MoorMaster™ Frequently Asked Questions

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Rev	Comment	By	Date

1.0 INTRODUCTION

The purpose of this document is to provide ready answers to Frequently Asked Questions (FAQs) regarding the Cavotec MoorMaster™ automated mooring system.

MoorMaster™ 200D, Port Hedland, Western Australia

MoorMaster™ 400, Picton, New Zealand

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CAVOTEC Inspired Engineering

2.0 GENERAL

How does the MoorMaster™ work?	MoorMaster™ uses large vacuum pads with an attraction force of 20 tonnes to create a fast and secure couple between shore and ship. The vacuum pads are monitored, controlled and positioned via a hydraulically actuated robotic mechanical linkage.
What is the range of sizes of ships currently using MoorMaster™?	The ships range from a 91m RoRo ferry in Denmark (displacement 4,900 Tonnes) to 350m post panamax container ships in Salalah (displacing up to 130,000 Tonnes) to 310m LOA bulkers (displacement 210,000 Tonnes).
Hull strength requirements?	Few ships need any reinforcement. However, steel structures with a thickness below 10mm should be examined more closely. Note that the force exerted on the hull by MoorMaster™ is never more than 1 atmosphere and therefore less than that from fenders
Can MoorMaster™ attached to hulls that are not made of steel, eg aluminium?	Yes.
Can Cavotec assist us with berth integration / design issues?	Yes.
Can Cavotec undertake the hydrodynamic studies to determine the feasibility of MoorMaster™ in our port?	Yes. However, Cavotec engage external consultants. If the customer wishes Cavotec can provide the names of suitable consultants so that they may hire them directly.
How long do these studies take?	Between 4 and 12 weeks depending on the complexity and customer requirements.
Can we supply mobile MoorMaster™ units?	We do not have a mobile MoorMaster™ unit at present. However, this is possible and if there was enough interest from the market this could be developed.
What is the delivery time for a system?	Usually 36 weeks ex works from order for a typical installation. Once delivered the installation time is determined by the customer and then followed by 6-12 weeks commissioning time.
Is any special consent required from regulatory agencies?	We have not encountered any such requirements.
How do MoorMaster™ owners feel about taking responsibility for mooring the ships?	There are precedents for shore mooring systems and our existing customers have not found difficulty obtaining Protection and Indemnity cover for mooring related risks.
Have we experienced any concerns from operators or masters based on their experience of the system?	None have been received so far and MoorMaster™ completed over 100,000 moorings to date.

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Is mixed mooring possible, i.e., MoorMaster™ + ropes?	Generally yes. However, in some cases this is not desirable as the MoorMaster™ and ropes can tend to counteract each other. This is quite a common approach where automating only one end of a vessel is required to minimise berth length, for example.
Are the mooring units a substitute for fenders?	No. Conventional fenders are required for absorbing berthing loads.
What is the operating hydraulic pressure?	170 to 250 bar depending on the machine.
What are vacuum seals made of?	The chemical composition of the seal is confidential to Cavotec however it is a neoprene rubber element. The seals are moulded.
Do the vacuum seals get damaged with use?	The seals do wear out but the time for this to occur varies a lot across our various installations.
Do the vacuum pads break down with exposure to UV?	No
Are there any proprietary spares associated with the MoorMaster™?	Seals and software are the only proprietary items in the system. Some of our seals are in their 9th year of daily use and showing little sign of wear.
What is the load capacity of the vacuum pad?	Our standard pads are rated to 20 tonnes.
What is the co-efficient of friction of the seal?	As a standard we can place reliance through testing of 0.6. However, the surge force that MoorMaster™ will produce is limited to 10 tonnes (0.5) by the software.
Do the vacuum pads leak?	The efficiency of the seal is related to surface condition and the efficiency of the couple. A poor seal will mean that vacuum pumps may run continuously or start up frequently to maintain pre-set vacuum levels.
Pad sensitivity to variations in the hull surface?	The surface does not have to be smooth, as the pads can work with plate deflections of up to 25mm. Welding beads/seams and other minor deformations are normally not a problem.
Does the hull require any special preparation?	No although harder paints have shown some benefits to the vessel operators regularly using a MM system
How is vacuum created/maintained if the surface of the vessel is rough, rusted and in way of weld seams etc?	The vacuum seals are very durable and flexible enough to cope with the overwhelming majority of hull surfaces typically encountered.

