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Meat & Livestock Australia Technology transfer kits

This Technology Transfer Kit is one in a series of Do-It-Yourself (DIY) resources prepared for the Australian meat industry to encourage the development of project engineering skills at meat processing sites while implementing simple, useful items of technology. As each processing site has unique design and construction features the information in this kit should be used as a guide only. Some modifications from this kit, to ensure the successful application at individual sites, are likely.

DIY Kit #20 - Smallstock carcass & beef quarter Ezi-Lift

During smallstock and beef carcass dressing and handling there are a number of instances where heavy lifting is required. Often this lifting includes unacceptable OH&S hazards that result in injuries to processing and handling staff. In high throughput plants many of these lifting actions have been eliminated through mechanical aids and automation. However in small and very small plants these hazards still remain and can result in considerable to costs to the processor.

Particular areas of concern identified at Maclagan Meats, a very small throughput plant processing 120 smallstock units and 40 beef units per week, which involved unacceptable lifting hazards, were:

- smallstock shackling and hoisting onto the processing rail immediately after sticking
- beef carcass load-out, where sides are quartered and loaded onto delivery vehicles

The difficulty, and danger, of manual lifting for smallstock carcasses at shackling is shown in photograph 1.

Photograph 1. Lifting the shackled smallstock carcass the old way.



The reliance on manual lifting in these areas was also known to be inefficient so that any mechanical assistance would also improve processing efficiency, not only in these areas but across the process line.

Given the small throughput of the process line at the Maclagan Meats plant, it was essential that any new equipment needed to be simple to use and inexpensive to develop, install, maintain and operate. It also had to be suitable for these specific lifting tasks and the hygiene requirements associated with a meat processing premises.

Local general engineering skills were used to identify a workable option, draw up plans and construct prototypes.

Description

The concept of using a ram to lift from one height to another is quite simple but the engineering aspects of this project were challenging because, like most existing process areas, the area available within the existing structure was limited. This was particularly relevant in the beef quartering and loadout areas.

Air rams were selected for both lifters because there was a need for them to be responsive in their application and practically maintenance free. The rail system and air rams selected have proven to meet these design criteria. The following photographs, the appended drawing and the further available detailed drawings show how these lifters have been constructed and installed.

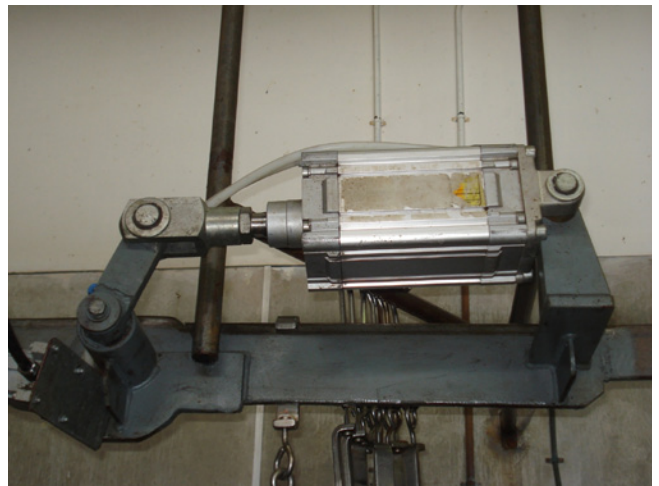
The smallstock carcass Ezi-Lift

The smallstock lifter required the removal of the existing section of the static shackling rail. This section was reused after strengthening around the pivot end to reduce flexibility. The remaining section of the main rail was fitted with a clevis point to mount the air ram and a pivot to connect the swinging section of rail. As the load on the lifter was limited to approximately 90kg maximum, it was possible to mount the pneumatic ram on the main rail and lift the swinging rail from the pivot end. These are shown in photographs 2 & 3 and the available drawings.

Photograph 2. The smallstock carcass lifter.



Photograph 3. Detail of the smallstock carcass lifter installation.



The pneumatic cylinder used in the smallstock lifter is a Festo Ram stock number DNC-125-100-PPV-A. It has a 125mm bore with 38mm rod diameter and 100mm stroke.

The pivot point uses a sealed roller bearing for long life and minimal maintenance. The bearing used is a SKF – 6007.

