ACE Winches

THE DECK MACHINERY SPECIALISTS

Active Heave Compensation

Welcome to ACE Winches

ACE Winches is a global leader in the design, manufacture and hire of hydraulic winches, marine deck machinery and associated personnel for the offshore oil and gas, marine and renewable energy and construction markets.

- Established in 1993
- 200+ Employees
- Turnkey Solution Provider
- Award Winning Company

ACE Winches
THE DECK MACHINERY SPECIALISTS

ACE Divisions

ACE Manufacturing

- Design
- Manufacture
- Testing
- Installation
- Bespoke equipment

ACE Hire Equipment

- Extensive range for hire
- Floating vessels
- Fixed offshore installations
- Land-based projects

ACE Hire Personnel

- Multi-disciplined
- Qualified
- Experienced
- Commissioning
- Operation

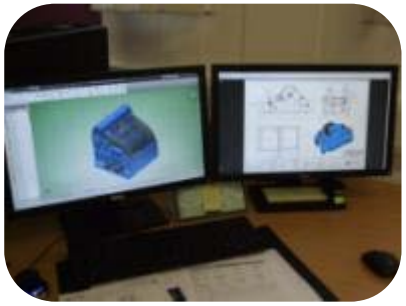
ACE Winch Academy

- Aims to be the unrivalled provider of competent, certificated personnel for winch operations

ACE Winches
THE DECK MACHINERY SPECIALISTS

Total Project Solutions

ACE Winches provides turnkey design, manufacturing and delivery of quality equipment safely, on time and on budget.



From concept development to design....

...manufacturing, fabrication and assembly...

...to the final product , testing and delivery...

...and after sales Support

ACE Winches
THE DECK MACHINERY SPECIALISTS

Active Heave Compensation (AHC)

Why Active Heave Compensation?

- To increase working weather window
- Safer deepwater seabed interfacing

Application

- Any offshore crane or winch application where it is beneficial to reduce the amount of vessel motion transmitted to the hook load

Difficulties

- Awareness and understanding of AHC systems and their benefits and limitations

ACE Winches

THE DECK MACHINERY SPECIALISTS

Active Heave Compensation (AHC)

