>	<b>44</b>

## **4. Conclusion.....**

## **5. Works cites.....**

**6. Appendix.....48**

# **1. INTRODUCTION**

## **1.1 COMPANY PROFILE**

### **IHC CALAND**

**IHC Caland N.V.** is a management company of a group of international companies, working mainly as suppliers to (1) the offshore oil and gas, (2) dredging, and (3) maritime industries on a global basis. The company has been listed on the Amsterdam AEX-Stock Exchange since 1965, but its dredger building activities have a history of many hundred years. The Group started its offshore activities in the early 1950's and subsequently became a pioneer in Single Point Mooring (SPM) systems, drilling vessels, jack-up drilling rigs and heavy offshore cranes. The Group's present activities comprise mainly the design, supply and installation offshore of floating crude oil loading/unloading systems for tankers, Floating Production, Storage and Offloading systems (FPSO's/FSO's) for the offshore oil and gas industry.

The Group is also in the business of owning and operating the above mentioned Floating Production, Storage and Offloading systems. These units are contracted on long-term charters, always including their operation, to oil companies in various parts of the world but excluding the North Sea. At the end of 2003 the Group had thirteen units in operation. Besides being the initiator of this concept, the Group is also the largest player. Design and engineering services to the offshore oil and gas industry in a wide range of products is provided through the Group's engineering offices.

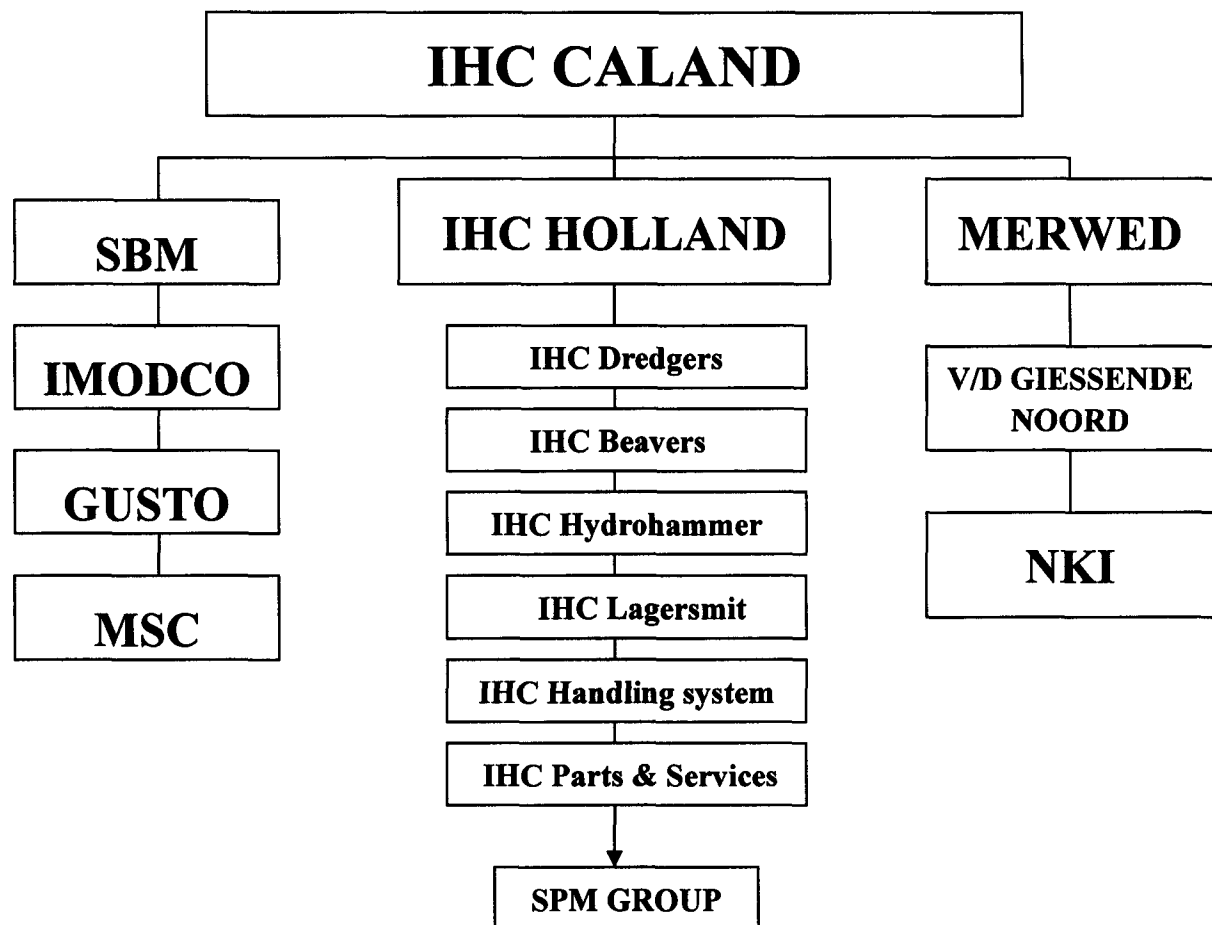
Furthermore the Group is the world leader in designing and building custom-built or standard types of dredging equipment, and is also involved in a wide range of technological activities essential for the development of this market position. In addition, some of the shipyards have a strong reputation for custom-built specialized ships. Finally, the Group's activities also include the design and construction of airport terminal building infrastructure.

In most of these activities, the Group companies are the market leaders, both in terms of market share and technical expertise. The Group has a good track record in developing new, cost-effective technical solutions for the ever changing needs of its customers, and holds a considerable number of patents related to its technology.

The above mentioned products are developed by the individual Group companies and are marketed under their own identity. Within an agreed financial and strategic framework, Group companies have considerable operational and entrepreneurial freedom. Cohesion is created in that they all have potential to support each other using one or more of their individual core competencies.

The Group can appropriately be characterized as a niche player in its chosen fields of business.

## Group structure



## **IHC Hydrohammer B.V**

IHC Hydro hammer is a division of IHC Holland, world-wide suppliers of dredging barges and machinery and a manufacturer of piling hammers and related equipment. In 1985 IHC Hydrohammer introduced the first intelligent pile driver. Since then over 300 pile drivers have been supplied world wide. This electronically controlled, hydraulic piling hammer is the answer to the demands imposed by modern foundation technology. IHC provides world-wide service and assistance in piling computing, piling hammer selection and operational proceedings.

The highly reliable electronic control system of the Hydrohammer ensures optimum control of the piling process and the design enables a range of safety, monitoring and indicating devices to be incorporated without the need for sensitive mechanical components. Compared with other piling hammers, the Hydrohammer may justly be described as multifunctional. The limited number of components contributes to its reliability. Dutch and foreign patents have been applied in respect of the unique construction of the Hydrohammer.

The Hydrohammer is a universal hydraulic piling hammer for use onshore and offshore, in air or submerged. More than 20 years' development, manufacturing and operation experience lie behind the revolutionary design.

Among the most striking advantages of the Hydrohammer are the control of the energy per blow and the limited number of components. The weight of the Hydrohammer is small in comparison with the energy which it generates.

Engineering assistance based upon many years of experience in offshore piling, both above the water and submerged, is available. The Hydrohammer is of modular construction. There are no bolts, hoses or other connections inside the hammer, a fact which contributes to its reliability. Should vital parts such as valves, accumulators, sensors, etc. require replacement, these can easily be reached from the outside. Exhaustive tests on various types of piling operation on land and offshore have fully confirmed the reliability, controllability and ease of operation of the Hydrohammer. All necessary ancillary equipment such as pile guide sleeves, adapters, compensators, power packs, winches etc. can be supplied.

## **IHC Handling Systems**

IHC Handling Systems is a subsidiary of IHC Holland, a group that includes, among others, the world leader in standard and custom-built dredgers and associated equipment.

IHC Holland is a member of IHC Caland NV, a group of international companies,

suppliers of capital goods and services to the offshore oil and gas, dredging, marine mining and shipping industries on a global basis. IHC Caland NV is listed on the Amsterdam Stock Exchange.

IHC Handling Systems has more than 45 years experience in the oil and gas market. Since then, their activities have been directed mainly by the oil and gas industry with particular emphasis on the design and supply of offshore equipment and services.

### **The product range includes:**

Internal-and external lifting tools, bear cages, leveling systems, jacket pile grippers, skidding equipment, hydraulic shackles and pin-release systems, power packs, hose reels, etceteras. IHC Handling Systems also offers the opportunity to rent a tool from its product range. All tools in our large rental fleet are maintained in excellent condition.

Marketing customers' interests these own; they will solve your problems from design through to commissioning and service. The unique combination of engineering, manufacturing and commissioning allows them to offer you total responsibility during the project. This results in high quality products to mutual satisfaction.

Besides, oil and gas experience IHC activities include pulse mig/mag cladding and Plasma cladding. IHC Handling Systems has gained considerable experience with Plasma cladding/pulse mig/mag cladding techniques in the following applications:

- Fittings for appliance construction (nozzles including flange surface)
- Valve seats
- Sliding surface of swivel clutches
- Piston rods, crankshaft, sliding blocks, brake disc etc.

## **IHC SPM Group**

The SPM-GROUP (single point mooring) is an ISO 9002 certified department within IHC HOLLAND parts & services in kinderdijk.

### **The core business**

The core business of SPM group is the fabrication of several type of rotating connections(swivels) carrying high-pressurizes oil, gas or other fluids for the offshore industry which are mounted on a floating production storage off loading vessel (FPSO). Multiple swivels can be stacked on the top of each other allowing the FPSO to weathervane around the swivel stack under a continuous flow of fluid.

## **Main client**

Single point mooring (Monaco) and Imodco (USA). They are responsible for the design and fabrication of the hull, topsides, mooring system and swivels.

The swivels are made of carbon steel or super duplex stainless steel and the sealing surface are overlay welding with wear resistant inconel 625.

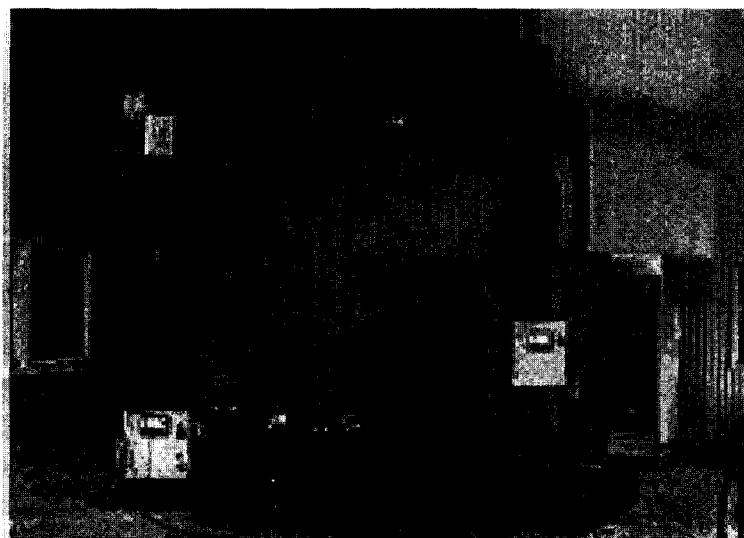
At the IHC-yard in kinderdijk they are able to fabricate a complete swivel stack. The project department provides the preparation and coordination of the activities. These activities consist welding, post weld heat treatment, machining, assembly and testing, painting and seal fabrication. During and after offshore installation of the swivel stack their service-term is able to provide a worldwide service. The departments belongs to the SPM group are the welding shop, the Assembly and testing shop and the seal fabrication shop.

