



DOCKLEVELLERS

A view on the equipment available, its distributors and manufacturers

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Docklevellers

A view on the equipment available, its distributors and manufacturers

1.0 Preface

This report has been written as part of the ongoing initiative to increase company knowledge base and to decrease the amount of time required in the procurement process. The views expressed in this document are those of the writer based on their experience in industry.

2.0 Introduction

To facilitate the efficient loading of trucks, docking stations require certain pieces of equipment. A dockleveller is one such item.

The dockleveller serves to maintain a stable, floating ramp from the building onto the truck to enable forklifts to gain access into the truck. The dockleveller unit must float as the height of the loading floor in the truck varies slightly depending on the load on the truck. Two major types of dockleveller are available. Units activated with an air bag and units operated using hydraulics.

Most of the current suppliers have worked with each other at one time or another. This said, one supplier overshadowed the others in their knowledge of the equipment and how it operates.

Several accessories are available in the market. These however are typically not installed in the South African market due to them being damaged on a regular basis.

3.0 The Dockleveller

In broad terms a dockleveller is simply a hinged deck with an extending lip on the un-hinged end. There are 2 main types of lip extension, swing lip and extending lip. The swing lip type is further split according to the method used to raise them – airbag and hydraulic.

The structural design of both dockleveller variants are very similar. The main differences being the allowances made to accommodate either the hydraulics or the airbag and the swing or extending lip.

The supporting deck structure is either of “I” beam which is relatively rigid and is normally supplied with sliding rear hinged mountings to allow the twist required to align with the vehicle bed, or the Kelley “Lambda” beam and the Dockleveller Supplies “L” beam both of which are designed to allow the deck to twist and both are therefore able to use rigid rear hinge mountings.

Several elements of the deck can be, and indeed are, altered depending on customer requirements. Among these are the deck size, deck load rating and length of the lip.

If required, the lip design can be altered to create a forklift barrier at the edge of the dock. This is to provide a final barrier to notify personnel of the dock edge as well as to prevent forklifts falling off the dock.

Truck docks are inherently dirty places and are subjected to regular sweeping and wash-down. The dockleveller must be designed so that it is able to deal with the dirt and water. Dirt that is allowed to accumulate within structures causes damage by mechanical wear as well as increasing the likelihood of corrosion when mixed with water. Some designs cater for this while others do not. This is one of the things that must be checked when selecting the equipment.

3.1 Airbag Variant (Swing lip)

These units are more economical to manufacture and operate due to the cost of the parts used in the unit. They are also potentially more reliable.

The deck is lifted by inflating a bag below the deck by blowing air into it using a blower. The lip is activated by a mechanism via gravity once the deck has finished being lifted and is lowering onto the deck of the truck. This mechanism, although being more complicated than the hydraulic cylinder as used on hydraulic units, is less costly to replace.

The majority of the South African market as well as a large portion of the North American market uses airbag units.

All but one of the airbag units currently sold in South Africa are fabricated locally. Only one, the “Kelley” is currently imported from the United States.

The air blower on most units are installed behind the airbag with only one manufacturer opting to install it in front of the unit. Although this makes it accessible for maintenance, it puts in harm’s way when the dock is being cleaned, usually with high pressure water. The air blower does not often fail. Maintenance crews can easily extract blowers from behind the airbag.

Airbag units can be used in almost all applications. They are however limited in applications where the mass of the deck and lip get too large. In this case, the use of a hydraulic unit is recommended.

Some units have retractable safety legs typically two posts behind the lip which support the deck when in not in use. To cater for trucks that are lower than the dock these posts can be retracted to allow the deck to drop below the level of the dock and rest on the truck. The posts are normally retracted using a pull ring in the deck. The position of the pull ring differs from supplier to supplier – some positions being more optimal than others.

Other units use a catch on the base frame into which the lip is located when in the lowered position. This system is prone to failure due to accident damage and failure of the lip to locate properly.

The airbag operating philosophy is far less complicated than the hydraulic unit. Typically, there is a single button to operate an airbag dockleveller.