Changes in available technology

Computers

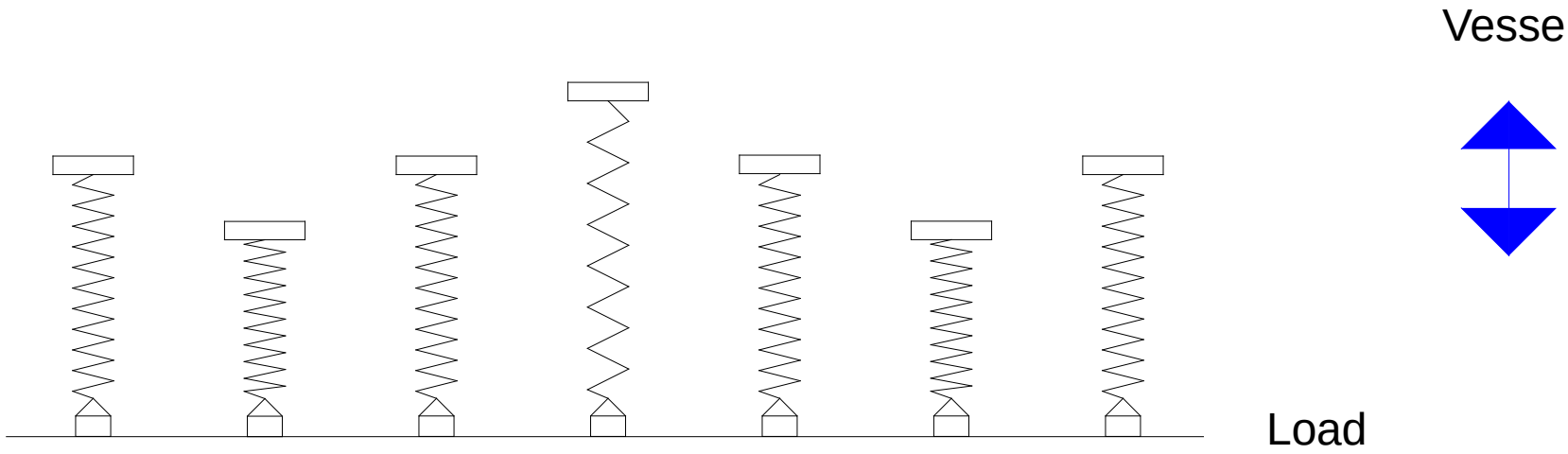
- Processing speed
- Hardware costs

Understanding

- Better understanding of AHC
- General acceptance of technical restrictions

ACE Winches
THE DECK MACHINERY SPECIALISTS

Basic Principles of AHC



- Load suspended on an idealised spring
- If foundation is moved up and down, load remains in rest position

ACE Winches
THE DECK MACHINERY SPECIALISTS

Active and Passive Heave Compensation

What are the differences?

Passive Heave Compensation

- Provides simple heaving load limitation
- Adapting for any increase in load due to external influences by giving way or pulling in
- Similarities:
  - Car shock absorbers
  - Tug of War
  - Mattress

Active Heave Compensation

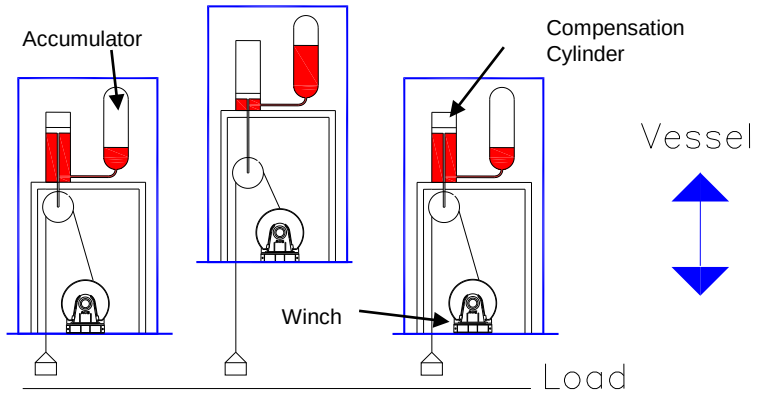
- Movement sensed electronically
- Information interpreted by computers
- Computer then sends control signals to make necessary changes
- Similarities:
  - Any electronic close-loop control
  - Nintendo Wii
  - Car ABS

ACE Winches
THE DECK MACHINERY SPECIALISTS

Passive Compensation Cylinder and Accumulator

Passive Compensation

- Hydraulic cylinder replaces spring
- Cylinder is connected to an accumulator
- This type of motion compensation can be used for equipment with high resistance against motion, e.g. diving bells



Advantages:

- No power consumption
- In principle, easy system to understand and maintain

Disadvantages:

- Requires load with very high resistance against motion
- Requires adjustment for actual load and motion
- System will always have a greater positional hysteresis
- Worst case amplify motion of load
- Limited range of motion

ACE Winches
THE DECK MACHINERY SPECIALISTS

Passive Compensation Hydraulic Motor

Passive Compensation

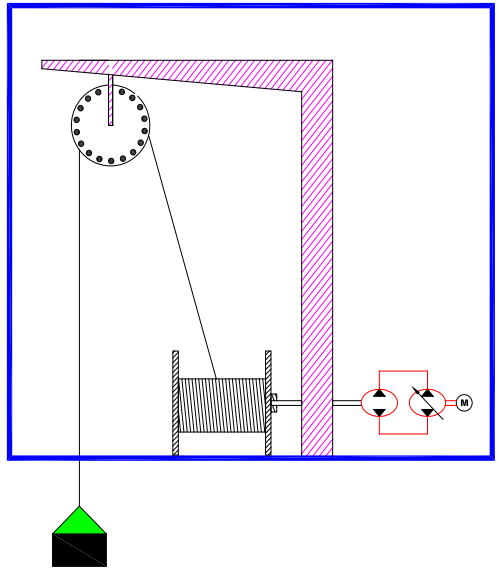
- Spring is replaced by hydraulic motor which is run on constant tension
- This type of motion compensation can be used for equipment with high resistance against motion, e.g. diving bells

