



TIANCHENG ELECTRICAL MARINE EQUIPMENT PTE LTD

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Claims:

1. A method for active heave compensation, comprising:

- Measuring the heave of a vessel using a measurement device.
- Outputting a heave signal representative of the measured heave.
- Using the heave signal to move a connection device relative to the vessel to compensate for the heave.
- Processing the heave signal to reduce errors and outputting an adjusted heave signal.
- Using the adjusted heave signal to move the connection device to compensate for the heave.

2. A passive heave compensation system, comprising:

- A combination of gas springs or hydro-pneumatic devices to buffer the load.
- Mechanical components acting as shock absorbers to reduce the impact of heave motion on the load.

3. A marine heave compensating device, comprising:

- A winch drum driven by an AC asynchronous motor via a gearbox.
- A variable speed control for the motor as a function of heave speed.
- Low inertia components for the motor and winch to compensate for heave substantially instantaneously.

4. An apparatus for heave compensation, comprising:

- A vessel motion measurement device for measuring the motion of the vessel.
- A control device or computer for receiving an output from the vessel motion measurement device.
- Controlling the winch or crane system according to the movement of the vessel to stabilize the load.

5. A method for integrating dynamic positioning (DP1) with heave compensation, comprising:

- Implementing a user-friendly control panel interface for seamless barge operations.
- Displaying real-time data and control options on the master control system software.



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- Enhancing precise positioning and control of mooring winches and active heave compensation systems.

6. A method for achieving $\pm 300\text{mm}$ accuracy high precision in offshore positioning, comprising:

- Utilizing an 8-point mooring winch system.
- Ensuring precise placement of construction components.
- Reducing rework and operational costs through accurate positioning.