Items to watch out for on the airbag unit

- Upper airbag plate – This plate undergoes a high amount of flex. This flex must be accommodated in the design. If not, the fasteners attaching the plate to the underside of the deck shear
- Lower airbag trolley – The strength of this trolley is important as it supports the airbag which in turn carries the full weight of the deck. If not sufficiently rigid, this plate deforms allowing water to collect. This water then corrodes the plate and impacts on the performance of the deck and the lip. In addition, the lip activation mechanism will not locate correctly causing the lip to malfunction.
- Airbag trolley wheels and axles – These if not designed correctly will collapse.
- Hinge design – some designs are more susceptible to failure than others. There are 2 basic types of hinge, discussed in more detail in section 6.1 below.

3.2 Hydraulic Variant (Swing lip)

The hydraulic unit costs more to fabricate and operate. There are several more systems on this unit that require maintenance, and the replacement parts have higher costs than the airbag unit.

Single acting hydraulic cylinders are used to lift the deck as well as to activate the lip on the unit. 2 types of single acting cylinders were seen installed on the units inspected. Displacement cylinders, often called plunger cylinders, and piston cylinders.

Displacement cylinders are cheaper to fabricate than piston cylinders and require a higher pressure to operate. The higher operating pressure in turn increases the risk of leaks in the system. The rod on displacement cylinders is not as securely supported than on the piston cylinders, placing more strain on the seals which, coupled with the increased operating pressure, further increases the risk of leaks.

All suppliers use piston cylinders for the lip cylinder. There is however one fabricator, Dockleveller Supplies, that offers the option of their airbag lip activator on their hydraulic unit should the client require it. This decreases the

complexity of the unit as well as repair costs. It also opens the possibility of installing their Patented “Crash Resistant Lip Activation” system.

The hydraulic unit is used throughout Europe as it is deemed to be safer to operate due to the hydraulic cylinders being able to lock. Maxiflex imports a hydraulic unit from Crawford, a division of Assa Abloy, in Europe. Features such as twin deck lifting cylinders are an example of the stringent customer requirements that exist in Europe. These systems are also available as a local unit from Dockleveller Supplies.

The control system of the hydraulic unit is of particular interest as there are several operating strategies that can be used. A float valve must be installed into the hydraulic system as the deck must float when resting on the truck. Some systems are designed in such a way that solenoid coils are active during the loading / unloading procedure which can lead to the coils being burnt out. When buying a hydraulic unit, one must be very aware of the control philosophy for the unit.

In some instances, the type of hydraulic oil used is regarded as a risk as it could be a source of contamination. This is of particular concern in the food industry.

Items to watch out for on the hydraulic unit

- The life cycle costs – Lip activation cylinders are sometimes damaged by trucks reversing into the dockleveller. When this happens, the cylinder will most certainly require replacement.
- Poor workmanship regarding the manufacture and installation of the hydraulics – this could cause hydraulic fluid to leak which in turn has an impact to environmental, maintenance and longevity.
- The type of cylinder used – displacement cylinders require higher pressures to operate and have a greater risk of leaks due to their design as well as the higher operating pressures.
- Hinge design – some designs are more susceptible to failure than others. This is discussed further in 6.2 below.
- Control Philosophy of the hydraulic system.

3.3 Hydraulic Extending-lip (Telescopic-lip) Variant

The extending lip dockleveller unit was only offered by Dockleveller Supplies.

The unit has a hydraulically operated deck with a lip that, instead of swinging out when deployed, it slides out from beneath the deck. A hydraulic cylinder is used to extend the lip and a spring is used to retract the lip.

On swing lip units, the length of the lip is limited as it needs to swing out when being deployed. The longer the lip, the longer the arc of movement, and the greater the force required to deploy the lip. Both of these factors have practical limitations.

The length of the extending lip can be made to be much greater than a swing lip due to its operation. There are several advantages with having a longer lip:

- The extent to which the lip is deployed (extended) can be varied.
 - This means that when a trailer is fully loaded and pallets are loaded to the edge of the truck, the packages and/or pallets at the door are not in the path / swing arc of the extending lip. The extending lip is rather only extended when the pallets and boxes are out of harm’s way and only to the length required. In this way cylinder damage is rarely encountered as the operator is in complete control of the lip deployment.
- Lip can reach trailers or containers that are positioned slightly further away from the dock
 - Sometimes when a container is loaded onto a trailer it is not in line with the back edge of the trailer. Swing lip units would only be able to reach the trailer. The forklift would then struggle to negotiate the step into the container. The extending lip can be extended so that it reaches the container edge.