Advantages:

- Additional installation for compensation is minimal
- In principle, easy system to understand and maintain

Disadvantages:

- Requires load with high resistance against motion, or load has to be moored to avoid drift of load position
- Full power consumption
- Requires adjustment for actual load
- System has a greater positional hysteresis

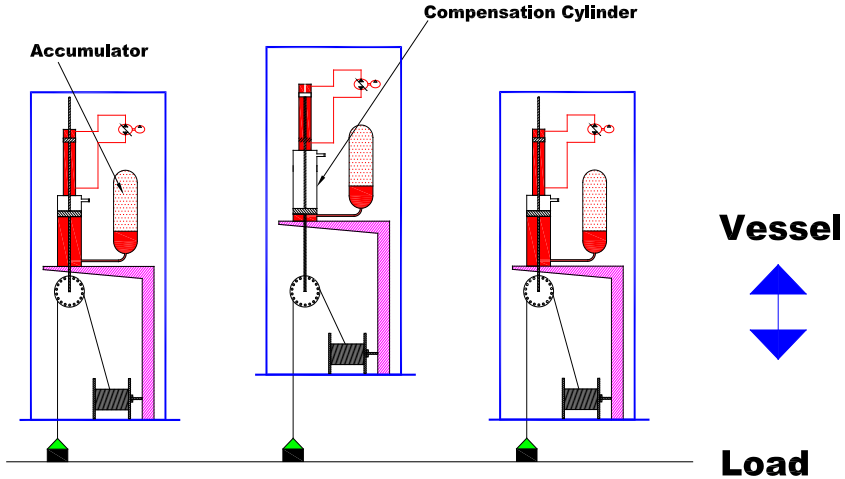


ACE Winches
THE DECK MACHINERY SPECIALISTS

Active Compensation Cylinder and Accumulator

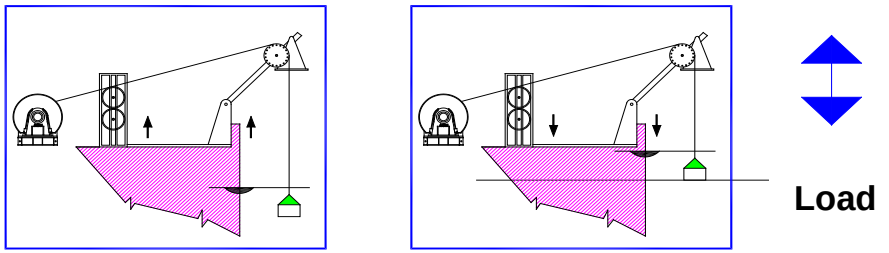
Active Compensation

- Hydraulic cylinder replaces spring
- Cylinder is connected to an accumulator to balance out most of load force
- Accelerometer senses ship movement
- Small cylinder attached for active position of load out from ship movement



Advantages:

- Low power consumption
- Good regulation with small fault and
- Adapted regulation parameters for compensation task



Disadvantages:

- Demands gas adjustment for actual load
- Additional space installation for compensation
- Equipment (cylinder, accumulator and hydraulic)
- Limited movement

ACE Winches
THE DECK MACHINERY SPECIALISTS

Active Compensation Hydraulic Motor

Active Compensation

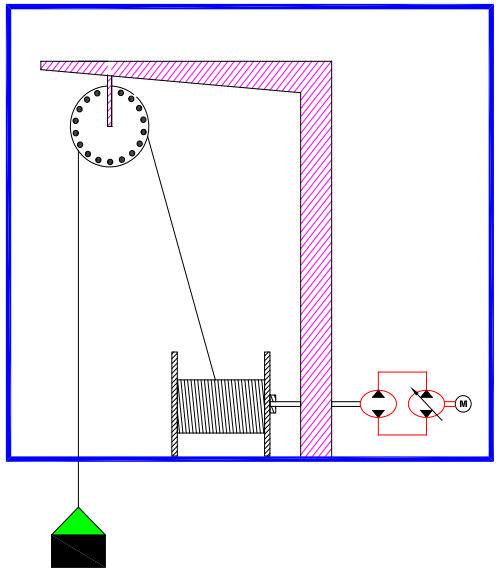
- Spring replaces hydraulic motor which is run active for motion compensation
- Accelerometer senses ship movement