The raising and lowering of the swing arm is controlled by a three way Festo spool valve mounted near the pivot point in close reach of the operator. Once the air is supplied to the valve it can be turned to direct air to one end or other of the ram to either extend the ram and lower the rail or retract the ram and raise the rail. The third position allows the swing rail to be stopped and held in an intermediate position if required. The smallstock lifter in use is shown in photograph 4.

Photograph 4. Lifting the shackled smallstock carcass using the rail lifter.



The beef quarter Ezi-Lift

The beef lifter required the construction of a new overhead structure to support the pneumatic ram and its mounts. Given the greater weight of the beef quarters and the greater height of the beef rail, it was necessary to amount the ram so that it operated from above and towards the free end of the swinging rail. The support frame was fitted with a clevis point to mount the air ram and the existing rail was fitted with a pivot to connect the swinging section of rail.

The pneumatic cylinder used in the beef quarter lifter is a SGS Ram stock number C95SD200-1000. It has a 150mm bore with 38mm rod diameter and 1,000mm stroke.

The pivot point uses a one inch diameter UNC ZP GR.8 bolt and nylon nut. This is expected to give an adequately long life and minimal maintenance given the lower number of uses of this lifter.

Photographs 5 & 6. Separate views of the beef quarter lifter.



Maclagan Meats recognised the need for safety when 150 – 200 kilograms of beef side is hanging overhead. A safety pin device that locks the rail in position was fitted in case the main ram failed when under load. This device is mounted at the free end of the swing rail near the main ram mounting point. The ram is pneumatically operated by a small ram mounted at right angles to the rail. The ram used here is a Festo Ram stock number 163501 DNC-125-100-PPV-A. The pneumatic signal switch is mounted at the non-pivot end of the main ram and is triggered by a cam ring mounted on the ram's active rod.

The locking ram is activated by the trigger when the rail gets to a predetermined raised position. Positioning of the trigger's activating cam ring is important as the triggers operation can be affected by the amount of weight on the rail. Maclagan Meats found that during initial trials there was too much flexibility in the apparatus that required the strengthening of pivot joints and swing arm to ensure correct operation of the trigger. These modifications are included in the drawings provided.

The raising and lowering of the swing arm is again controlled by a three way Festo spool valve mounted on the wall in close reach of the operator. Once the air is supplied to the valve it can be turned to direct air to one end or other of the ram to either extend the ram and lower the rail or retract the ram and raise the rail. The third position allows the swing rail to be stopped and held in an intermediate position if required.



Operation

The operation of either lifter is a simple task for a trained operator. With either lifter it is important that the small stock supporting slide or beef supporting roller is correctly positioned on the rail before activation. Once in the correct position the control valve is simply turned to the required position and the carcass or quarter is either raised or lowered as required.

Maintenance requirements are minimal but all pivot points and operation of the beef lifter locking pin should be checked regularly for correct operation and minimal wear.

Benefits

Maclagan Meats have been using the Smallstock and Beef Ezi-Lifters continuously for several months without problem. In this time, staff at Maclagan Meats have been able to fine tune the lifters and train operators in their use. Anecdotal evidence from all staff using the lifters is that safety is significantly improved and the risk of a lifting injury dramatically reduced. Savings associated with the reduction in workplace injuries is an obvious payback to the company.

Management at Maclagan Meats has noted that the efficiency in the beef loadout area particularly has increased with a reduction in time to beef into load transport vehicles. This has resulted in a payback in reduced labour costs and more rapid delivery to customers.

To date the lifters have proven to be robust and shows no sign of wear or corrosion. Routine maintenance has been minimal and the units are very easy to clean without contribution to wash down time or cost.

Suitability of Application

Despite the limited space available for their installation and operation, the Smallstock and Beef Ezi-Lifts do not interfere with the operation of the processing or loadout areas. They should both be able to be fitted at any plant encountering OH&S risks at either smallstock shackling and beef quartering and loadout.

Given the flexible design of these lifters it is reasonable to expect that they could be further modified to suit many other smallstock and beef lifting applications within a meat processing establishment

Key points to consider

Maclagan Meats has highlighted the key points to consider to ensure the successful installation and use of these lifters.

- Use good air switches that allow you to control the direction and speed of the lift at all times (three way switch). Maclagan Meats used three way Festo spool valves (approx cost \$225 each).
- Use rams of sufficient or excess capacity. For the beef lifter, ensure the unit can lift a minimum of two quarters at a time.
- Use air exhausts and run them into an area that will not be affected by noise.
- Use a good compressor that will supply ample air, remembering that sufficient capacity should cover the concurrent use of other air operated devices. Maclagan Meats installed a new compressor to ensure that adequate air was available for all air operated devices.
- Ensure that all equipment is of durable construction, especially the pivot joints.