- Some trucks have lifts installed so that they can be accessed in the field. This equipment prevents the trailer from being able to reverse right up to the dock. The extending lip is able to bridge this increased gap.
- There is no lip hinge
 - Not having a hinge means that there is nothing to be damaged in a collision. That said the lip cylinder could still require replacement as it is directly attached to the lip.

4.0 Corrosion Protection

The coating method or system chosen to protect the dockleveller against corrosion depends on multiple factors all of which are location specific. The specific conditions found at the installation site must be determined and considered when selecting the optimum coating system.

The two main options are painting and galvanising, each of which have their pros and cons.

Painted units are typically the rule, galvanising is the exception.

4.1 Painting

The majority of the dockleveller units are painted. This is a suitable method of protection as the high wear areas of the dockleveller are easily accessible when the coating needs to be repaired.

The advantage of painting is that the specification can be altered to cater to the specific conditions found on a site.

4.2 Galvanising

Galvanising is a hardy protection method which is very versatile. It is not however a “one size fits all” solution: it has its limitations.

Not all units can be galvanised in a single dip. The size of the deck in combination with the dimensions of the galvanising bath determine the number of dips required to fully coat the deck. Double-dipping a deck, or any long item for that matter, is not recommended as it causes metal to twist due to temperature differentials created in the galvanising process. Double dipping leads to post dipping stress relieving which is not a perfect science. Residual stresses regularly remain in the steel causing the steel to deform.

Galvanising is an acceptable means to protect a dockleveller, however only if it is possible to dip each of the separate components in a single dip and the environmental conditions are suitable.

5.0 Accessories and Associated Equipment

Several accessories are available and can be supplied by most of the dockleveller vendors.

Regularly installed	Dock Seals / Shelters Dock Lighting Dock Buffers Truck Guides
Not commonly installed in South African applications	Dock traffic lights Truck restraints Deck seals / Brushes Wheel Chocks

Table 1: Available Accessories and Associated Equipment

6.0 Modes of Failure

6.1 Lip Impact Damage

Docklevellers are installed in relatively benign environments. However, the risk of a truck reversing into them is high. Docklevellers should only be activated once the truck is in position and parked, however operators, in an attempt to reduce cycle time, have been known to activate the unit before the truck is docked. This leads to trucks impacting the lip.

Lip impact causes damage to the hinges as well as the lip activation mechanism.

Lip Hinge Damage

Two major lip hinge designs were seen as part of this study.

The critical factor of the hinge is the amount of welding present on the hinges. The lip hinge is a highly stressed area and can be subject to a lot of maintenance if incorrectly designed.

- Piano hinge design
 - This design collects dirt and grime and requires more maintenance than the self-cleaning design. The hinge is a series of steel tubes welded along the front edge of the deck with a hinge pin.
 - The tube is susceptible to failure as a result of corrosion or overloading. This causes the tube hinge to split
 - Corrosion increases the force required to operate the lip and places additional stress onto the lip-activation arm causing the arm to fail.
 - The welding has been known to fail on the tubing as well.
- Self-cleaning design
 - This design allows dirt to fall through the hinge thus preventing dirt accumulation.
 - The rule of thumb with these hinges is the more welded area, the better. One supplier uses a smaller plate for the hinge portion than others – the larger plate is preferable due to the increased weld lengths in the hinge. The larger plate also has a better load distribution and hence stronger. No reports of failure were attributed to either the imported Kelley or the Dock-Rite unit supplied by Dockleveller supplies.

Some hinge designs are not sufficient to withstand a lip impact. Correctly designed hinges are able to withstand the majority of impacts without any repairs.

Lip Activation Mechanism Damage

On hydraulic units the lip activation cylinder is liable to deform due to impact and will need to be replaced.

There are a variety of lip activation systems on airbag units, all proprietary to the vendor supplying the unit. Some vendors have done a lot of development of lip activation systems while others have not. This is discussed under each particular vendor in Section 0 below.

