



RESTRAINING AND LEVELING SYSTEMS



**A**  
Vertical restraint to provide lock-down in case of high winds or seismic events



**B**  
Actuation cylinder on vertical restraint



**C**  
Typical horizontal restraint to lock the drillfloor/substructure and skidbase during drilling operations



**D**  
One of four leveling cylinders rated at 1500 tonnes each (with vertical restraints on the right)

**Bardex Restraint Systems** for applications on offshore platforms are installed to stabilize and secure the drilling facilities during major seismic events or high wind loadings. These systems have been installed in seismically active areas such as Sakhalin Island, Russia, and the Caspian Sea.

A typical Bardex Restraint System includes Vertical and Horizontal (loads transverse to skid direction) Restraints and a locked Gripper Jack Assembly (load in-line with skid direction). Bardex has supplied systems to withstand simultaneous seismic loadings exceeding 1500 tonnes in all three axes.

The complete Bardex system includes a free standing control console and remote-mounted programmable logic control.

- The Vertical Restraint shown here (see A / B) is installed by bolting to the rig footing. The hydraulic cylinder engages a wedge block between the underside of the skid flange and the Vertical Restraint side plate. Once the wedge is engaged the rig is restrained from moving in the vertical direction.
- The Horizontal Restraint (see C) is locked by engaging the wedge block between the backing structure on the footing and the edge of the skid beam flange. Once the wedge is engaged, the rig is restrained from moving in the transverse direction (perpendicular to the direction of skidding).
- In both the Vertical and Horizontal Restraint, the wedges, once engaged, do not require hydraulic pressure to remain locked. The Restraints are released by actuating the hydraulic cylinders
- The wedge cylinders are connected to the control panel by flexible hoses and hard piping.
- After the rig is skidded to the appropriate location, the Gripper Jack Assembly is used to resist horizontal motion parallel to the direction of skidding. The Gripper Jack Assembly can be equipped with either an accumulator (see adjacent page) or a mechanical device to maintain the Gripper clamping force after the hydraulic pressure is released at the control station.
- In some cases, due to sea floor subsidence or structural deflections, a rig leveling system is required. Leveling Cylinders (see D) are typically mounted at each drill floor / substructure foot or each skid base foot to level the drilling rig. Lifting capacities in excess of 1500 metric tons per foot have been provided by Bardex. An alternative is the Levelock Gripper Jack shown on the adjacent page.
- The complete Bardex System includes all controls to operate Skidding, Leveling and Restraining Systems in a safe and efficient manner. A range of controls from simple manual controls to PLC based systems can be provided based on the customer's requirements

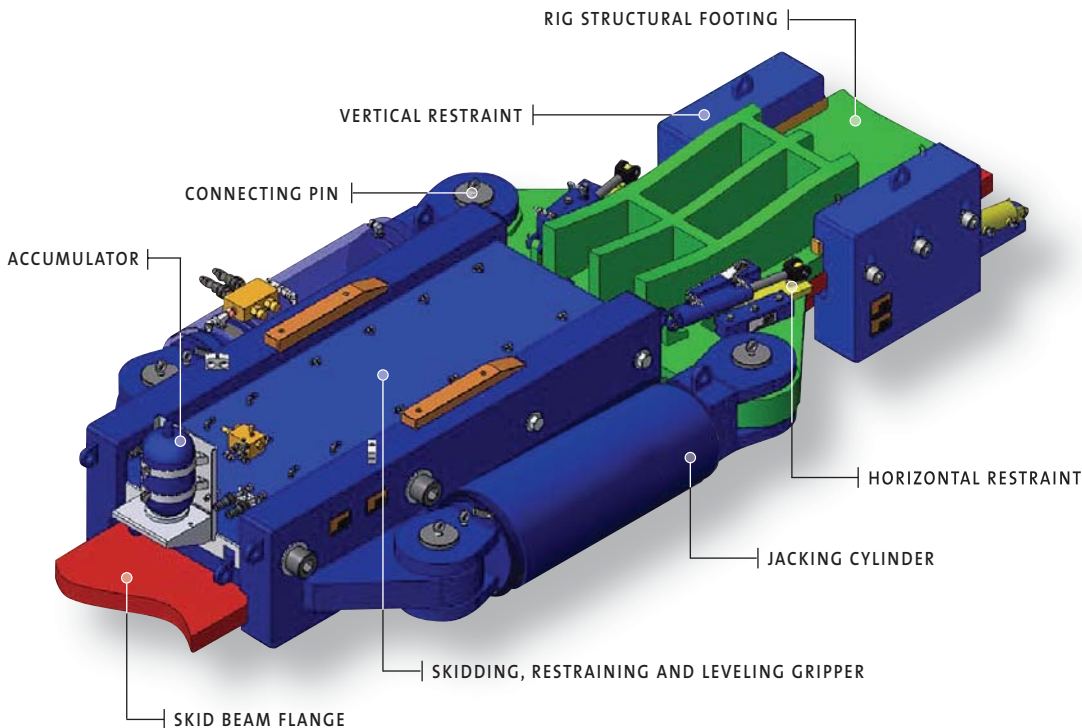
# AND LEVELING SYSTEMS

## LevelLock

Gripper Jack and Leveling Assembly



The **LevelLock Gripper Jack and Leveling Assembly** is a Bardex patent pending design which integrates skidding, restraining and leveling functions into one compact unit. Normally, four LevelLock Gripper Jacks are used. One is placed at each corner of the drillfloor/substructure or skidbase to level the rig. The LevelLock illustrated has a lifting capacity of 1750 tonnes and a horizontal jacking and locking capacity of 400 tonnes. A mechanical wedge mechanism or accumulator lock down can be incorporated in the LevelLock Gripper Jack assembly to maintain the gripper clamp force after hydraulic line pressure is released.



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