Reducing Engine Room
Overhauling Height
Using an MAN B&W Double-Jib Crane
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MAN B&W Double-Jib Crane
Low-headroom Engine Overhauling Crane

Introduction
In the process of selecting engines for a ship, the height required for overhauling purposes is a significant parameter.

For a normal single hook engine room crane, the total building-in height required for the engine in an engine room, measured from the centreline of the engine’s crankshaft to the underside of the deck beam, depends on the:

- height from the crankshaft to the lifting point in the overhauling tool attached to the component to be overhauled,
- necessary additional height for component withdrawal,
- height from the crane hook to the deck beam with the crane hook in the top position (building-in height of the engine room crane).

In the late 1970s, MAN Diesel & Turbo in Copenhagen conducted an investigation into the building-in heights of engine room cranes, and found that, at that time, all engine room cranes on the market required far too much headroom.

We therefore decided to develop a particularly low-headroom crane, for which we were granted patents in many countries. The further development of this crane led to the “MAN B&W double-jib crane”.

Fig. 1: MAN B&W double-jib crane installed on board
**Working Principles**

The MAN B&W double-jib crane is equipped with two crane hooks and is designed to match the standard overhauling tools for the engine. The hoist arrangement for each hook is carried by a separate beam.

The crane offers ample space between the beams for the components to be overhauled. Fig. 1 shows an MAN B&W double-jib crane installed on board a ship.

When both crane hooks are used, they are attached to the overhauling tool at a position well below the top of the engine component to be overhauled, so that the top of the component can be lifted above the crane hook, up through the crane structure.

When pistons are pulled, they can be lifted right up to the underside of the deck beams, thus utilising the entire engine room height. Records show that the time it takes to overhaul a cylinder unit using the double-jib crane is the same as with a conventional crane.

In order to ensure the availability of cranes built to our quality standards at a competitive cost, we have signed an approbation agreement with the specialist company Danish Crane Building A/S.

Today, Danish Crane Building both manufactures and markets the above-mentioned concept.

The installation dimensions of the MAN B&W double-jib cranes appear in Figs. 2 and 3.
Fig. 3: MAN B&W double-jib crane – manually operated, capacity 2 x 0.5 ton
Required Overhauling Heights and Crane Capacities

Fig. 4 illustrates an engine room equipped with a normal crane (on the left) and one where the distance from the centreline of the crankshaft to the underside of the deck beam is too small for a normal crane to be used (on the right). The hatched area represents engine room heights that require the use of an MAN B&W double-jib crane instead of a normal crane.

Dimension \( H_3 \) in Fig. 4 is the minimum building-in height required when using an MAN B&W double-jib crane. If an additional height (dimension \( D \)) is available, it will be possible to pull up the exhaust valve without removing any exhaust valve studs.

It is important to note that dimension \( H_3 \) is measured from the centreline of the crankshaft to the underside of the deck beam, whereas dimension \( H_1 \), \( H_2 \) (for the normal engine room crane) is measured from the centreline of the crankshaft to the crane hook.

Therefore, when comparing dimensions \( H \), the building-in height of a normal engine room crane must be added to the dimensions \( H_1 \) and \( H_2 \).

The capacities of the MAN B&W double-jib cranes for the respective engines, should be strictly observed. The cranes are designed to match the engine’s standard tools in all details, as a specially designed supplement to the range of engine overhauling tools, and their design is continuously being updated along with the tools they match.

If, for example, a larger crane capacity than that specified for a certain engine type were selected, this would involve a risk that the crane hook dimensions and chain angles might not fit the tools for the engine.

To guard against any mishaps in the event of such an attempt being made, the crane is equipped with a slip-coupling that will prevent it from lifting.

The crane hook travelling area must cover at least the full length of the engine and a width in accordance with dimension \( A \) given on the drawing, see the cross-hatched area.

It is furthermore recommended that the engine room crane can be used for transport of heavy spare parts from the engine room hatch to the spare part stores and further on to the engine.

The crane hook should at least be able to reach down to a level corresponding to the centreline of the crankshaft.

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1) With minimum overhauling height \( (H_1, H_2, H_3) \), one cylinder cover stud has to be removed to allow the stuffing box, mounted around the piston rod, to pass between the remaining studs

2) The hatched area shows the height where an MAN B&W double-jib crane has to be used

Fig. 4: Engine room height, component mass and crane capacity
Further Reductions of Required Overhauling Height

The piston with rod and stuffing box is the component assembly that requires the most headroom for overhauling purposes. The total overhauling height is given by dimension \( H_3 \) in Fig. 4. Dimension \( H_3 \) is the necessary minimum distance from the centreline of the crankshaft to the underside of the deck beam for a tilted piston, including a safety margin. Fig. 5 shows the lifting procedure for a tilted piston, and Fig. 6 shows an MAN B&W engine installed in an engine room with restricted headroom.