Cost

The total project cost of this development was approximately \$17,000 (exc GST) including \$1,365 for preparing design plans. It is likely that the component costs to construct, install and commission a similar unit based on this design would be:

Beef lifter	\$3,650
Sheep lifter	\$2,450
Air compressor (if required)	\$9,500

All costs excluding GST.

The cost savings in eliminating OH&S hazards associated with carcass and quarter lifting would be very significant and the payback for the investment would be measurable in a matter of weeks.

Support Information

The general layout engineering sketches are shown on the following pages:

Drawing 1 Sheep carcass lifter

Drawing 2 Beef quarter lifter

A full set of detailed drawings for both lifters and a short video showing their use are available on request from MLA.

Acknowledgments

This kit has been prepared by Meat & Livestock Australia with support from the Australian Meat Processors Corporation.

Concept Design

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Maclagan, QLD

Equipment design, development and construction

Trevor McHugh, No Troubles Engineering,
Maclagan, QLD

Equipment installation and operation

Maclagan Meats, Maclagan, QLD

Disclaimer

No parties involved in the development of this kit, or the equipment it is based on, make any representation as to the accuracy of any information or advice contained in this document. All parties involved exclude liability as a result of reliance by any person on the information or advice contained in this kit.



Further Information

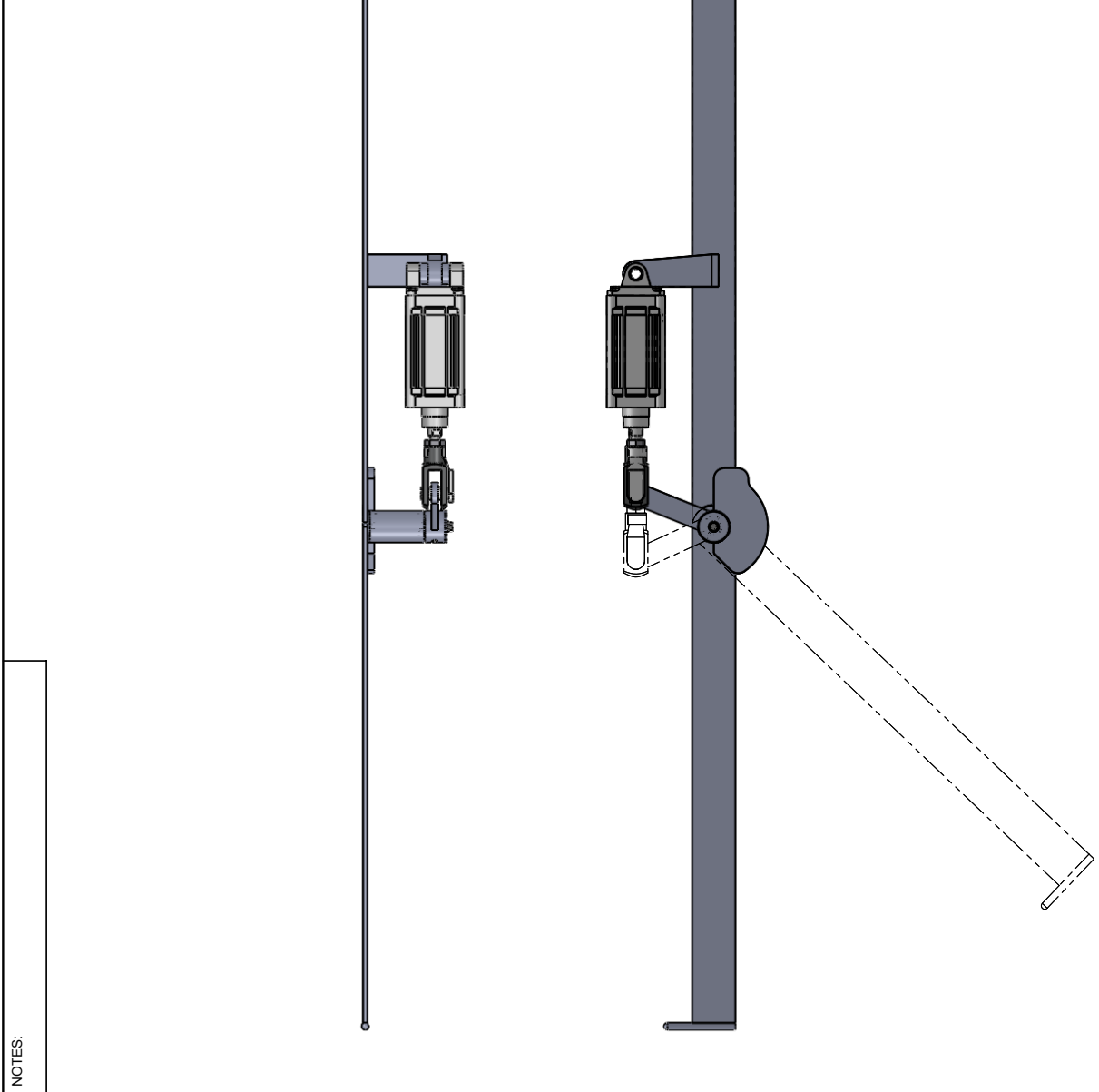
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Drawing 1. Sheep carcase lifter.