6.2 Deck Hinge Failure

Dockleveller units are designed to float on the back of the truck as well as to flex. If not correctly catered for in the design, the flexing causes welds on the hinges to fail due to fatigue. Some designs are such that the rear hinge has completely detached from the base frame. This is discussed under each particular vendor 0 below.

6.3 Dockleveller Installation Considerations

The design of the area surrounding the dockleveller can aid or detract from the efficient operation of the unit.

The approach to the dock should be level. Having a decline leading to the dock is fraught with risk and has major problems. It is not recommended.

- A declined approach increases the risk of a trailer hitting the dock or building. The angle of the ramp increases the risk of the top of the truck hitting the building as well as making it difficult to open the truck doors once the truck has docked.
- Opening the trailer doors on a decline before docking increases the risk of the load falling out the truck.

Curbing installed in the truck approach on either side of the dock would guide the trailer into the dock and building. This would prevent the trailer arriving at the dock out of position. Steel balustrades, known as truck guides, are often installed to guide the truck into the dock. The distance of truck guides from the building is critical and largely determined by the wheel configuration of the truck intended to be used in the dock.

Guiding lines must be painted on the approach to the dock to assist drivers in lining up with the dock.

Dock Bumpers are essential. The “D-type” is not hard wearing and requires regular replacement. The “leaf-type” (made of conveyor belt) is far more versatile and longer lasting.

7.0 Vendors

7.1 Maxiflex

Maxiflex is a distributor for Crawford docking systems. Crawford is a division of Assa Abloy originating in Europe. They offer a full suite of dock equipment including various types of industrial doors, dock seals, buffers, docklevellers, lights and other accessories. They are a one-stop shop.

The company’s main focus are industrial doors for which they have an extensive range and comprehensive knowledge.

A field service crew is available. The crew services Maxiflex’s equipment as well as equipment supplied by 3rd parties if the need arises.

Maxiflex currently only has a hydraulic unit on offer.

Maxiflex’s Hydraulic Dockleveller

Being designed and fabricated in Europe, this unit is of a high standard and quality. The deck is operated using hydraulic cylinders, one on either side of the deck. This increases the stability of the deck should the truck pull away from the dock while a forklift is on the deck.

The lip is operated with a single cylinder in the centre of the lip.

The lip hinge is of the self-cleaning design with increased weld area. The deck hinge and welds are of a substantial design.

7.2 Dockleveller Supplies

Dockleveller Supplies is an independent, South African based, manufacturer that designs, fabricates and installs docklevellers and other truck loading equipment under the Dock-Rite label. Dockleveller Supplies offer a full suite of dock equipment including various types of industrial doors, dock seals, buffers, docklevellers, lights and other accessories. They are a one-stop shop.

The staff at Dockleveller Supplies have an extensive knowledge of the industry as well as the operation of a dockleveller. Their product has gone through stringent development. Their standard lip activation system is also of a robust design and can sustain minor bumps without an issue. Most noticeably they have developed and patented a “Crash Resistant Lip Activation” system to get round the continuous costs associated with lip activation breakdown. This system is available as an option on their entire swing arm dockleveller range, both hydraulic and airbag.

Dockleveller Supplies has an aftermarket crew to maintain their equipment as well as equipment supplied by 3rd parties if the need arises.

Dockleveller Supplies units, once installed require very little maintenance other than regular oiling of moving parts. They have designed the majority of maintenance problems out of their units.

Dockleveller Supplies Airbag Unit

The Dockleveller Supplies airbag unit goes through continuous development. This company is very attentive to problems that arise in the field and they alter their design to remove the problem.

The welding, hinges and base frame are all substantial.

The lip activation arm has been developed to the stage where a crash resistant arm is available as an option. The standard arm however is sufficient to handle normal use. The Dockleveller Supplies lip activation system is the most durable system out of all dockleveller units viewed.

All hinges are designed so as not to allow dirt and grime to accumulate in the unit. The self-cleaning lip hinge is the type that has a larger weld length.

The airbag trolley is of thick steel plate so that it does not distort. This means that water does not accumulate on the trolley, and the lip activation is not compromised.