## **Project department**

At the project department the work is co-ordinate and prepared. This includes the whole process from making offers, planning, purchasing, and taking care of the documentation and co-ordinating the production activities.

The quality of the activities is assured by the project department, therefore internal and external audits are being done regularly. Since 1997 the SPM group is ISO 9002 certified for manufacturing, assembly and testing of mechanical components for the offshore industry.

## **Welding shop**





The welding shop offers a wide range of welding facilities. The shop is specialized in the production of high pressure components for the offshore industry which demand a high quality, e.g. swivels. All welders are qualified in the welding methods used. Special attention is given to the cladding of duplex, super-duplex or other types of stainless steel castings with nickel based overlay such as inconel and hastalloy. These layers are very resistant against wear and tear and are practically corrosion free.

Beside offshore products the welding centres also produce high pressure vessels and special piping.

Research and development has been a field of interest for the centre for a long time already and will continue to be so in the future. Some of the results from this R&D are directly applied in the various welding methods:

The bulk of the work is done using electro slag and submerged arc welding;

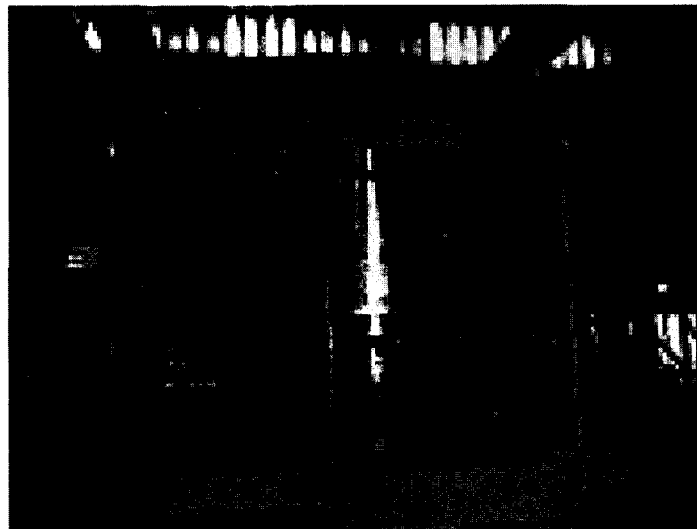
Wire (1, 2 to 5mm) and strip (30 to 60mm) welding;

Welding under clean-room conditions;

Internal cladding of components with an inner diameter varying from 76 to up to 4500mm;

Fully automated hot wire tig system;

### **Assembly & testing shop**



A very select group of fitters are currently employed in the workshop. The fitters are specialized in the assembling and testing of high pressure equipment and high pressure offshore swivels in particular.

The workshop consists of:

12.5\*37.5m work-floor;  
2 fully automatic test benches;  
Two overhead cranes, with a capacity of 20 tons each;  
Extensive range of hydraulic and mechanic tools;  
Large quantity of standard and special blind flanges;

### **Seal fabrication shop**



In 1996, the SPM group started manufacturing their own seals, mainly because their suppliers did not meet their high quality demands. By producing their own seals and therefore keeping the knowledge within the group, the SPM group was able to boost up the quality and seal mechanics and seal behaviors and inevitably to a better quality swivel. As a result the SPM group decides to place a special temperature controlled seal controlled seal hall in which the ideal conditions and maintained for seal production. A special lathe for synthetic and plastic materials was purchased. The developments of the late few years led to a number of very specific specialties, such as:

- Production of seamless seals up to a diameter of 3 meters;
- Production of seals with a diameter larger than 3 meters by welding base material;
- Production peek materials back up rings;
- Welding of peek material;

## **1.2 Thesis definition**

### **Feasibility of Chinese offshore market.**

#### **Considering:**

The relation between IHC and China has history that goes back to the 19<sup>th</sup> century. Today the export to different Chinese customers is becoming more intensive. IHC is increasing their activities in China.

At this moment IHC operating the following activities in China;

- Service centre for Spare Parts
- Representative office for commercial operations
- Co-operation with different Chinese shipyards for new builds of dredgers.
- As a subcontractor IHC P&S has delivered components for the offshore industries.
- Several IHC Holland business units; Hydro Hammer; Handling Systems are delivering equipment/installations to several Chinese offshore companies.

The main activities of the SPM group of the business unit Parts & Services of IHC Holland is swivel manufacturing for the SBM Company.

In the summer of 2004 the IHC Caland group will be divided in two companies. One part will be focusing on the offshore market (manly SBM and Gusto). The other group will focus for the main activities on the shipbuilding market. IHC Parts & Services will be part of IHC Holland and therefore part of the shipbuilding division.

#### **Assignment:**

The student is asked to make a feasibility study of the Chinese offshore market for IHC Holland in general and the SPM group in particularly.

A study and description of the products of IHC Holland is necessary.

With the knowledge of the IHC products a comparison with possible offshore products for the Chinese market can be made and will form an integrated part of the report. The presented products should be technologic described in function and design.

The focus on the potential products will be the products that are at this moment imported in China by European suppliers. A list of these products will form an integrated part of the report.

The organisation (possible organisation-chart) of the Chinese offshore market and the active companies will also be a part of the report. The operation lines and procurement philosophy/behaviour is, if possible, also an interesting chapter.

Naturally a list of the present European suppliers for the Chinese market is requested.

**General:**

The student is responsible for the schedule and progress of the project.

The assignment will be finished with a report and presentation for the Hogeschool van Utrecht and possible internal for IHC.

The coach in IHC is Mr Ir. R.J. de Vries.

## 1.3 Problem approach

According to the project definition I followed total design book chapter two design core market/user needs and demands to think of the problems.

The start point for any design should be the establishment of marker/user need situation in considerable depth. Research progress in both the product area and analogous areas should be obtained and studied together with the proceedings of conferences, reference books and the like, research paper listings and abstracts are readily obtainable through computerized data searches and modern information retrieval systems available in many large libraries.

Needs analysis is concerned with establishing the true needs of the customer. This can be obtained by extensive examination of the view and representative bodies, market data publications, reports giving official opinions and reactions to products in use and also by structured interviews or customer questionnaires.

## **2. Description of IHC products**

### **2.1 LMU**

#### **Leg Mating Units**

Leg mating units (LMU) are used in the float-over process. In this process a top-structure is installed onto an in-site base structure (e.g. jacket). The top-structure is transported to the site with barge will be slowly submerged.

During this process the loads need to be transferred from the barge to the structure in a controlled manner. This is achieved by using a Leg Mating Unit. LMU are units consisting of a steel structure incorporating rubber elements to achieve a spring rate. The specified spring rate depends on the expected loads and movements.

Initially the top-structure sits barge mounted LMU. During submerging the loads are then slowly transferred from the LMU on the barge to the LMU on the structure. Any wave movement is then absorbed in the rubber elements in the LMU.

After the installation is completed the top-structure is fixed (e.g. by welding) to the sub-structure.

### **2.2 Hydro hammer**

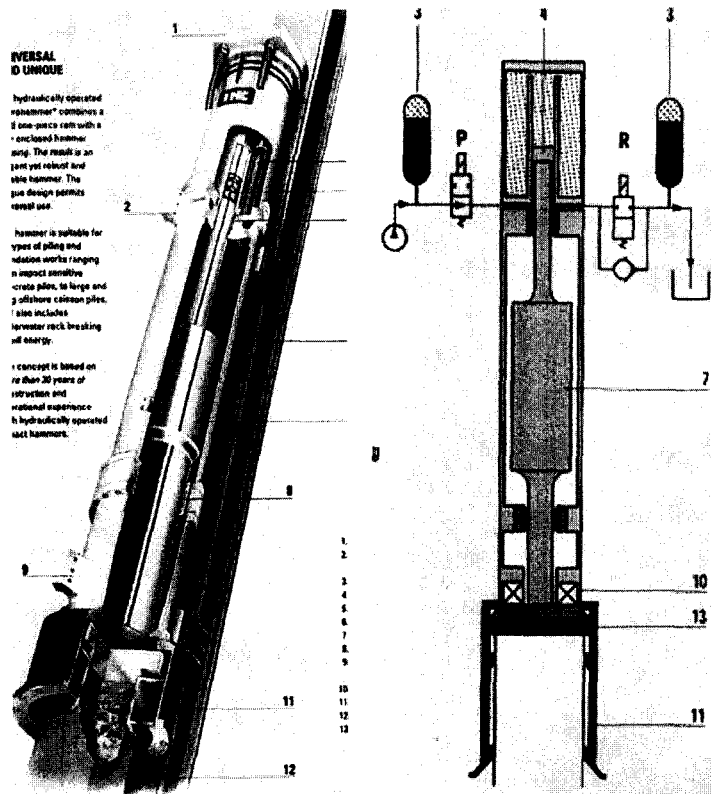
#### **2.2.1 In general**

The hydraulically operated hydro hammer combines a solid one-piece ram with fully enclosed hammer housing. The result is an elegant yet robust and reliable hammer. The unique design permits universal use.

The hammer is suitable for all type of piling and foundation works ranging from impact sensitive concrete piles, to large and long offshore caisson piles, and also includes underwater rock breaking at full energy.

The concept is based on more than 30 years of construction and operational experience with hydraulically operated impact hammers.

## 2.2.2 Operating principle



1. valve plate
2. upper leader attachment
3. accumulator
4. piston
5. upper bearing
6. hammer housing
7. ram
8. lower bearing
9. lower leader attachment
10. shock absorber
11. pile sleeve
12. pile
13. anvil/pile cap

The operating cycle begins with the lifting phase of the ram (ram weight, ram pin piston rod are forged in one piece). Valve P in the pressure line is opened and valve R in the return line is closed. When the preset stroke position point is reached, the valves are

automatically reversed allowing the ram to start its downward stroke. The ram is accelerated by pressurized gas above the piston and reaches a maximum acceleration of 2g. This reduces the necessary maximum stroke and at the same time increases the blow rate of hammer. After impact the cycle repeats itself automatically.

The ram is guided by oil lubricate upper and lower bearings (some types have greased lower bearings). This eliminates wear on the ram. The hammer operates under every inclination, even horizontally thanks to the cap pressure.

On impact the ram strikes either a solid steel anvil (for steel piles), or a pile cap (for concrete piles). The pile cap contains a hammer cushion on the top and a pile cushion at the bottom.

The hammer can operate leader guided or free hanging. For the latter the hammer is equipped with a pile sleeve for sufficient stability when driving.