ITEM NO.	PART NUMBER	DESCRIPTION	Default t/QTY.
1	MB-0001	MAIN RAIL	1
2	MB-0002	SWING ARM	1
3	SKF - 6007	ROLLER BEARING SEALED	2
4	MB-0003	PIVOT ARM	1
5	MB-0004	KEEPER WASHER	1
6	-	BOLT 1/2" UNC x 1" LONG ZP GR 8.	1
7	-	WASHER SPRING 1/2" ZP	1
8	-	GRUB SCREW 1/2" UNC x 3/4" LONG GR 8.	2
9	DNC-125-100-PPV-A	PNEUMATIC RAM (FESTO)	1
10	14987 SG-M27X2-B	SGS Rod Clevis Female thread (Festo)	1

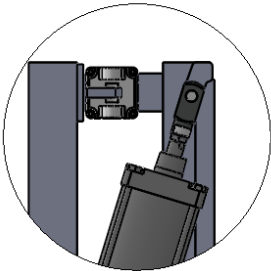


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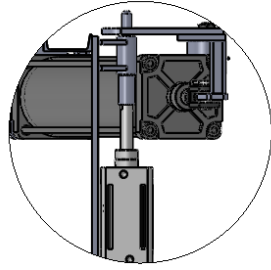
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FINISH REQUIRED		TOLERANCES UNLESS OTHERWISE SPECIFIED DIM. FABRICATION +/- 0.05 DIM. HOLE +/- 0.1 DIM. HOLE CTNS. +/- 0.5 DIM. FINISH 6-4 UM		
JOB NO.		UNLESS SPECIFIED REMOVE ALL SHARP EDGES AND DEBURR ALL HOLES ALL DIMENSIONS IN MM UNLESS OTHERWISE SPECIFIED MATERIAL CERTIFICATION IS REQUIRED FOR ALL COMPONENTS		
DRAWN BY: C.M.		DATE: 07/04/10	APPROVED BY:	
CHECKED BY:		DATE:	TITLE: RAIL LIFTER	
DWG NO: MB-1001		SCALE: 1:10 DO NOT SCALE	SIZE: A3	REV: A
SHEET 1 OF 1				

Drawing 2. Beef quarter lifter.