Advantages:

- Additional installation for compensation is minimal
- Good regulation with small fault and adapted regulation parameters for compensation task
- AHC and winch drive and control systems are the same and fully integrated with each other

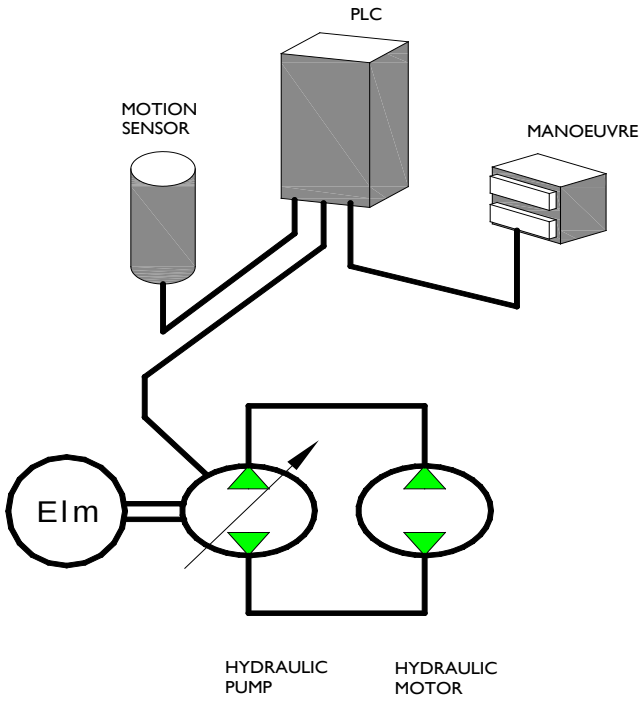
Disadvantages:

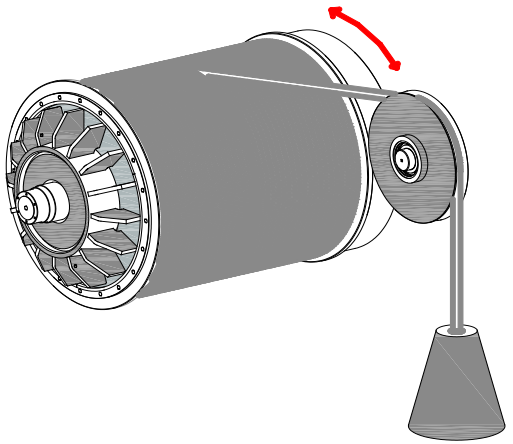
- Full power consumption



ACE Winches
THE DECK MACHINERY SPECIALISTS

AHC Components





- Accelerometer senses ship movement
- Signals from the accelerometer and winch are processed by the PLC, which regulates direction and speed of the hydraulic motor on the winch

ACE Winches
THE DECK MACHINERY SPECIALISTS

Information Required

Load

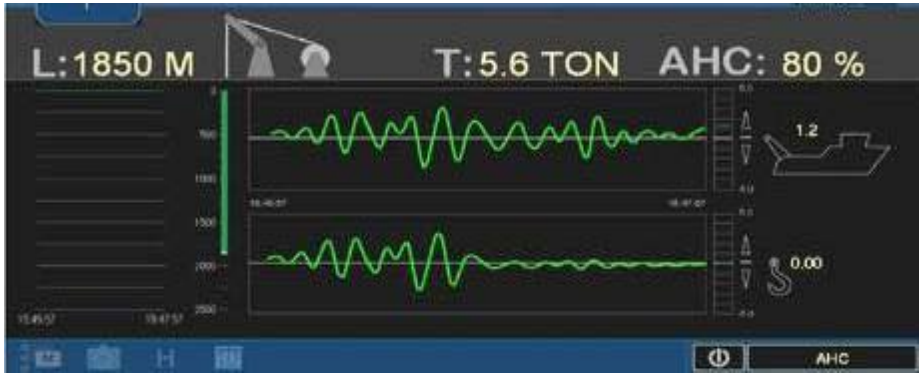
- Description of equipment and function
- Safe Working Load
- Wire size, length and working depth
- Load physical size, weight in air and in water, drag coefficient