### 2.2.3 Specification

HAMMER S SERIES		S-30	S-35	S-70	S-90	S-120	S-150	S-200
OPERATIONAL DATA								
Max. blow energy on the pile	kNm	30	35	70	90	120	150	200
Min. blow energy on the pile	kNm	2	2	2	2	6	6	10
Blow rate at max. blow energy(1)	bl/min	65	60	50	50	44	45	45
WEIGHT								
Ram	ton	1.5	3	3.5	4.5	6.2	7.5	10
Hammer with ram in air(2.3)	ton	3.7	7.1	8.3	9.6	14.3	16.2	24.5
DIMENSIONS								
Outer diam. hammer	mm	457	610	610	610	712	712	915
Length hammer(4)	mm	5745	5600	7130	7880	7960	8710	8920
HYDRAULIC DATA								
Operation pressure	bar	280	220	230	280	250	280	250
Oil flow(5)	l/min	160	160	220	220	460	460	750
Hose ID	mm	25	32	32	32	38	38	50
POWER PACK TYPE (recommended)								
Air cooled		P-170	P-170	P-250	P-250	P-460	P-460	P-750L
Water cooled								P-750W



<b>HAMMER S SERIES</b>		<b>S-280</b>	<b>S-500</b>	<b>S-600</b>	<b>S-900</b>	<b>S-1200</b>	<b>S-1800</b>	<b>S-2300</b>
<b>OPERATIONAL DATA</b>								
Max. blow energy on the pile	kNm	280	500	600	900	1200	1800	2300
Min. blow energy on the pile	kNm	10	20	20	45	60	180	230
Blow rate at max. blow energy(1)	bl/min	45	45	36	30	30	30	30
<b>WEIGHT</b>								
Ram	ton	13.6	25	30	45	60	75	115
Hammer with ram in air(2.3)	ton	29	55	63	125	138	200	260
<b>DIMENSIONS</b>								
Outer diam. hammer	mm	915	1220	1220	1625	1625	1830	1830
Length hammer(4)	mm	10190	10200	11000	12785	14065	15840	18040
<b>HYDRAULIC DATA</b>								
Operation pressure	bar	300	300	280	250	310	230	300
Oil flow(5)	l/min	750	1400	1500	2800	2800	4500	4500
Hose ID	mm	50	2*50	2*50	76	76	100	100
<b>POWER PACK TYPE (recommended)</b>								
Air cooled		P-750 L			On request			
Water cooled		P-750 W	P-1600W	P-1600W	On request			

<b>HAMMER SC SERIES</b>		<b>SC-50</b>	<b>SC-75</b>	<b>SC-110</b>	<b>SC-150</b>	<b>SC-200</b>
<b>OPERATIONAL DATA</b>						
Max. blow energy on the pile	kNm	50	75	110	150	200
Min. blow energy on the pile	kNm	1	3.7	6	10	10
Blow rate at max. blow energy(1)	bl/min	50	50	40	40	40
<b>WEIGHT</b>						
Ram	ton	3.3	5.7	7.9	11	13.6
Hammer with ram in air(2.3)	ton	5.9	9.8	14.1	18.75	26.5
<b>DIMENSIONS</b>						
Outer diam. hammer	mm	660	762	1020	1020	1330
Length hammer(4)	mm	5280	6115	5600	6380	5660
<b>HYDRAULIC DATA</b>						
Operation pressure	bar	220	270	260	280	280
Oil flow(5)	l/min	200	250	460	460	750
Hose ID	mm	32	32	38	38	50
<b>POWER PACK TYPE (recommended)</b>						
Air cooled		P-250	P-250	P-460	P-460	P-750L
Water cooled						P-750W

<b>POWER PACK TYPE</b>		<b>P-170</b>	<b>P-250</b>	<b>P-460</b>	<b>P-750L</b>	<b>P-750W</b>	<b>P-1600W</b>
<b>OPERATIONAL</b>							
Max. pressure	bar	350	350	350	350	350	350
Max. oil flow(5)	l/min	170	250	460	750	750	1600
Power	kW	130	167	344	435	450	1040
<b>DIMENSIONS</b>							
Length	mm	2900	3500	4000	4500	6040	6060
Width	mm	1200	1300	1500	1800	2440	2438
Height	mm	1650	1850	2250	2300	3200	2896
<b>WEIGHTS</b>							
Net weight	kg	3000	3600	5500	8500	13000	32000
Weight incl. Fuel and oil	kg	4000	5000	7000	11000	19000	30500

### **2.2.4 Two series of hammers S and SC**

The IHC hydro hammers are available in two series; the S and SC series. The ram weight of S series is relatively light and the hammer gets a greater part of its energy from acceleration due to the gas pressure on the top of the piston. This makes the hammer ideal for driving steel piles, such as casings, H-beams and offshore piles.

The SC series have a heavier ram weight and lower acceleration because of the lower cap pressure. With the same stroke as the S series the SC series have a lower impact velocity, making these hammers the better choice for the driving concrete piles, or when a universal hammer for various types of piles is required.

### **2.2.5 Drive ability**

A proper choice for a hammer can only be made after careful interpretation and assessment of the properties of soil. To support its users IHC has a staff of experienced civil engineers to assist them with pre-and post -pile driving analyses. These drive ability studies are carried out the most sophisticated computer programs. These programs are also used to enable IHC design engineers to optimize hammer components.

### **2.2.6 Hammer control and monitoring**

All hydraulic functions of the hammers are electronically controlled and monitored. This ensures optimum control of the energy, blow rate and an optimum transfer of the energy into the pile head.

Safety features are built into the controls. They include protection against too high or too low a ram stroke, too high level and incorrect hammer/pile positioning.

The electronic signals from the hammer sensors and from the power pack controls are fed into a single control box. In the event of malfunction the control box software assists in solving the problem. The piling data can be printed on site or stored in a data logger. The data logger option facilitates information transfer to PC□allowing engineers to conduct detailed analysis of the driving operation.

### **2.2.7 Cast-in-site piles**

One of the unique features of the IHC hydro hammer design, besides its sturdiness and high level of controllability, is its ability to facilitate extraction of earlier driven casings. For extraction a special clamp system rigidly connects the pile head and hammer housing. Line pull from the crane is transferred to the pile via the clamp. High frequency operation of the hammer with extremely low energy per blow reduces frictional resistance, enabling pile extraction at crane loads significantly lower than

used for conventional static pulling.

Under extremely difficult circumstances it is even possible to generate an additional upward force by impacting the hammer housing in an upward direction. This can set a jammed pile into motion.

This combination of features means that only one hammer is needed for both driving and extracting, making them ideal for handling cast-in-situ piles.

### **2.2.8 Rock breaking**

If equipped with chisel set, the hydro hammer is transformed into a highly effective and powerful rock breaker. As the S series have the highest impact velocity, this type is the most suitable for producing the high impact force necessary for breaking rock, cemented layers, concrete floors and slabs.

### **2.2.9 Sheet piles**

For driving sheet piles both the S series and SC series can be equipped with sheet legs. These legs give the hammer the required stability when driving sheet piles in a free riding mode. This eliminates the necessity of a leader and driving can be done with aid of a regular crane.

### **2.2.10 Offshore/underwater operations**

The enclosed hammer housing makes the hammer suitable for underwater operations. Compressed air inside the hammer housing and at the location of impact is required to prevent water entrainment.

### **2.2.11 Raked piles**

By adjusting the gas pressure above the ram's piston head the ratio between the energy delivered by gravity and by gas energy can be adjusted. When driving raked piles the gas pressure is increased to compensate for the loss of gravity energy. Battered piles up to a rake of 1:1 (45 degrees) can be driven at almost full energy. It is even possible to drive horizontally. In this case it is only the gas pressure which accelerates the ram.

For deep water applications a special air valve is available which automatically adjusts the housing pressure to the prevalent hydrostatic water pressure outside the hammer. The record water depth for an IHC hydro hammer is 900 meters in the Gulf of Mexico. Driving at even greater depths can be expected in the near future.

### **2.2.12 Noise insulation encloses**

A new feature of the hydro hammer is the possibility to equip the hammer with a noise reduction package. This consists an enclosure at the point of impact and below sections around the pile. Their design was developed in collaboration with the Dutch research institute TND/TPD. Noise levels can be reduce to less 80 db at 7 meters, which is a great improvement in the noise emission levels for today's building sites.

### **2.2.13 Service/Training**

Worldwide both IHC and IHC hydro hammer are well known for their reliability and the excellent quality of service and support, and the worldwide distribution network. All dealers have experienced service engineers and have a wide variety of spare parts to supply customers immediately from stock.

As a further service to customers, IHC hydro hammer also provides various training courses at their own test facility at kinderdijk. These courses enable customers to become acquainted with the equipment and operating principles and provide detailed training to the customer's service engineers.

Courses can also be tailor made to meet customer needs.

## **2.3 Swivels**

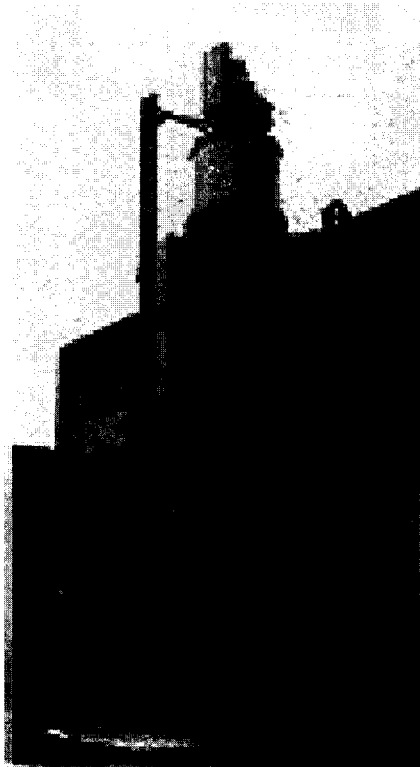
### **2.3.1 In general**

Swivels are tailor made system, used for mooring loading and off loading crude oil tankers and for floating production storage and off load vessels (FPSO). A swivel transfer one or more media across the interface between the rotating and the no rotating part of system.

A standard low or high swivel consist of a three race roller bearing, an inner fixed part, an outer rotating part which enclose a toroidal shaped passageway and special designed seals. The assembly of swivels is referred to as a stack and is an essential component on a FPSO.

The oil, gas, hydraulic or electrical products enters the swivel through the inlet at the bottom of swivel and passed the medium though the toroidal chamber to outlet. Concentricity of inner and outer ring is maintained by three race roller bearing.

Depending on requirements, the swivel stack can be arranged for handling different oil. Water, gas, hydraulic, electric and optical passes. Each of these functions flows through segregate passes, which when assembled from a vertical stack. Each swivel pass is especially designed for a condition of the medium that is being transferred.



Swivel

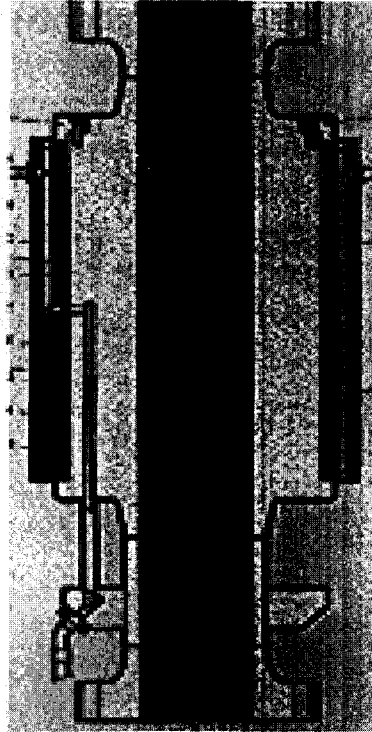
### 2.3.2 Seals

The seals are seated in grooves between the inner part and outlet part. The clearances between the two parts are minimized in order to avoid extrusion of the seals material into this gap.