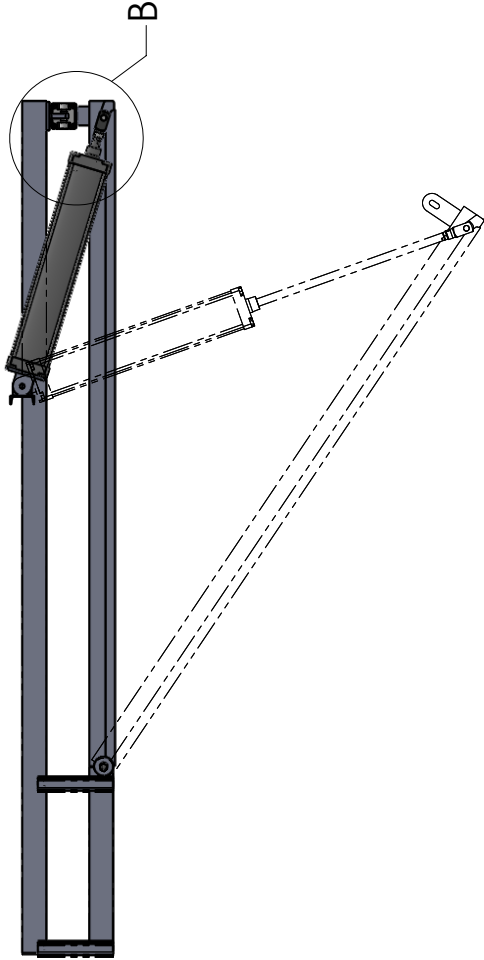
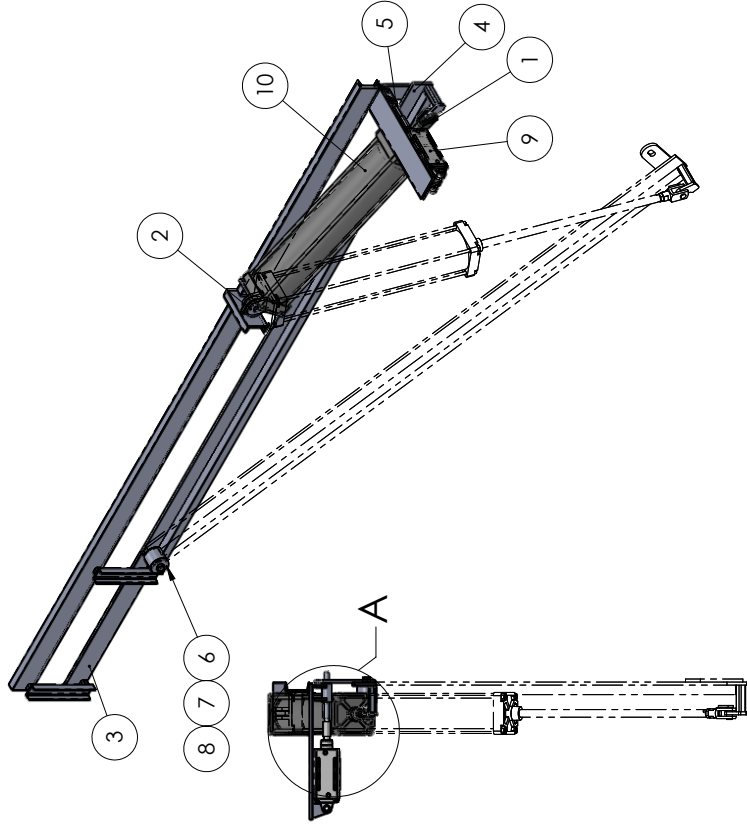
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	14987 SG-M27X2-B	SGS Rod Clevis Female thread (Festo)	1
2	MB-0005	RAM CLEVIS	1
3	MB-0006	PIVOT STRUCTURE	1
4	MB-0007	PIVOT RAIL	1
5	MB-0008	LOCK PIN	1
6	MB-0009	KEEP WASHER	1
7	-	BOLT 1" x 4 1/2" UNC ZP GR.8	1
8	-	NUT NYLOC 1" UNC	1
9	163501 DNC-125-100-PPV-A	PNEUMATIC RAM (FESTO)	1
10	C95SD200-1000	PNEUMATIC RAM (SGS)	1



DETAIL B
SCALE 2 : 25



DETAIL A
SCALE 2 : 25



NOTES:

DESIGN STANDARDS	REV	DESCRIPTION	BY	DATE
WELD STANDARDS				
FINISH REQUIRED		TOLERANCES UNLESS OTHERWISE SPECIFIED DIM. ±0.05 MACHINING ±0.05 DIM. ±0.1 MILLAR ±0.1 HOLE CTRS. ±0.05 FINISH 6-4 UM		
JOB NO.		UNLESS SPECIFIED REMOVE ALL SHARP EDGES AND DEBURR ALL HOLES ALL DIMENSIONS IN MM UNLESS OTHERWISE SPECIFIED MATERIAL CERTIFICATION IS REQUIRED FOR ALL COMPONENTS		

DESIGN BY: -	C.M.	DATE: 28/05/10	APPROVED BY: -	TITLE: RAIL LIFTER
CHECKED BY: -		DATE: -		

DWG NO: MB-1002	SIZE: A3
SCALE: 1:25 DO NOT SCALE	REV: A
SHEET 1 OF 1	