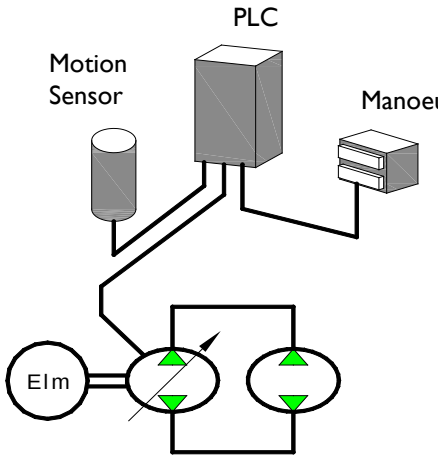
Operating Requirements

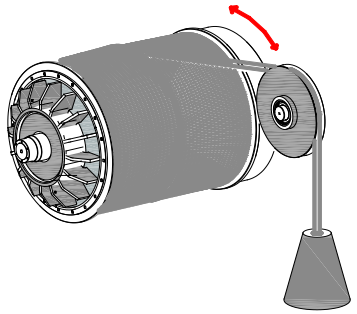
- Vessel movement: amplitude, max speed, max and min wave period and acceleration
- Location of equipment on ship; location of the overboard sheave
- Compensation requirements

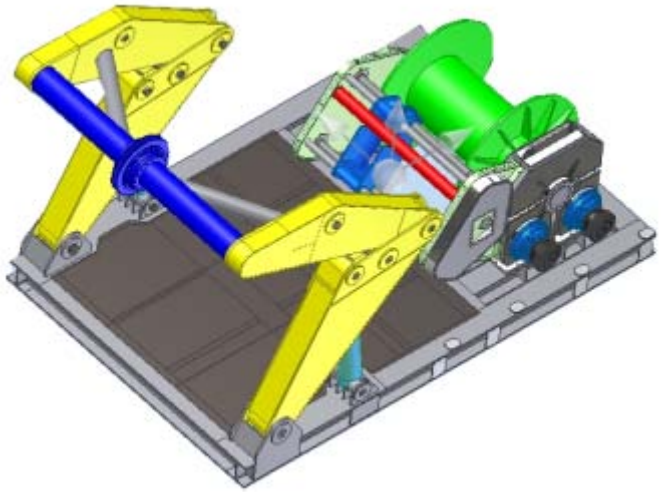
ACE Winches
THE DECK MACHINERY SPECIALISTS