The seals are in contact with the fluid and seal the fluid under pressure. These seals are called the primary seals. In case of a primary seal failure, a second seal is mounted directly behind the primary seal. The second seal is called the secondary seal. Sometimes a scraper seal may also be added to exclude solid contaminants from the primary seals.

Leakage ports are provided between the primary and secondary seals for leak detection and recuperation. The fluid leaking past the primary seal is collection in a recuperation tank. The contents of a recuperation tank can be drained and injected into the toroidal chamber.

### 2.3.3 Central pipe swivel

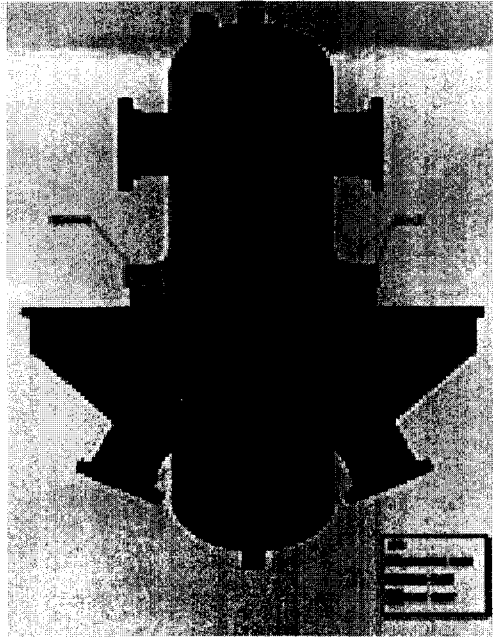


Another type swivel, but with the same principle of producing and sealing is a low pressure central pipe swivel.

The central pipe swivel is construction from two large diameter cylinders, connected to two rings, which are linked by means of three race roller bearing. This bearing secures the relative axial and radial position of two parts. The rotating part provides the housings for the seals.

The diameter of the inlets and outlet of the outer chamber are selected per application.

### **2.3.4 Hydraulic swivels**



Hydraulic swivels are designed to operate with a water based hydraulic fluid or a mineral oil based hydraulic fluid and when injection is required they are designed to be compatible with various types of chemical products.

Hydraulic swivels provide a large number of small paths, some swivels are provided with an inner bore to allow the passage of another fluid.

The axial position of the outlet rings with respect to the inner rings, demands for high machining tolerances in axial direction of all swivel rings.

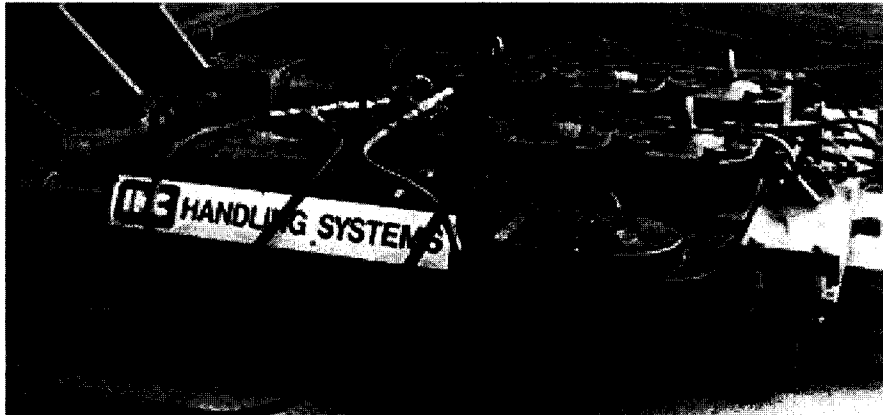
## **2.4 Handling systems**

Products includes Internal-and external lifting tools, bear cages, leveling systems, jacket pile grippers, skidding equipment, hydraulic shackles and pin-release systems, power packs, hose reels, etceteras.

Products descriptions are as follow:



## 2.4.1 Skidding Systems



Skidding is the most cost effective and accurate method of moving and positioning heavy loads. The skidding concept is simple but its execution is highly sophisticated. A heavy load to be moved is pushed or pulled safely over its supporting skid beams by compactly built skidding units. These units easily generate sufficient push or pull force to overcome friction and to slide the load over the beams in a controllable way.

### Applications

Our skid units are to generate very large traction forces in small, confined spaces. This feature makes them ideally suited for accurate horizontal movement of heavy loads. Capacities range from 10 tones push/pull force for container moving systems up to 6000 tones push/pull force launch barge skidding systems.

Applications include:

Offshore drilling

- Drilling skidding
- Mud treatment package skidding
- B.O.P. transport
- Drilling package transfer between jack-up and platform

Jacket fabrication

- Load-out
- Launching

Module fabrication

- Load-out
- Module positioning on platform
- Removable bumper guides

### Ship building

- Positioning of ship sections
- Ship transport to and from lift flat forms

### Construction

- Moving of large structures, bridge section, etc.

### Skidding systems:

- Do not require oil, grease or PTFE on the skid beam
- Keep skid beam fabrication simple, no slots or recesses are necessary
- Can operate on skid beams with considerable misalignment
- Have a built-in gripping back-up facility and have quickly inter-changeable gripper jacks
- Are easy to operate and require minimum maintenance
- Are designed for maximum long term reliability under the most rugged conditions

### Different types:

1. Launch barge skidding equipment with a low profile to allow overhead passage of jackets. Auxiliary grippers enable the units to walk over the skid beam without necessarily being attached to the jacket.  
Push/pull capacity of four units up to 6000 tones.
2. Yard skidding device provided with auxiliary grippers and a spreader mechanism. The spreader mechanism is used during repositioning of the skidding units. They move the gripper's apart facilitating installation on to the skid beam flange. Push/pull capacity of two units up to 1000 tones.
3. Rig skidding equipment for north/south and east/west movement of derrick and skid base. Basic equipment consists of grippers and skipjacks only. The gripper pistons are standardized; the gripper body and skipjacks are adapted to suit the customer's specification. A low design friction factor between grippers and skid beam flange offers maximum reliability.

There are no teeth in the grippers to cause wear on the flange. The rig skidding equipment allows the rig to be aligned in a controlled way, accurately and safely. The units are designed for long life in a marine environment. Other applications include BOP handling, mud treatment packages, cantilever, helideck and crane base skidding.

Push/pull capacity of two units up to 1000 tones.

4. Rail skidding device fitted with side clamping type grippers. These compactly built grippers are easily removable from the rails and can fit in narrow spaces.  
Push/pull capacity of two units up to 200 tones.

## Principle

The operation of our skidding equipment is based on hold force between a set of gripper jacks and the flange of a skid beam.

The gripper jacks operate hydraulically: when pressurized they clamp the skid beam flange firmly and serve as an anchor point for the skipjacks.

The skid jacks subsequently move the load for a distance of one jack stroke.

After completion of the skidding stroke, the gripper jacks are released again allowing the skid jacks to perform an unloaded return stroke.

This cycle can be repeated any number of times to move the load over any desired distance.

The method allows powerful, short stroke cylinders to be used in situations where relatively large traveling distances are required.

The load is supported by means of sledges or pads.

The need for wheels, bogies or transporters is eliminated.

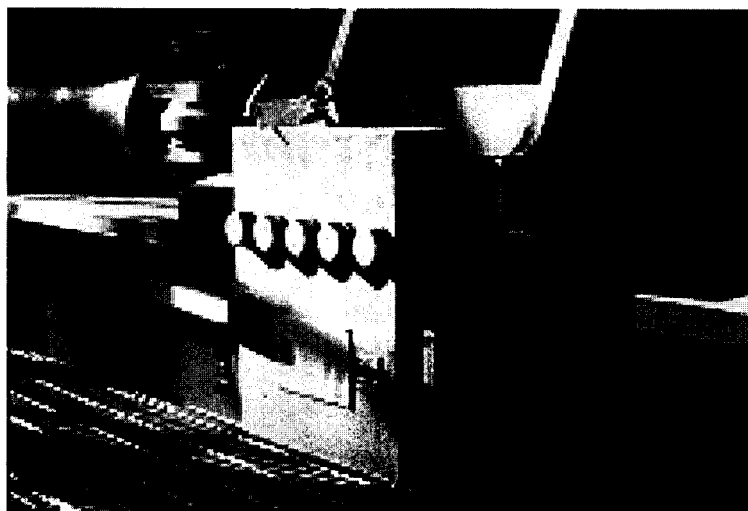
Precise positioning is another feature of the skidding technique.

Accuracies, superior to those of other transportation methods can easily be achieved.

### Specification rig skidding devices

- \* Typical dimensions
  - \*\* Overall width 'E' based on 500 mm wide skid beam; other sizes on request.
  - \*\*\* Twin skid jack version.
- 
- Working pressure 350 bar.
  - All skidding devices are custom built to customer specifications.
  - Data sheet dimensions are indicative only; consult IHC Handling Systems for full details.

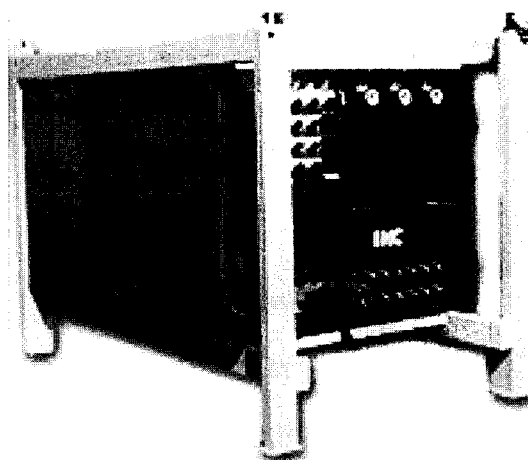
## 2.4.2 Hydraulic lock clamps



On drillings these sturdy wedge type clamps enable the drill floor to be locked in place when skidding is completed. The clamps are remotely controlled from the rigs kidding control panel. They are bolted to the module's foot and transfer possible horizontal and uplift forces into the skid beam. During skidding they serve as horizontal guides preventing any skew movement. The clamps are self locking; compression springs inside the hydraulic cylinder compensate rig vibrations.

Clamping or release is accomplished safely and quickly. The hydraulic lock clamps are designed especially for offshore applications: major moving parts are manufactured in non-corrosive materials.