The upper plate is not directly connected to the deck. It is rather attached to steel tangs which allow for the flex in the deck. This means that fasteners do seldom shear off.

The air blower is installed behind the airbag on this unit.

Dockleveller Supplies Hydraulic Unit

The Dockleveller Supplies hydraulic unit has the same design as the airbag unit. The only difference being that the deck is raised using one or two hydraulic cylinders.

The lip is activated either with the same arm used in the airbag units (standard or crash resistant) or a single hydraulic cylinder. The choice is customer dependant.

Dockleveller Supplies Hydraulic Extending-lip Unit

Dockleveller Supplies were the only supplier to offer this unit as part of their standard range.

The unit makes use of similar technology as their hydraulic unit with the exception of the lip only being activated hydraulically.

In addition to the features outlined in 3.3 above, the crash resistant lip protection system can be fitted to this unit for additional protection.

7.3 DDL

DDL is an independent, South African manufacture which has until recently only offered a hydraulic unit. At the time of writing this report an airbag unit was in development but not operational.

They offer a full suite of dock equipment including various types of industrial doors, dock seals, buffers, docklevellers, lights and other accessories. They are a one-stop shop.

DDL has a field service crew to maintain their equipment as well as equipment supplied by 3rd parties if the need arises.

DDL's Airbag Unit

DDL's airbag unit was in a process of a re-design at the time of the survey and as such was not seen in operation.

The lip is activated by a chain system attached to the base frame and a lever arm attached to the lip.

The lip hinge design is the self-cleaning type; the design is that which has a smaller weld area.

The location of the pull ring is in the middle of the deck. To retract the posts a person needs to stand on the deck while it is in operation. This has the potential of raising safety concerns due to personnel standing on operating equipment.

The air blower on this unit is installed in front of the airbag.

The rear hinge is a sliding post and susceptible to failure when the deck experiences excessive twist. This is not common, but has been known to occur.

DDL's Hydraulic Unit

This unit uses a single lift cylinder in the centre of the unit together with a lip cylinder in the centre of the lip.

The deck lifting cylinder is a single displacement type cylinder. The lip cylinder is a single acting push cylinder.

All other design aspects including the deck hinge are based on the same design as the airbag unit.

7.4 Stab-a-Load

Stab-a-load is both a distributor for "Kelley" docklevellers, imported from the United States as well as a fabricator of their own unit of their own design. They are one the largest company supplying dock levelling equipment, although not just for docklevellers. Stab-a-load has a broad range of products in their offering of which docklevellers is one.

Kelley is owned by Assa Abloy.

A field service crew is available. The crew services Stab-a-load equipment as well as equipment supplied by 3rd parties if the need arises.

They offer a full suite of dock equipment including various types of industrial door, dock seals, buffers, docklevellers, lights and other accessories. They are a one-stop shop.

The Imported "Kelley" Airbag Unit

This unit is fully imported from the United States.

The lip activation mechanism does not allow for any form of impact. The rod connecting the lip to the cams at the rear regularly bend through use. This impacts on the operability of the lip.

The airbag trolley on this unit showed evidence of slight deformation due to the thickness of sheet metal used. This increases the risk of water accumulating on the plate and causing the plate to corrode, as well as malfunction of the lip activating mechanism.

The location of the pull ring is in the middle of the deck. To retract the posts a person needs to stand on the deck while it is in operation. This has the potential of raising safety concerns due to personnel standing on operating equipment.

The air blower is installed behind the airbag on this unit.

The Kelley airbag dockleveller is well designed and well finished. The main limitations of these units being the airbag trolley and the lip mechanism.

Stab-a-Load "local" Airbag Unit

Stab-a-load has a locally manufactured airbag unit, the design of which is based on the Kelley unit. This is their most popular unit and has the greatest market penetration of all the docklevellers they market.

The lip activation mechanism does not cater for any form of impact. The rod connecting the lip to the cams at the rear regularly bend through use. This impacts on the operability of the lip.

The rear hinge is a sliding post and susceptible to failure when the deck experiences excessive twist. This is not common, but has been known to occur.

The location of the pull ring is in the middle of the deck. To retract the posts a person needs to stand on the deck while it is in operation. This has the potential of raising safety concerns due to personnel standing on operating equipment.

