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‘Level Luffing Deck Cranes’

In recent years there seems to have been an increasing incidence of damage to cranes, particularly deck cranes. Most cargo deck cranes used at sea are ‘level luffing’ and their mechanical arrangements are not much influenced by whether they are powered electrically or electro-hydraulically. The essential features of all cranes of this type are that they are fixed rigidly to the deck. The load can be traversed between the quay and one or two holds by slewing (rotating) the crane body about its vertical axis and the working outreach of the hook can be varied by luffing (raising or lowering) a ‘jib’ or derrick hinged at its base by ‘pintle bearings’. Hoisting and luffing functions depend on wire ropes and winches. A typical crane of this type might have a safe working load (SWL) of about 30mt and a working radius of about 26m.



Figure 1 - Luffing jib deck cranes

The ‘level luffing’ capability arises from the manner of ‘reeving’ the hoist rope in several ‘parts’ between sheaves (pulleys) at the head of the jib and the top of the crane body or ‘turret’; Figure 2. As the jib is lowered the additional length of hoist rope drawn into this multi-part system raises the hook by about as much as the head of the jib descends.

Thus the height of the hook is little affected by varying jib angle. Tension in the hoist wire is fixed by the load on the hook and remains constant during lifting, slewing and luffing. But luffing tension varies with jib angle and may become excessive as the jib is lowered; Figure 3. This is one of the reasons manufacturers incorporate a minimum angle trip switch in the jib control system. Hoist, luffing and slewing winches are provided with brakes which are applied automatically when power is lost and/or the relevant control levers are brought to neutral. Other safety devices usually include hook height and overload trips.

A slewing bearing insinuated between the head of the fixed deck pillar and the underside of the turret allows the crane to rotate. In addition to supporting the weight of the turret, jib and hook-load this bearing must resist the tilting moment generated by the extended jib and the weight of cargo acting at the jib end. As the tilting moment tends always to tip the crane forward, toward the quayside or open hold asymmetric forces affect the normal distribution of slewing bearing wear.

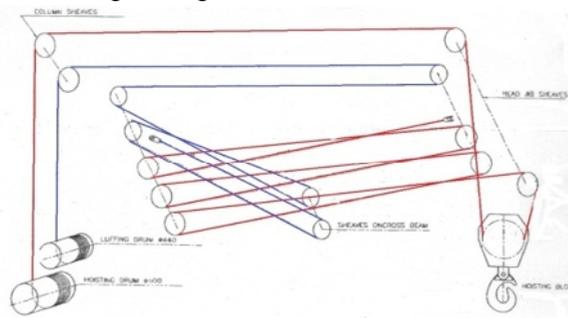


Figure 3 - Schematic reeving diagram

The design, nominal capacity, testing and surveying of shipboard deck cranes are subject to approval by

classification societies. Societies such as Lloyd’s Register, American Bureau of Shipping and Bureau Veritas publish rules for this purpose. The rules set the limiting environmental and operating conditions and also the dynamic accelerations, dead loads, wind forces etc. which must be taken into

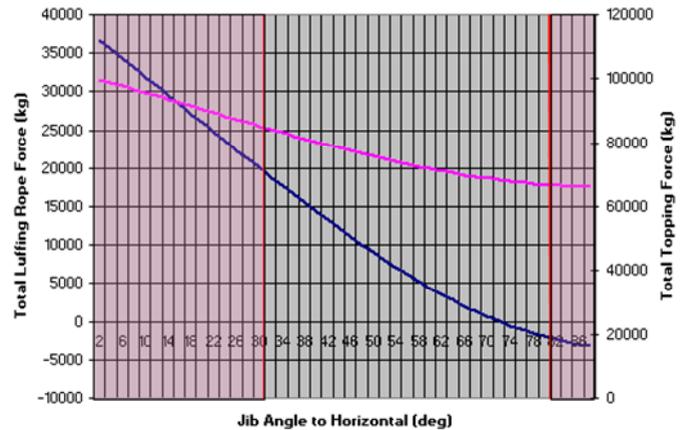


Figure 2 - Variation in luffing rope tension with jib angle

consideration in arriving at a design. An important classification operational restriction is that the SWL is reduced by about 20% when a crane is working bulk cargoes with grabs.

Deck cranes are usually driven by stevedores. The level of skill and care exercised by drivers varies from place to place and disputes often pivot on allegations of negligent stevedore operation - countered by allegations of inadequate shipboard maintenance.

Access to good maintenance records and a clear understand of crane design principles is essential to resolving the disputed issues.

Technical Notes are a service to the enlightened lay reader and are intended to explain marine engineering issues which have featured in maritime disputes.

Alex Sinclair is an independent consulting marine engineer with over 30 years of experience of casualty investigation, arbitration and litigation. A full CV is available at www.ajsinclair.com.