## 2.4.3 Power packs

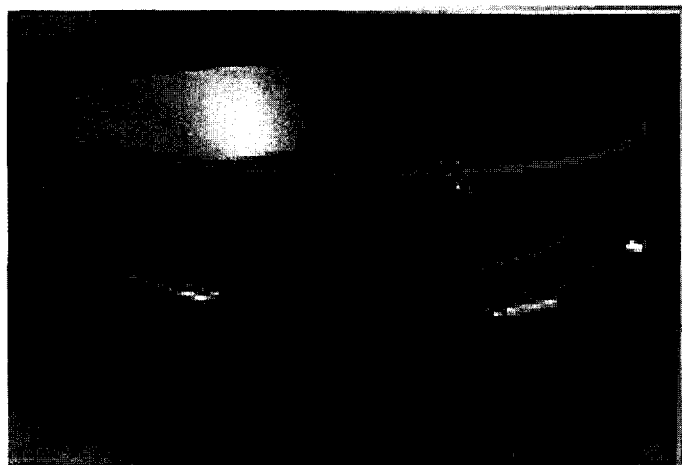


Hydraulic power is supplied by power packs which are mounted in strong protective frames equipped with pad eyes for ease of handling.

The pumps can be driven by air, diesel or electric power to match your requirements and integrated or separate control panels are available.

Connections between the power pack, controls and skid units can be made in hard piping and flexible high pressure hose; self closing quick disconnecting couplings are used where rapid repositioning is of importance.

#### **2.4.4 Jacket Pile Grippers**



#### **Product description**

A Jacket Pile Gripper JPG is an external gripper especially designed for jacket installation operations. The JPG is part of the pile sleeve enabling a rigid connection between the pile sleeve and the pile during installation, leveling and grouting. When a jacket is installed in sections, these type of grippers can also be used for temporarily connecting the jacket's upper and lower structure sections during grouting operation and while the grout cures.

In cases of emergency caused by bad weather conditions or any other incident during jacket installation, the JPG allow for quick and safe connection of the pile sleeve to the pile, even if the pile is not completely driven yet.

The JPG assembly consists of a number of double acting hydraulic gripper cylinders, radically arranged in cylindrical structure housing. This ring type housing is beveled at top and bottom sides for welding to the pile sleeve sections. The JPG can also be provided with pile stabbing cones to form the complete topside of the pile sleeve which

leaves less welding work for the jacket manufacturer. This consequently saves time and reduces the risk of damaging the JPG while building it in the jacket's structure. The gripper jacks feature double acting cylinders, allowing gripping and releasing actions for several times. Gripper jack facings are provided with hardened teeth, the teeth profile will also hold on weld beads and grout shear keys.

### **Ready for installation**

IHC Handling Systems design and manufacture Jacket Pile Grippers as complete fabricated and pre-installed units, ready to be welded in the upper section of skirt pile sleeves on the jacket fabrication site. The hydraulic jacks of the JPG are connected by stainless steel hydraulic piping up to a central control unit which can be connected to the external pressure supply or ROV operation.

The control unit consists of a hydraulic manifold for no-leak connection of the hydraulic controls and piping, optical pressure indicators and female hot stab connectors for ROV operations.

### **Controls**

Activating the hydraulic jacks can be designed and executed in different ways, depending on the actual circumstances, technical possibilities and client's specification. Hydraulic lines from the gripper assemblies to the surface can be provided in the jacket's legs to supply hydraulic fluid to the gripper jacks. Hydraulic fluid under high pressure can also be stored in accumulators which are integrated in the JPG hydraulic. Properly designed, the accumulators can contain sufficient energy for several gripper actions. The hydraulic power can also be supplied by ROV connected to the central control unit by means of a dual port hot stab. Hydraulic valves are integrated in the control panel which can be "manually" operated by the ROV. Pilot operated check valves secure main hydraulic lines.

### **Custom Built**

For optimum gripping additional centralizing guides are welded in the gripper housing to minimize eccentricity of the pile and the pile sleeve. For pin gripping and structures with pre-installed piles, tolerances are substantially higher, which could result in greater eccentricity between pin and sleeve. The hydraulic cylinders are custom built and the stroke of the hydraulic jacks is designed to ensure full holding capacity even when the pile is off-center. The JPG can also be designed and provided with an integrated leveling system.

### **Quality Assessment**

The Jacket Pile Grippers are designed, manufactured and tested in accordance with the

relevant codes, standards and regulations for offshore structures and additional client's specification. The hydraulics of all fabricated units is pressure tested at 150% working pressure. Prior to delivery the JPG have been full-load tested at the specified holding capacity in our workshop.

### **Field service**

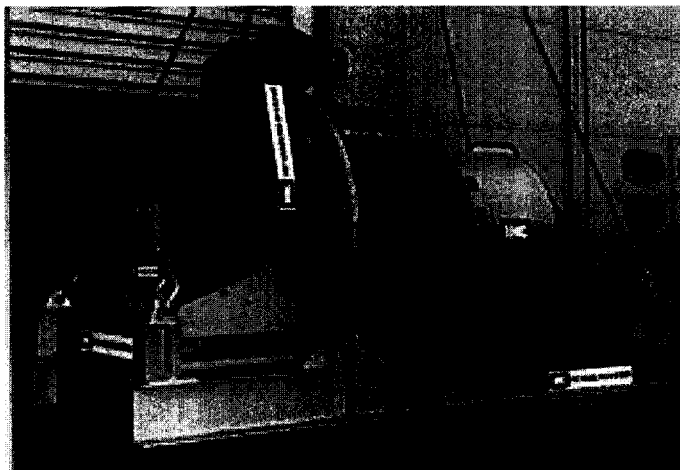
After installation by the jacket manufacturer IHC Handling Systems can provide on-site assistance during operation of the jacket pile gripping system.

## **2.4.5 Pile and Conductor Handling Tools**

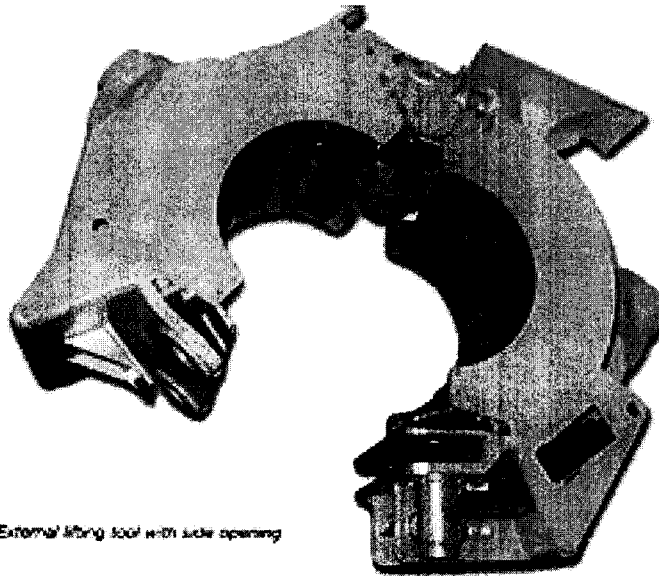
### **Applications**

1. Internal lifting tool ILT
2. External lifting tool ELT
3. Bearcage
4. Frame with jacks and upper ELT
5. Lower external lifting tool ELT

### **In-And External Lifting Tools**



**INTERNAL LIFTING TOOL**



*External lifting tool with side opening*

## EXTERNAL LIFTING TOOL

Applications include:

- Handling piles from the horizontal to the upright position;
- Stabbing and lowering into guide sleeves;
- Holding piles in position whilst add-on sections are welded;
- Pile and conductor alignment and lowering;
- Jacket jacking and template leveling.

The lifting tools utilize a radial gripping force to hold a pile, exerted by sets of opposed wedges.

The lifting tools are weight energized; increase of pile weight automatically increases the gripping force.

Activation of the clamp/release mechanism is done hydraulically, either by local control on the tool, or remotely from the power pack or a crane operator's cabin.

Features:

- Fail-safe design: when a pile is suspended by the clamp it cannot be released by faulty operation or hydraulic hose failure;
- Buttons are circular; this, combined with a low hold force per button, limits pile deformation to a minimum;
- Wedge sliding faces are flat; they are provided with bronze alloy bearing plates and a grease system to guarantee low internal friction and to reduce maintenance;
- Easily adaptable to different pile diameters.

IHC internal and external lifting tools simplify the handling of large diameter tubular



piles. The lifting tools are quickly installed and easy to operate. They speed up pile handling operations and at the same time increase safety. Awkward rigging, welding and use of temporary pad eyes on piles is no longer required.

External lifting tools have a unique and patented wedge synchronization system. It assures synchronous operation of all wedges without stressing the piston rods, even in asymmetric loading conditions.

This system results in compactly built tools. High loads imposed by guide cones or bearages are transferred easily through the housing. Well proven simple and sturdy equipment designed to last longer.

### **Internal Lifting Tools ILT**

The internal lifting tool can be inserted into a pipe either in a vertical or horizontal position. A cone at the forward end of the clamp facilitates stabbing.

The horizontal pick-up arm, installed to handle the unloaded clamp horizontally, can be removed easily to allow passage of the tool through narrow pile guides.

The lifting tool consists of an inner body machined from thick-walled pipe, with a pad eye welded on top for lifting. Opposed wedge assemblies are equally spaced around the inner body.

The clamp and release motion of a double acting hydraulic cylinder, mounted internally is transferred to the outer wedges by the shell of the tool. These wedges are provided with bolt-on spacers are designed for a specific internal pile diameter, their thickness, together with the height of the external guide strips bolted to the shell, can be adapted to suit different pile sizes.

Hardened alloy steel gripping segments (buttons) are contained in the button plates. The tools are sturdy and easy to operate; they provide a quick and safe connection between a crane hook and a pipe.

### **External Lifting Tools ELT**

The external lifting tools can be used in two modes:

- Suspended from a crane hook, they can pick up piles from the horizontal, rotate them to the vertical whilst lifting, and then carry out stabbing and lowering.
- They can act as a static holding device, supported by a jacket's spider frame, to grip a lower pile whilst add-on sections are welded.

Additionally in static mode, two external lifting tools operating in conjunction with double acting hydraulic jacks can be used for conductor handling and jacket leveling.

This technique permits an operator to lower a conductor pipe accurately or to level a jacket precisely.

The external lifting tools consist of a U-section outer body with the wedge and counter-wedge assemblies equally spaced around the inner circumference.

Bronze alloy bearing/slide plates with grease channels are bolted between the two wedges to guarantee low internal friction and to reduce maintenance. The double acting wedge operating cylinders are mounted inside the tool housing and are mutually connected by the wedge synchronization system, resulting in concentric pile clamping and symmetric pile and tool loading. Spacers protect the wedges when a pile is passing through a lifting tool in the open position. Different wedge spacers and guide upsets can be supplied for adaptation of the tool to different pile diameters.

#### Operational extras

- Accumulators on tool for high speed operation.
- Tools adapted to submerged operation.
- Guide cones top or bottom.

### **Bearcages and Leveling Systems**

Bearcages are used to line up pile sections prior to welding.

They are installed on top of an external lifting tool which holds the lower pile such that the beveled pipe end is at mid height. The weld-on pile section is inserted in the open bearcage vertically and, after closing the bearcage, welding can be accomplished through gaps in the bearcage's sleeve. The bearcage consists of two hinged sections. Opening and closing is done hydraulically by means of double acting cylinders. Upsets can be provided to adapt the bearcage to a different pile diameter.

Leveling tools are used for the leveling of templates, manifolds and jackets. Well proven rental tools are available for as well above water leveling as sub sea leveling. Both types are positioned on top of the driven pile and connected to the structure to be leveled.