The lip hinge uses a piano hinge as described above.

The airbag trolley wheels often collapse and require replacement. This has an impact on the operation of the deck as it will not be able to be raised to the same height. This in turn has an effect on the lip activation arm.

The steel sheet on the lower airbag trolley is not sufficiently thick to prevent the plate deforming, albeit slightly, under load. This allows water to accumulate in-between the plate and the airbag. This causes the plate to corrode, and the lip activation to be compromised.

The upper plate is attached directly to the deck support beams. The fasteners connecting the plate to the deck often break in shear due to the differential flex in the deck and the plate.

The air blower is installed behind the airbag on this unit.

7.5 Super Equipment

Several attempts were made to make contact with Super Equipment without success.

8.0 Comparison Matrix

Rating: 1 = Poor, 2 = Average, 3 = Good

Airbag Unit Comparison Matrix					
Comparison Item	DDL	Dockleveller Supplies	Maxiflex	Stab-a-Load (Local)	Stab-a-Load (Kelley)
Lip activation arm/system	*	3**	#	1	1
Position of pull ring	*	3	#	1	1
Airbag trolley wheels	*	3	#	1	1
Airbag trolley plate	*	3	#	1	1
Rear deck hinge design	*	3	#	2	3
Lip hinge design	*	3	#	1	3
Blower position	*	2	#	2	2
Lip hinge design does not collect dirt	*	3	#	1	3
Sum	*	23	#	10	15

Table 2: Airbag Unit Comparison Matrix

* The airbag unit from DDL was not rated as it has not been witnessed in operation

** Crash resistant activator

No airbag was available from Maxiflex at time of report

Hydraulic Unit Comparison Matrix					
Comparison Item	DDL	Dockleveller Supplies	Maxiflex	Stab-a-Load (Local)	Stab-a-Load (Kelley)
Lip Activation Method	2	3 [#]	2	###	###
Rear deck hinge design	2	3	3	###	###
Lip hinge design	1	3	3	###	###
Cylinders	1 ^{##}	2	3	###	###
Lip hinge design does not collect dirt	2	3	3	###	###
Sum	8	14	14	###	###

Table 3: Hydraulic Unit Comparison Matrix

- Dockleveller Supplies crash resistant lip activation arm used in comparison.

- Displacement cylinders

- No hydraulic unit offered

No comparison could be made for the extending lip unit due to only one supplier offering it in this survey.

9.0 Summary

There is a lot more to a dockleveller unit and its selection than meets the eye. There are several subtle nuances that if not carefully considered could lead to increased maintenance costs and troublesome operation.

All of the vendors have similar product offerings in that they will be able to supply all equipment (industrial doors, dock shelters, truck guides, docklevellers, etc.) as well as other equipment used for loading trucks. It is not uncommon for industrial doors from one supplier to be installed with a dockleveller from another.

Attention needs to be given to the following when selecting a dockleveller:

1. Dock height
2. Angle of approach
3. Load capacity requirements
4. Nature of load and its susceptibility to damage (swing lip vs. extending lip)
5. Working environment
6. Cost of operation

In the South African market, the airbag dockleveller is by far the most popular choice due to its ease of operation and low maintenance costs, but for some applications this unit falls short. In these situations, the hydraulic swing-lip or the hydraulic extending-lip unit would be better suited.

Dockleveller configurations can be altered to suit most customer requirements.

The choice of corrosion protection should not be taken lightly given the limitations of certain systems and its application onto the dockleveller.

Dockleveller Supplies has maintained a critical view of all their dockleveller units, particularly the airbag unit with specific attention being paid to the lip activation arm. Through their development they have designed common problems out as soon as they become aware of them. This has meant that equipment maintenance has been significantly decreased. In cases where the unit has suffered a truck impact the unit remains operational since their patented crash resistant activation arm can handle the majority of impacts.

No two dockleveller units are exactly the same. There are however two main critical areas to look at when selecting a dockleveller:

Airbag variety	Hydraulic variety
<ul style="list-style-type: none">• The lip activation mechanism;• hinge design and• airbag trolley	<ul style="list-style-type: none">• Deck hinge design and;• hydraulic cylinder type and seals.