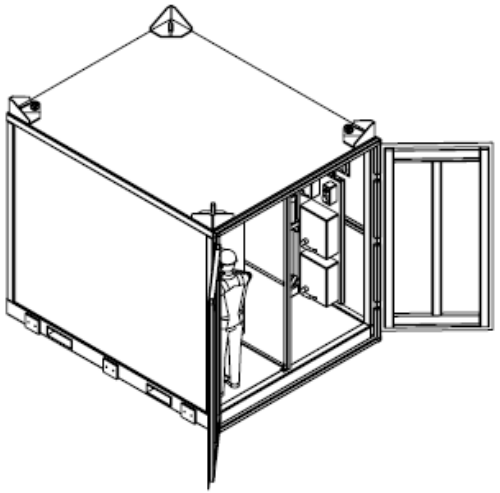
Active Heave Compensation Systems



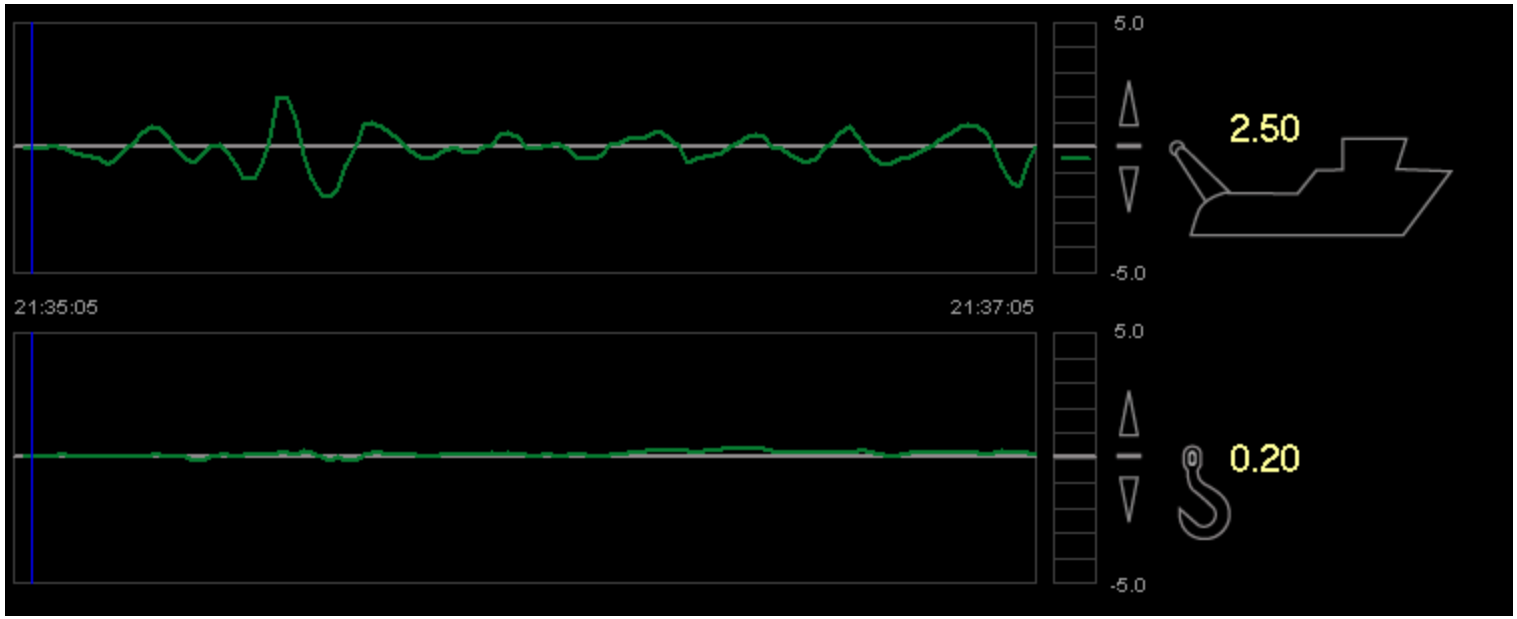








ACE Winches' AHC System



Typical screen showing vessel movement

ACE Winches
THE DECK MACHINERY SPECIALISTS

ACE AHC System Modes

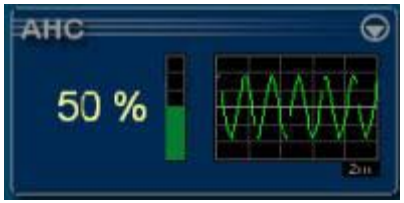
AHC: **Active Heave Compensation**
Using the signals from the Motion Reference Units, the system operates the winch to compensate for the vessel movement.

ACT: **Active Constant Tension**
For safe deployment and recovery.

CT: **Constant Tension**
Ensures that a selected tension is kept in the line at all times, irrespective of load movement

ADSF: **Automatic Depth Safety Function**
Working with a depth sensor to prevent over deployment of the cable onto the seabed

AHC Predictor: **Active Heave Compensation Capability**
The system is a dynamic real-time model which is constantly updated with load data and sea conditions. Using this, the system predicts its achievable capability.



ACE Winches
THE DECK MACHINERY SPECIALISTS

ACE AHC System – Predictive Software

Base information

- Max Hook load 12 Tonne
- Max displacement 5m (+/- 2.5m)
- Max wire speed 2.4m/sec
- Max acceleration 1.9m/sec
- Wave period 8 seconds

Simulation no:			
Test conditions		Test results	
Displacement	5 m (+/- 2.5)	Compensation	100 %
Period	8 s	Max speed	120 rpm
Load	12 tons	Max acceleration	
Length out	0 4000 m on drum	Max torque	11.5 kNm (82%)