The above water leveling tool is connected to the main lifting pad eyes on the jacket.

The sub sea tool can be used driverless. A hydraulic jack, fitted with a special gripper head, is extended such that it engages over the pile catcher. The gripper is locked hydraulically and the jack is retracted until the structure is level.

## **3 Description of the market**

### **3.1 company profile**

#### **China national offshore oil corporation (CNOOC)**

China national offshore oil corporation (CNOOC) is the only one offshore company, which is developing into an international first-class energy company with big and quick strides and full of determined and dauntless gumption and youthful spirit. Headquartered in Beijing, CNOOC registered with a capital of 50 billion RMB and has 22,000 employees at present, including 1000 foreign employees. At the end of 2003, CNOOC had total assets of 116.7 billion RMB and net assets of 67.6 billion RMB.

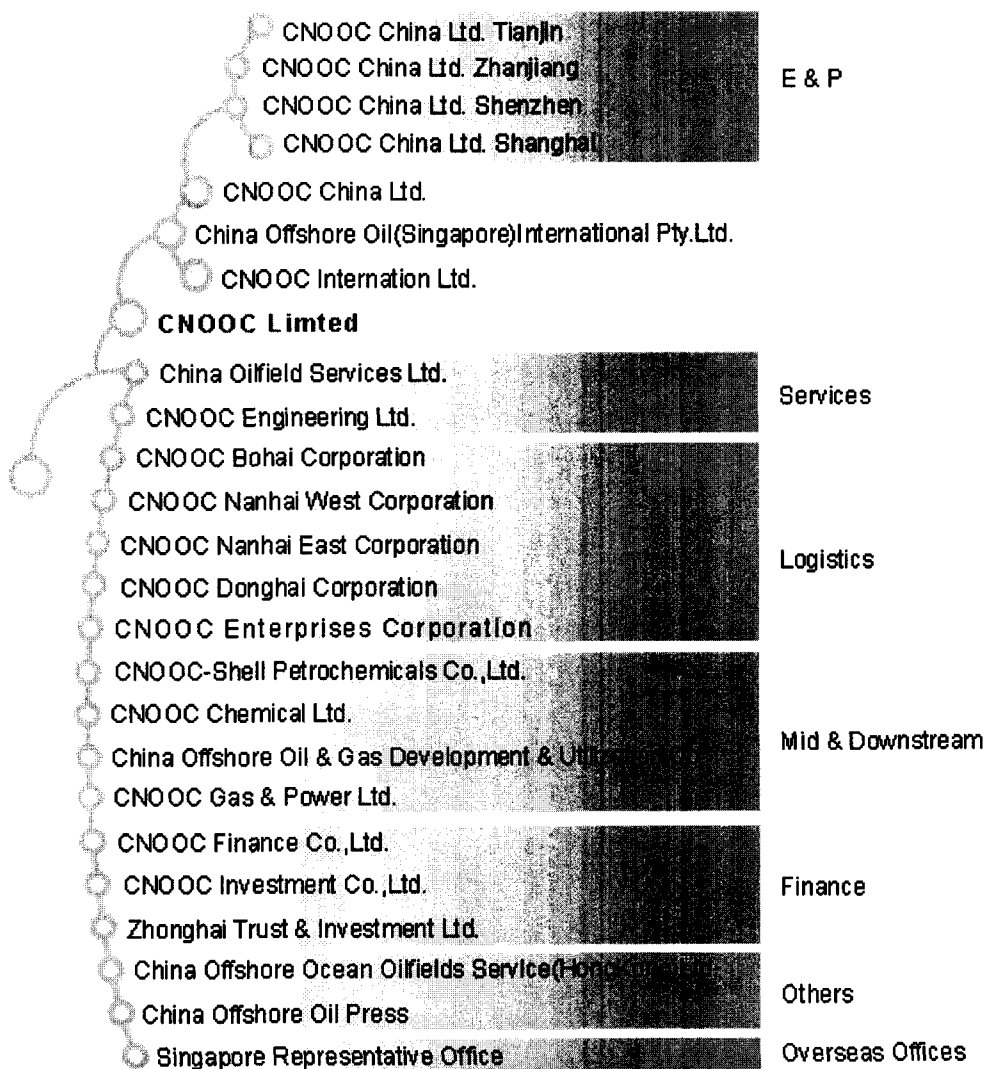
CNOOC owns three listed holding companies, among which there is a Red chips company listed abroad, an H-share company listed in Hong Kong and an A-share company listed at home. In addition, CNOOC has a non-listed holding trust company and eight subsidiaries of sole investment, and manages a petrochemical company and a life insurance company in cooperation with Shell and Dutch Life Insurance Company respectively.

Authorized by Chinese State Council, CNOOC, incorporated in 1982, took charge of exploration and development of China offshore oil and natural gas resources through cooperation with foreign partners. In over 21 years, CNOOC signed more than 150 contracts with over 70 international petroleum companies, attracting foreign capitals of more than 70~108 US dollars. Through cooperation with foreign partners, CNOOC has obtained offshore oil and gas exploration and development techniques of international level, effectively utilized international capitals, and acquired internationalized management experience and concept, thus bringing up qualified personnel who are familiar with international practices, grasp advanced management knowledge and techniques, and have innovative concepts and strong capabilities. The high-efficiency and high-speed development of CNOOC has won extensive recognition from both home and abroad. Among the large state-owned enterprises of over 100~108 RMB assets in China, CNOOC ranked the first in the operation achievement evaluation conducted by Chinese Ministry of Finance successively in 1999, 2000 and 2001. In 2002, both CNOOC and its holding company, CNOOC Limited, were awarded a BBB and A2 (positive) respectively by international authoritative credit evaluation institutions such as Standard & Poor and Moody, unprecedented by any other Chinese businesses.

CNOOC has established a main-work-predominated structure of production with well-defined lines and favorable interaction. The upstream oil and gas exploration and development, as the predominant business, is in a nuclear position; oil refining, chemical engineering, natural gas power generation and pipe network, as the midstream and downstream businesses extended from the upstream business, are developing

rapidly; the specialized petroleum service industry providing services for the upstream business is gradually growing into the biggest and strongest offshore petroleum contractor in the Pan-Asian region; the profitability of the financing unit aiming to provide financial services for industrial plates of the society and corporation has been enhanced increasingly; the new and developing international trade industry with oil and gas import and export as its major operation will bring more revenue to CNOOC.

## Organization



## **China Offshore oil engineer (COOEC)**

China Offshore Oil Engineering Co., Ltd., (abbreviated as: CNOOC Engineering) is engaged in offshore engineering design, fabrication, installation, offshore platform repair & maintenance and offshore engineering technology development. In the past years, CNOOC Engineering (COOEC) has built up a proven track record of reliability and high quality work. Treating the customer's objectives as there own, exceeding their expectations and competing every project on time.

With 30 years experience in offshore oil industries, CNOOC Engineering (COOEC) has demonstrated its strong capability. Our business area up to now is widely outspread over China seas and Southeast Asian areas.

CNOOC Engineering possesses a strong team in developing engineering technology. There are currently 1210 employees in our company, including more than 200 project management personnel, 400 engineers with full discipline coverage, 300 6G/6GR welders and 70 NDT inspectors.

More than 18 persons have obtained Grade I & II project manager qualification certificates issued by the Ministry of Construction P.R.C... There are also two UT level III experts, one RT level III expert and 46 RT and UT operators holding certificates issued by ABS. There are 23RT and 4 UT operators holding certificates issued by DNV. CNOOC Engineering has its Tanggu fabrication yard of total area 203121 square meters with 200 meters wharf. Apart from Tanggu Yard, there's another yard located in Zhanjiang, Guangdong Province.

They make efforts trying to build a better future for both our clients and ourselves.

## **3.2 Strategy and philology**

### **Development objective**

Moving into the pattern of world economy globalization quickly. Now feel more strongly than ever before that we must acclimatize ourselves to the changing environment more quickly, make progress more quickly and make a bigger contribution to the high speed development of the China economy by virtue of the increase of international competitive capacity of there own. Just under such perception we have begun to study the spanning-type development strategy of CNOOC in depth. When working out the strategy, we must regard global economy as the decision background and place CNOOC in the large environment of international competition; the decision-making thought must have relatively strong foresee ability so as to give a judgment of the situation of the year at least 5-10 years later; in addition, the strategy must accord with enterprise actual conditions and have relatively strong operability.

The in-depth analysis of international and internal environments is the premise for us to work out the strategy.

Under current international environment a remarkable sign is namely that in recent years the merger of petroleum corporations has been still continuing up to now. The competition between world petroleum corporations is a sort of heavyweight contest at all times, and the most important means are incorporation and merger, which can result in decrease of cost, integration of techniques and enhancement of control resources and capabilities of influencing market. 14 largest petroleum corporations in the world three years ago have been incorporated into 6 larger super corporations up to now. The formation of these corporations has resulted in a relatively large pressure on numerous medium-size and small-size petroleum corporations. The pressure in CNOOC that has just opened its market and entered the international market is also very large.

Standing in the large checkerboard of world economy, they cannot regard the mergers as cases to hear, and this is a literal and crucial competition. They must face the competition and realize their position in the international competition pattern very clearly. In 2001 we regarded STATOIL as their benchmark. This corporation development background and assets structure are similar to theirs to a certain extent. This corporation ranked the 189th among 500 strongest enterprises in 2000 and once was their teacher during cooperation with it in those days. Compared with STATOIL, they can clearly observe their deficiencies. For example, the integration degree is very low compared with that of STATOIL; STATOIL has large-scale refineries and more than 2000 gasoline filling stations in several counties, with very strong risk resistance capability; whereas the main body of our downstream is three projects that are being constructed. They must clearly realize these deficiencies. Before that, they have a larger benchmark.

Deep-level challenges are similarly potential under internal economic environment. After the admission to WTO, the protective clauses for specialized technique corporations have been rescinded, and some large international specialized corporations have reached the wall. After a large quantity of corporations swarm into China, they will implement talent localization strategy and attract talents depending on a well-paid and flexible institution; as a result, the talent contest will be inevitably intensified and the domestic competition will also be more and more severe. Vice Premier Wu Bang-guo has once indicated that your several large corporations are not bad compared with others at home but shall move towards the world for comparison with transnational corporations.

The development of China economy has also put forward higher requirements for them. Whether a country comprehensive competitiveness is strong or not is closely related to the number of large enterprises of international competitiveness that the country owns. The high-speed growth of American economy mainly rests with the fact that America is

in possession of a group of large corporations developing with high speed. Among the top 25 largest corporations of America, at least 8 corporations didn't exist at all before the year of 1960 and at least 8 corporations made their sales amount more than 10 billion US dollars in ten years. Nowadays, what China moving towards the world needs is no other than such a group of corporations, and CNOOC shall be duty-bound.

On the basis of the full studies of external environment and their own conditions, they have put forward the spanning-type development strategy of CNOOC.