If an appropriate spacing of the deck beams has been selected, and the location of the main engine is such that the pistons can be pulled up between the deck beams, the building-in height can, in some cases, be reduced even more.

The reason is that this will allow the use of the space in between the deck beams, i.e. increase the available headroom. In an engine room with an extremely low headroom, where even the electrically operated double-jib crane cannot be used, the small manually operated double-jib crane, shown in Fig. 3, can in some cases perform the job.

The standard version of this crane is available with a capacity of 2 x 0.5 ton, which suits the requirements of the L35, S35 and S26 type engines. This type of crane has an even lower building-in height than the electrically driven double-jib crane and, furthermore, it is able to elevate the crane hooks closer to the deck beam than is the electrically driven double-jib crane.

The manually operated double-jib crane therefore permits a further slight reduction of the necessary headroom in the engine room.
Lifting Procedures for Main Components of the Engine

When the heaviest and most space-demanding components of the engine are to be lifted using the double-jib crane, the procedure differs somewhat from the one used for a standard crane with only one crane hook.

Details of the lifting procedure for each of the components listed below will be described and illustrated:

- Exhaust valve
- Cylinder cover complete with exhaust valve
- Piston with rod and stuffing box
- Cylinder liner with cooling jacket

Exhaust valve

The exhaust valve is lifted using only one of the crane hooks of the double-jib crane. The hydraulically tightened nuts on the exhaust valve studs are loosened and the connected pipes are removed. The exhaust valve studs are unscrewed. In most cases it is sufficient to unscrew only one or two studs.

One crane hook is attached to the eye bolt on the exhaust valve top, and the exhaust valve with unscrewed studs can be lifted off the cylinder cover, see Fig. 7.

However, if more than the minimum building-in height of the MAN B&W double-jib crane is available, see height D in Fig. 4, the exhaust valve can be lifted off the cylinder cover without the need for removing any exhaust valve studs, see Fig. 8.

Cylinder cover complete with exhaust valve

Both hooks of the double-jib crane are required for removal of the cylinder cover. The two extension studs with eye bolts are screwed into the threaded holes in the cylinder cover, see Fig. 9.

The cylinder cover is loosened, and the connected pipes are removed.

The two crane hooks are attached to the eye bolts mounted in the extension studs, and the cylinder cover with exhaust valve can be lifted away.
Piston with rod and stuffing box

The procedure for lifting the piston with rod and stuffing box is in two stages, with both hooks of the double-jib crane being used in the second stage. If the building-in height is restricted, one cylinder cover stud will have to be removed to allow the stuffing box, mounted around the piston rod, to pass between the remaining studs.

First, one of the crane hooks is attached to the lifting tool, which has been mounted on the piston crown, see Fig. 10. Next, the piston is lifted high enough to provide ample room over the cylinder cover studs.

The collar ring is mounted on the piston rod in such a position that the spacers on the collar ring lie true against the piston. The intermediate supports are placed on top of the cylinder cover studs. The piston is then lowered until the collar ring rests firmly on the intermediate supports.

Both crane hooks are attached to the collar ring, thereby allowing the piston to be tilted out of the cylinder liner, see Fig. 11. Then the piston is lifted as high as possible, and the crane is moved in athwartship direction while simultaneously lifting the piston. The piston rod must be kept clear of the cylinder liner and the cylinder cover studs during the tilting operation.

If permitted by the space conditions, the piston is straightened up again and taken to the cut-out in the gallery for overhauling.

Cylinder liner with cooling jacket

Both crane hooks of the double-jib crane are to be used for dismantling of the cylinder liner with cooling jacket from the engine.

Depending on the available height in the engine room, a number of cylinder cover studs may have to be removed.

After removal of the required number of cylinder cover studs, the two lifting screws are fitted horizontally in the threaded holes in the cylinder liner, see Fig. 12.

The crane hooks are attached to the lifting screws, and the liner is lifted as high as possible. Note that the top of the liner will go up between the chain boxes of the crane. Finally, the crane is run athwartships.

It may be necessary to tilt the liner slightly to pass above the fuel pump.
Closing Remarks

As described and illustrated in this paper, the overhauling procedure using a double-jib crane differs somewhat from the procedure with a standard single hook crane.

However, time studies carried out on board show that this does not affect the total time spent on overhauling.

The MAN B&W double-jib crane has been in production since 1979, and it has proved to be a successful extension of the engine’s overhauling tools in numerous engine room installations with restricted headroom.
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