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3.0 BERTHS AND BERTH INTEGRATION

Foundation requirements?	We have documents that we can provide explaining system loads specifications for each MoorMaster™ model.
Do the units fit on any berth?	The units are designed to be as universal as possible. However a degree of civil works will be required on many berths to disperse the loads into the surrounding structure.
Can MoorMaster™ controls be integrated into our wider port control system and potentially operated from a remote location?	Yes and yes.
Can MoorMaster™ be made intrinsically safe for EX zones?	Yes.
What involvement does Cavotec have in installing the systems?	Cavotec provides information on civil loads and the customer arranges installation of the system. Cavotec attends the site to provide advice during installation. Once the system is installed Cavotec commissions the machinery and trains the operator's staff.
How should MoorMaster™ units be protected from ships hitting them?	Behind compressed fender line and fenders mounted as close around MM units as possible.
What is the minimum space required between the Wharf wall and the Rail to install this unit?	This depends on the model of MoorMaster™ chosen and where space is limited this may dictate the choice of model. The most important dimension is the distance from the compressed fender line to the seaward edge of the exclusion zone created by ship-loader / STS crane running gear. Using the MM200 this could be as little as 1150mm, less if berth deck height allows.
What determines the number of units required for a particular installation?	A detailed engineering analysis of the berth and ship sizes/types is undertaken before calculating the predicted wind and sea loads on the ships. Where significant dynamic activity is expected at the berth it is recommended that a detailed CFD (Computational Fluid Dynamics) study is completed. A recommended holding power for the upper limit of conditions is then adopted.
How much overcapacity should be built into the system, to ensure adequate safety in case of single unit failure?	This is determined by the customer during the design phase.
What percentage of a vessel can extend beyond the end of the quay?	This is dependent entirely on the vessel hull form and operational access.

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What environmental conditions is the MoorMaster™ system designed to cope with?	Generally all systems can cope with -25°C up to +50°C ambient air temperature. The systems are also designed to survive (but not moor a vessel) in winds up to 180knots.
What about dirty/dusty conditions?	MoorMaster™ is designed to survive in the dirtiest of environments (iron ore terminals) and can withstand an ore spill of 6000kg.

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4.0 OPERATIONAL

How fast is automated mooring with MoorMaster™?	Attachment is achieved in less than 30 seconds and let go in less than 15 seconds.
How many operators are required for a MoorMaster™ system?	One. This can be an operator on the berth or the pilot via remote control or an operator at a computer either on site or remotely. . In ferry applications with regular A to B cruises, the captain or the 1st mate could be the operator of the MoorMaster™
Can MoorMaster™ be integrated into a port wide automation system?	Yes
How quickly can the units warp a ship along the berth?	It depends on many site specific factors including the number of MoorMaster™ units, the unit location, the model, the vessel and environmental conditions at the time of attempting to warp. Generally speeds between 0.15m/minute and 0.5m/minute are achievable.
Can several units be operated independently of the others?	Yes, by grouping them using the control interface (SCADA, remote or local control) for the duration of the ship's port stay.
Does the ship need to be completely stationary before the mooring system can attach?	Not entirely. The ship must be within range of the units and moving along the berth at speeds around a quarter of a knot or less prior to attachment.
How do the units cope with change of draft or tidal movement?	The units freely float vertically once attached to the vessel. If a unit approaches its mechanical travel limit it will release and reposition itself vertically automatically in a patented process referred to as "stepping". The control system ensures this process is never undertaken in the event it would result in any risk to the vessel or personnel.
What is the maximum surge/tide/current/swell that the system can withstand?	There is no theoretical limit to the environmental conditions that MoorMaster™ can withstand. However, the limit is commercial due to the capital cost of the system.
What is the range of heel and pitch accommodated by the MoorMaster™ pads?	Bearings on the back of the pad allow +/- 6 degrees of heel and +/- 6 degrees of pitch.
How complex is the control interface?	It can be as simple as the operator requires ranging from a simple LCD display with 2 buttons (Moor/Release) for quick turnaround ferries to a detailed touch screen HMI with full system control and diagnostics for ships which stay in port over longer periods.
What skills are required to operate and maintain the system?	Any ship or terminal operator used to operate their own vessels or cargo handling equipment will have no difficulty with the system.

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What happens in a power failure situation?	The control system continues to monitor system and sound alarms as it has UPS back power on the control system. System hydraulics and vacuum systems do not operate. Where the power grid is considered a significant risk, a back-up generator should be employed.
In case of a power failure, for what duration of time does the vacuum hold? Is there any alarm system to warn the terminal?	The typical duration is between 15 minutes and 15 hours dependent on the vacuum seal against the hull.
What on-going costs are there with the system?	Aside from the planned maintenance program, no on-going costs are applied.
What is the approximate cost of the power consumed by the MoorMaster™ system?	Cost will vary dependent on the operational requirements and local power costs.
How much maintenance do the units require?	A planned maintenance program is supplied with each system. This details monthly, quarterly and 6 monthly and annual maintenance checks.
How much does maintenance cost per unit?	It is dependent on the location and the environment, yet in general terms a cost of not more than 1% of the capital purchase price per annum, averaged over a period of 5 – 7 years.
Do MoorMaster™ systems require specialist staff to maintain beyond our usual mechanical, electrical and hydraulic competencies or do we have to call Cavotec for most maintenance?	No. Normal trade skills are all that is required.
What safety systems exist to warn the operator in high winds?	Alarms are generated when the loads exceed pre-set levels determined in conjunction with the customer. The customer would then have their own procedures associated with each escalating alarm level.

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