The development objective of CNOOC is to make them corporation become a comprehensive energy corporation of relatively strong international competitiveness and become one of the 500 strongest enterprises in the world with relatively quick development speed, relatively strong profitability and superior quality in 5 years or so. In upstream fields, they will strengthen hydrocarbon exploration and accelerate development so as to make hydrocarbon production and quota become doubled and to make the cost effectiveness of their corporation the 5th or higher compared with that of the same sort of corporations in the world. They will fulfill the commitment to the capital market and maintain excellent performances to make our corporation market value rise continuously and investors obtain satisfactory returns. They will carry out high-quality merger closely related to core businesses to realize spanning-type development. The period of 5-6 years for an oilfield to explore and develop is very difficult to surpass; therefore, merger is a very good method for spanning-type development.

In downstream fields, we will build up world-scale CNOOC-Shell Petrol-chemical project in 5 years and large fertilizer projects to set up the largest fertilizer production base. The corporation plans to become the largest bitumen producer and seller in China within the next five years. By taking the opportunity of the adjustment of our country oil refining and chemical industry after admission to WTO, they also plan to enter the oil refining and chemical engineering field.

In the field of natural gas and power generation, within 5 years we plan to build up the first LNG terminal station in China, import 30~104t LNG, make liquefied natural gas generally available in Zhujiang Delta and Hongkong, and accelerate Fujian LNG project. We will strengthen natural gas exploration to strive for breakthrough of Nanhai natural gas exploration and to accelerate development of Donghai natural gas. Through these jobs they can adopt the point-first-line-second and horizontal expansion strategy to grab the natural gas market along the coast and then establish the basis of the large north-south coastal natural gas pipe network in China. At the same time, we shall take the opportunity of large development of China economy to enter natural gas power generation field selectively and in good time and build up CNOOC natural gas power generation industry.

In the field of oilfield services, the corporation plans to make every effort to become the

largest comprehensive offshore oilfield service corporation in the Asia-Pacific region within 5 years by adopting superior equipment and advanced techniques, with listing at home and internationally.

In the field of science and technology, they will continue to insist on the guideline Introduction, Integration, Innovation, Application increase the investment, and fully utilize internal and international human and intellectual resources so as to make the core technique of offshore hydrocarbon exploration and development reach advanced world standard.

The base system needs to be close to main work so as to build up a pillar industry of supporting long development and comprehensively enhance enterprise diathesis.

They still need to set foot in the finance field, basing on financial corporation, self-insurance corporation, trust corporation and mutual share-holding international life insurance corporation to head for a combination of industrial capital and financial capital step by step.

Through such developments, in five years CNOOC will establish an overall modern enterprise system; the parent corporation will become a holding corporation of clear property right that will carry out holding or mutual share-holding of upstream corporations, downstream corporations and specialized corporations; the capital link will become the primary link mode of the enterprise instead of the administration link. In addition to performing the function as a shareholder, CNOOC will base itself upon a higher starting point, considering how to develop the maximum benefit of the Group industry chain to ensure superiority complementation and mutual motivation between all parts, and utilizing the Group superiority to carry out capital operation, look for and establish good-quality assets to continuously strengthen the listed corporations, and then make the parent corporation, holding corporation and subsidiary corporations realize rolling-type development with high standard and large amplitude.

### **3.3 Project research**

I am focusing IHC's products and found projects as follow:

#### **On going projects**

##### **3.3.1 East 1-1 gas field**

The east 1-1 gas field lie in Beibu Bay south, from Hainan Province eastern city more than 100 kilometers, about 70m of depth of water of sea area , this gas field sets up three well heads platform (A , B , E ) and a platform of centre (CEP ) with well head facility, gas field set up three fail submarine pipeline , three complex cable and first land and lose the angry pipeline at a long distance to collect, set up eastern terminal station , the east fail to ocean mouth angry pipeline and ocean mouth mix angry to stand by land. Whole gas field divide into two stage development, develop maritime facility that the



project includes as follows, while being the first stage of one CEP in the center platform, one WHPE well head platform, and gas field pipeline debark the pipeline.

In the East 1-1 gas field pipe shelf includes CEP in the center pipe shelf and WHPE well head pipe shelf of the first stage of the project to design in detail. The pipe shelf CEP in the center is eight legs and eight skirts and a structure, the pipe shelf consists of five level layer and eight well head troughs, eight under water skirt of diameter 84, lie in pipe shelf periphery 4 leg bottom separately, adopt hydraulic pressure drive pile hammer squeeze into sea floor following 96m the mud, pipe sets of total weight about 2700 tons, one is about 1990 tons in weight.

WHPE well head pipe shelf four legs four skirt of structure, pipe shelf consist of six level layer and 6 well head troughs, four legs under water skirt of diameter 84, lie in pipe shelf leg bottom separately, adopt hydraulic pressure drive pile hammer squeeze into sea floor following 76m the mud, the weight that the pipe one is total is about 1000 tons, one is about 800 tons in weight. The pipe shelf of eastern gas field has totally adopted the operational procedure and scheme of the pipe shelf of deep water, its course includes: Move shipment slippery the barge hauling Hoist and enter the water Float and supporting it. It is flat that drive pile and adjust Forming a vesicle and joining etc. under water, to each construction course, it needs to carry on complicated construction scheme computational analysis to design, the platform should resist one strong typhoon and tropical storm met in 100 in life cycle, so the design of platform should respond to the request that operate storm condition, extreme storm condition and fatigue life, the projected life of two platforms was 30 years.

### **3.3.2 4-2/5-1 of the oil fields in Fanyu**

Project includes Fanyu 4-2 and 5-1 two oil fields; lie in the South China Sea east sea area, 200 kilometers from Hong Kong, 110 meters of depth of water. It is CNOOC and BURLINGTON cooperation, Have mainly two 8 legs well head platforms, two 18 kilometers submarine cable, a FPSO and a SPM.

One 13<sup>th</sup> 10, 2003 go into cooperation.

### **3.3.3 12-1 North oil fields of WEI**

Lying in the western Beibu Bay of the South China Sea, 33 meters of depth of water, there is a well head platform, one 2.5 kilometers pipeline of sea floor, a water flooding pipeline. A submarine cable.

16<sup>th</sup> 12, 2003 goes into operation

### **3.3.4 The south oil gas field of BOHAI Sea**

Lying from the Bohai Sea to 175 kilometers in Dalian, 100 kilometers from Longkou of Shandong. 25 meters of depth of water, one comprehensive platform, one 31.9 kilometers pipeline of sea floor, one 90.6 kilometers disembarkation pipeline, one

terminal station by land of seat. Transform of BZ28-1 south and north two platforms (SPM has transformed by SBM). One goes into operation in 2004, 6. 30 days. Two issues are uncertain

### **3.3.5 CAO FEI DIAN 11 oil field**

Lie in the west of Bohai Sea Gulf, 90 km from Tanggu, 26 meters of depth of water. One 150, 00000 tones FPSO and SPM. Two platforms and 14.6 kilometers pipeline of sea floor and the sea cable, (SBM made by APL Company) First period puts into operation on 31<sup>st</sup> 7, 2004.

Second period has one platform and sea floor pipeline.

2005, 12 goes into operation.

### **3.3.6 BZ25-1 project**

Lie in the sea area of the southeast of the Bohai Sea. 150 kilometers from Tanggu. The nearest from bank place 25 meters. 19 meters deep water. There are 6 platforms mainly, a FPSO (150, 00000 tones), a SPM. 11 sea floor platform pipelines (27 kilometers). And sea cable. (SBM made by APL Company). The date of going into operation is as follows; Two platforms --2005, 8, 31. Three platforms ---2004, 8, 31. A platform --2006, 6, 1. FPSO completes 2004, 6.

BZ25-1 EPCI project describes 6 pipes shelf / 6 groups one / the pipeline of 6 pieces of sea floor / the designs of 3 submarine cables especially, purchase , build , install Operation time September of 2002 Estimate completion time October of 2006

BZ25-1 FPSO begins department module project the work load describes the designs of 7 of module especially, purchase, build, install, debug Operation time November of 2002 Estimate completion time July of 2004

The work load of the project name BZ25-1 SPM project describes the design of a SAL YOKE System especially, purchase, build, install at sea Operation time March of 2003 Estimate completion time November of 2004

### **3.3.7 LD group projects oil field**

Lie in the middle part of the distant east gulf in the Bohai Sea, 30 meters of depth of water. Have one 8 legs center platform (CEP), one 8 legs center platform (DPP), two flat 4 legs platform, and terminal station of land. One pipeline of a sea floor and one submarine cable. One 18 inch sea floor pipeline long 57.3 kilometers, one sea floor pipeline long 13.6 kilometers. And two submarine cables. 1st 5 2006 goes into operation.

### **3.3.8 NANBAO Project**

A centre deals with the platform, a well head platform, pipeline of two pieces of sea floor , water flooding pipeline of a sea floor , one piece the submarine cable one design,

purchasing, building, marine transportation /install  
Operation time August 2003  
Estimate completion time October 2005

### **3.3.9 LUFENG Project**

a pipe shelf especially, a well head platform, a 12KM power control the cable , a 12KM and mix and fail design , purchasing , building , marine transportation of management / install; LF13-1 platform is transformed.  
Operation time September of 2003.  
Estimate completion time June of 2005

### **3.3.10 QK18-2 Project**

1 6 legs pipe shelves (550T ) build , install especially, 1 6 legs group piece (1800T ) build , install , debug, fail 6 pipeline to mix. 3 kilometers, QK18-1 platform transformation goes into operation in April of 2002 of time and estimates in May of 2004 of time for completion

### **3.3.11 CHUNXIAO gas field**

The gas field group lies on continental shelf of East China Sea of 450 kilometers of southeast direction in Shanghai. It is including CHUNXIAO, TIANWAITIAN, DUANQIAO, CHUNXUE four gas fields, TIANWAITIAN field distance Pinghu about 60 kilometers about 350 kilometers from Ningbo of Zhejiang, this regional depth of water is 90-110 meters. The work load is described especially Design, purchasing, build, join and debug at sea of 3 groups.

Operation time March of 2003

Estimate completion time May of 2005

Gas field pipe shelf, the work load is described especially Transportation, installation of 3 pipes shelf.

Group one Operation time August of 2003.

Estimate completion time January of 2005.

### **3.3.12 East 1-1 second stages**

The east 1-1 second stages of gas field; Newly building two well heads platform, plan 2005 , 11, 1 goes into operation.

### **3.3.13 LVDA Project**

The work load is described especially Of drill adopts the platform, one centre platform , two well head platform , four sea floor pipeline , two sea floor power and communication complex design , purchasing , build , install at sea of cable

Operation time June of 2003

Estimate completion time June of 2005

## **The east of the South China Sea**

### **3.3.14 19-3 project**

19-3 project in Huizhou; to build two rig platforms, To build 12 pipeline 7 -km-long sea floor, To build 18.34 -km-long pipeline, build 24.4 kilometers  
2004, 10 goes into operation.

### **3.3.15 FANYU natural gas project**

The natural gas project of Huizhou of Fanyu; to build 21-1 platforms. To built the pipeline of sea floor , land terminal station by Zhonghai oil. Lose the angry pipeline 360 -km-long to Zhuhai, diameter of 20 inches. Terminal station by land have section attack district of collecting etc. The dealing with area of natural gas, the liquid products store the tank field , the measuring area of dry gas , fail pressurized outside The district, the liquid products transport outward the quay area, the loading area of the liquid products, set the empty district free, enclose and help the producing area, the office park, living quarters . There are pipeline districts of natural gas by land and divide and lose the station, the pipeline is 150 -km-long.