Simulation no:			
Test conditions		Test results	
Displacement	5 m (+/- 2.5)	Compensation	100 %
Period	8 s	Max speed	140 rpm
Load	12 tons	Max acceleration	
Length out	1500 - 2500m on drum	Max torque	13 kNm (93%)

Simulation no:			
Test conditions		Test results	
Displacement	5 m (+/- 2.5)	Compensation	100 %
Period	8 s	Max speed	160 rpm
Load	12 tons	Max acceleration	
Length out	2500 - 1500m on drum	Max torque	13 kNm (93%)

ACE Winches
THE DECK MACHINERY SPECIALISTS

Case Study: AHC Winch System

ACE 12te SWL Active Heave Compensation Winch System

ACE Winches
THE DECK MACHINERY SPECIALISTS

Case Study: AHC Winch System

ACE Active Heave Compensation System – HPU and Operator Panel

- Real Time Logging
- Ethernet remote service access
- Dynamic real time learning with predictive function
- Active Constant Tension for safe deployment and recovery

ACE Winches
THE DECK MACHINERY SPECIALISTS

Case Study: AHC Winch System

Oceaneering 12te SWL Deepwater

Winch Performance as described below is based on:

Wire Size:	30mm	Required Cross Port Pressure:	265 bar
Required Oil Flow:	1270 L/Min	Power:	600kW

Layer	Diameter	Pull/Speed	Accumulated Length
1st layer	1030mm	31.5te/100m/minute	165 metres
3rd layer	1150mm	28te/111m/minute	530 metres
5th layer	1270mm	25.5te/123m/minute	935 metres
7th layer	1390mm	23te/134m/minute	1375 metres
9th layer	1510mm	21.5te/146m/minute	1855 metres
11th layer	1630mm	20te/158m/minute	2375 metres
13th layer	1750mm	18.5te/169m/minute	2935 metres
15th layer	1870mm	17te/181m/minute	3535 metres
17th layer	1990mm	16te/193m/minute	4150 metres

ACE Winches
THE DECK MACHINERY SPECIALISTS

Case Study: AHC Winch System

AHC Winch System for Oceaneering

Client: Oceaneering

Project: BP, Block 31, offshore Angola

Scope of work: 12 Tonne SWL Drum Winch, 600kW Electric Hydraulic Power Unit and Active Heave Compensation Control System

Status: Commissioned in May 2011

Project details:

- Designed and manufactured for deepwater use
- Commissioned on board the vessel, the Russell Tide, which is undertaking work for BP in Block 31, off Angola
- Rated at 12 tonnes at up to 2,500m water depth
- Supplied with 4,000 metres of 30mm diameter low rotation wire rope
- Designed and certified to DNV 2.22 – Lifting Appliances
- Capable of operating at speeds in excess of 100 metres per minute to achieve the Active Heave Compensation

ACE Winches
THE DECK MACHINERY SPECIALISTS

Case Study: AHC Winch System

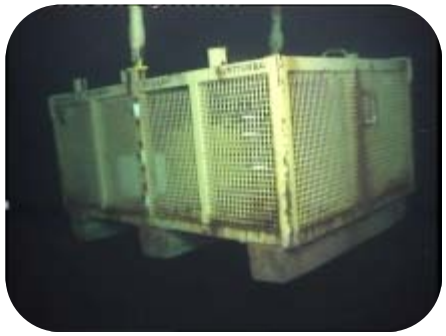
AHC Winch System for Oceaneering

- Designed to ensure the constant deployment or retrieval of the winch hook load or reduce its movement related to external movements of the winch assembly
- Uses a Motion Reference Unit (MRU) to sense movements of the vessel, caused by wave action, related to the seabed
- Filters out the effect of wave movement
- Allows for more accurate data readings
- Wire wear management
- Online remote service and data download access
- Increased equipment safety
- Reduced weather-related downtimes
- Prevents unwanted undulation or heavy sea movement that causes sudden slack or pull on cables
- Results in safe and controlled deployment and retrieval of loads

ACE Winches
THE DECK MACHINERY SPECIALISTS

AHC Winch System Video

Active Heave Compensation Winch System Video



ACE Winches
THE DECK MACHINERY SPECIALISTS