2006, 12, 31 goes into operation.

### **3.3.16 Lu Feng 13-2 oil field**

Lie in the mouth of Zhu Jiang sea of China, 210 km from Hong Kong. Build one with four legs platform, and one 12 -km-long sea floor pipeline and sea cable. Still utilize (1,210,000 tones) of original Lufeng 13-1 FSOU to store the crude oil.

2006, 1, 4 is completed.

### **3.3.17 The first stage of PENGLAI 19-3 project**

19-3 oil fields in Peng Lai lie in Bohai Sea Gulf, found in May of 1999, the reserves of crude oil were 600 million tons, and it is the second large oil field of our country. It is estimated; go into operation in the first oil field by 2002, the oil field daily output in Peng Lai can be up to 35,000-40,000 barrels. Zhonghai oil has already signed the agreement which has developed the offshore oilfield with Phillips group. CNOOC will have 51% of the shares of this oil field, Phillips has other 49% of the shares.

The development at first stage of 19-3 oil fields in Peng Lai is going on at present; Phillips is setting about carrying on the feasibility research at second stage too. The marine petroleum project Limited Company is a general contractor of the first stage of project of 19-3 oil fields of Peng Lai, including designing, purchasing, builds and installs at sea in detail working range.

The first stage of the project including one well head platform, one single point mooring platform and oil ship transform one sea floor pipeline and a submarine cable. Among them, the pipe shelf of well head is six legs, four stake , 24 well heads, gross weight is about 900 tons. The top group one is two layers, gross weight is 1200 tons. It is the unmanned operating platform. The pipeline of sea floor is a water flooding pipeline and a piece of oil pipeline, the length is 1. 65 kilometers.

Main technological difficult point of project are innovation piece large thickness welding, pairs of application and on-the-spot priming paint craft that silk weld of board. This project will test and CTOD that one pair of silks will be welded for this reason.

### **3.3.18 WENCHANG 13-1/2 oil field project**

CNOOC cooperate with Canadian Husky Company. Wenchang oil field lies in Wenchang of Hainan Province. 117 meters depth of water. This sea area belongs to the typhoon pilosity area.

4 legs and 8 skirts and a deep water pipe shelf are about 130 meters high, weight is about 2600 tons. Nobody garrisons in the well head platform, automatic with operating remotely, set up the well building machine. Weight is about 1500 tons. Two submarine cables. Two double layers keep the pipeline of sea floor warm. A floating type of 150,000 ton produces the oil storage and unloads the putting amount of oil (FPSO ), does not free for ever. One by 9 suction anchor chain regular to turn over single point mooring inside (SPM). Technological world leads. The annual production of supreme crude oil of 13-1/2 of the oil fields of Wenchang: 2,500,000 tons.

### **3.3.19 QHD32-6 Oil field**

QHD32-6 oil field and lie in the centre of the north of Bohai Sea Gulf, water of oil field position is deeply between 19. 7 and 20.4 meters. It is from tangu Tianjin 130 kilometer. Great annual production capacity including: Oil 4,230,000 the cube / every year, water 8,680,000 the cube / every year, gas 73,520,000 is marked the cubic meter / every year.

This oil field will be according to China National Offshore Oil Corporation (CNOOC), American Texaco Chinese Co., Ltd. (Texaco) and petroleum contract of American Atlantic Richfield China Co., Ltd. , department of A , (ARCO ) pass and develop cooperatively, Chinese marine petroleum Co., Ltd. is it manage for homework person to whole concrete work of development of oil field to make. Major project facilities are as follows:

The well head platforms of 6 4 legs (WHPA, B, C, D,E,F) A single point mooring (SPM) One 15 10,000 tons-class floating types produce the oil storage device (FPSO) 6

submarine cables and 6 pieces of sea floor drift along and lose the pipeline Project facilities that pipeline COOEC bulids platform pipe shelf of 4 well heads (WHPC, D, E, F)top structure and equipment of 6 well heads platform (WHPA, B, C, D,E,F) 1 single point mooring, 6 mix and fail the pipeline of sea floor to order 6 water flooding pipeline and 6 submarine cables Top facilities of FPSO, include a motive force module , a hot medium module , 3 oil gas deal with module, 2 produce water treatment module and one torch tower. The system between SPM and FPSO is perfect connection.

### **3.4 CNOOC Prospective plan**

CNOOC are making great efforts to be an international oil company, CNOOC are widely exploring the related trades of in oil and gas industry, and exhibit an array of corporation with domestic and oversea partners.

To compete and strengthen internationally, CNOOC have set an aim at annual oil output of 50,000,000.00 cubic meters. To accomplish this goal, CNOOC are expedite exploring and construction. In recent years, CNOOC are extending oil field based on the constructed oil fields such as QK18-2, JZH20-2 etc.

CNOOC now have some major projects under way of development, such projects will pay important role in the strive of CNOOC, DF1-1 phase II, LD projects, BZ25-1 and CFD11-1 are the representatives among them, additionally NB35-2 Oil Field is be a try in development high viscosity and heavy gravity oil field, the successful start-up will explore a new direction of CNOOC development.

Meanwhile CNOOC is looking at the corporation with oversea company, and now CNOOC have one South East Asia. Indonesia project is under way of construction. And the oversea pat is inclined to increase.

At present, PL19-3 Oil field is the biggest one in CNOOC and will play important role in the development of CNOOC, which is a joint -venture between CNOOC and CONOCOPHILLIPS. The estimated annual output will be 50,000,000.00 cubic meters. Phase one is under operation and phases two is under study, ODP will be completed at the end of this years. The OOIP of PL19-3 and PL25-6 was officially approved by the COMMITTEE, which shows a great accomplishment and pave the road of the success of the two companies. And it is also a milestone for the PL19-3 oil field development and the development of CNOOC and CONOCOPHILLIPS. Here will give a conceptual idea of PL19-3 oil field, especially about Phase II. Phase II will include one FPSO and 6 platforms, among them five are wellhead platforms and one utility platform.

The followings are some general description of design premises:

Facility design codes based on international standards;

Facility design life is 20 years, platform fatigue design 40 years, cathodes protection 26 years. Platform subsidence criteria 3.8 meters;

H<sub>2</sub>S in produced gas stream 500ppm (V) at WHP test separator conditions of 325 psig & 125F. CO<sub>2</sub> content 15% average composite of all wells and 20%max for individual well.

And this project will have the world biggest FPSO which will have the following process capabilities:

Max production rates: 190,000STBOPD (1,259 STm<sup>3</sup>/h), 395,00BWPD (2,616m<sup>3</sup>/h), total well fluid 513,000BFPD (3,398m<sup>3</sup>/h), Max gas rate 40.7MMSCFD (48,021m<sup>3</sup>/h)

Estimated sand loading: 0.05 v/v% continuous, 0.12 v/v % max, sand particle size max 150micron.

Sale crude BS&W specification-0.5%.

Centrifugal technology will be used for dehydration and produced water treating, solid handling-sand jet systems in process vessels, sand slurry transported to sub sea injection wells by slurry pipelines.

And about 144 slots wells will be drilled in phase II.

In recent years, China encounters problem of lack of power supply because the fast industry development. To relive such pressure, China has taken some measures in now days, and one important decision is to introduce LNG projects among the costal cities. CNOOC are lucky to have been authorized as the sole partner of the different government in the coastal cities to develop the projects by taking its advantage of offshore and coastal working experiences. It's also deemed as one important direction of CNOOC in the near future, CNOOC have enrolled and chosen many excellent personnel to get involved in such projects. LNG of such projects is mainly introduced from Australia, and contract has been duly signed. HUIZHOU project are on the way of construction, FUJIAN project will be started, and personnel are being mobilized. The corporation contracts for ZHEJIANG/TIANJIN projects have been signed.

### **3.5 European cooperation companies**

Present European suppliers for the Chinese market are as follow:

1. Single point mooring(SPM)  
APL Company Norway  
SBM Company France
2. Diesel oil and crude oil engine  
MAK Company Germany  
MEN Company Germany

- 3 Screw pump  
MAK Company Germany
- 4 Rig model  
RDS Company UK
- 5 Vertical submerged pump  
Diesel engineer Frence
- 6 Heat medium boiler  
MAK Company Germany  
MEN Company Germany
- 7 Central control system  
DCS Company Germany  
Fire Gas Company Sweden
- 8 Type crane  
Liebherr Company Germany  
Equipment Nederland



## 4. Conclusion

The offshore market of China has very good development prospect and very extensive market. China had found a lot of large oil fields recently. Within 30 years in the future, Chinese offshore market will advance constantly.

The present competition is relatively fierce, a lot of big companies abroad should open up this market of China, enter China and develop one's own company and open-up business one after another, hope to obtain development by cooperating with company of China.

This is not only a chance but also a challenge to IHC HOLLAND, They have their own advantage, they have their unique products, all these are conditions which attract and open up the Chinese market. IHC HOLLAND has entered China one hundred years history , They exceed a lot of projects by cooperating with China, having established good prestige and high-efficient service, all these are advantages that they squeeze into the Chinese market. Compared with shipbuilding industry we have offshore market is still pale, face difficulty advance bravely we will succeed in.

A lot of projects began one after another recently, a lot of project IHC HOLLAND can be launched, so long as they got hold of this chance, the Chinese market will open. Wish sincerely IHC HOLLAND will be better tomorrow.

## **5. Works cites**

### **Reference**

IHC HOLLAND handling system working program;  
IHC HOLLAND copyright

IHC HOLLAND handling system Catalogue and presentation;  
IHC HOLLAND copyright

IHC HOLLAND SPM group working program;  
IHC HOLLAND copyright

IHC HOLLAND SPM group Catalogue and presentation;  
IHC HOLLAND copyright

IHC HOLLAND hydryhammer working program;  
IHC HOLLAND copyright

IHC HOLLAND hydrohammer Catalogue and presentation;  
IHC HOLLAND copyright

CNOOC Annual work report; (2004) Mr. CHENGYU FU

CNOOC Development report; (2004) Mr. CHENGYU FU

COOEC Annual work report; (2004) Mr. LIUCHENG WEI

TOTAL DESIGN (1990) ADDISON-WESLEY Publish Company  
Total design/Stuart Pugh chapter two design core: market/user needs and demands.

MARKERING (2004) Principles of marketing third European Edition

## **6. Appendix**

### **Personal acknowledge**

Through the practice this time, make me learn a lot of things. The advanced management theory of Dutch company and very good working environment, and I saw own deficiency at the same time. The enterprise development of China needs to take a very long way, we must draw lessons from, must study; this is the only way that Chinese companies can seek greater and more effective development.

Practice day will be finished soon; I thank very much my coach in IHC Mr Ir. R.J. de Vries and my supervisor Mr Reijer kok. They help me a lot. I also learned lot of things from them. Those are really important and useful to develop myself in the future. Thanks for Mr Honders and all of the lecturers. Wish sincerely to everyone.