



Final report

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Manual Assist Beef and Lamb applications including Quarter Beef Hydraulic Lifting

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Abstract

Currently there is no safe way of handling, lifting and loading out of frozen quarter beef other than using manual labour units to repetitively lift beef quarters from the quartering rail into the freezer stillages, then out of the stillage safer freezing and stacking into shipping containers in an effort to meet renewed export market demands.

The Torras carcass lifter was first seen at the IFFA trade show in Frankfurt, Germany in 2015 as a potential solution for loading beef & lamb carcasses in & out of meat transport vehicles for our Devonport site in northern Tasmania. Shortly after IFFA a new frozen quarter beef market opened in China. The current project was undertaken to modify a commercial Torras lifter with limited lifting capabilities and adapt a new end effector to provide pulling capability as well. The Torras lifter was also fitted with an alternative hook and successfully demonstrated as a beef aitch bone and beef knuckle puller.

Note current commercial Torras equipment (stationary version) was substantially modified on the end effector only. The commercial unit is supplied with a hook that was designed and limited to lifting applications only. To be commercial viable for meat processing applications, the unit was modified for pulling downwards instead of lifting upwards. See photograph below. The modified end effector is a basic design for pulling fabricated from stainless steel.



The following applications were trialled and considered practical usage in lifting, pulling and transferring product:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses (several carcasses at once is possible)
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts
- Pulling aitch bone & knuckles during beef boning
- Lifting fresh & frozen beef hind quarters in and out of freezer stillages

- Lifting lamb carcasses (several lamb carcasses at once are possible)
- Maintenance applications including motors, gear boxes, pumps and other standalone heavy lifting equipment applications

The modified equipment was evaluated as a potential OH&S solution for lifting beef quarters (weighing in excess of 120 kgs) off the rails and into freezer stillages. It was also determined that the same Torras lifter may have additional process benefits. The Torras lifter was successfully tested by the maintenance department as a lifting aid for moving gearboxes, motors and pumps.

While the applications of the current lifting device (ie Torras lifter) were validated over a wide range of commercial applications, the unit is limited to lifting quarter beef in chiller and/or freezer lifting applications. Lifting chilled and frozen quarter beef with the modified stationary version of the equipment is currently being used daily in commercial operations at the JBS Brooklyn plant.

The Torras lifter was successfully used for all applications. The Torras lifter has clearly & successfully demonstrated that it can be easily adapted to several tasks within the meat industry providing significant OH&S benefits at relative low cost.

The Torras lifter has clearly demonstrated that it delivers OH&S benefits in certain aspects of the industry.

Executive Summary

Currently there is no safe manual way of handling, lifting and loading of frozen quarter beef to meet renewed export market demands. Similarly, there are other equally operator hazardous tasks associated with lifting, handling, bone and/or cut pulling in beef and lamb processing that require an immediate and cost effective solutions for beef and lamb processing. The inability to address this urgent and immediate operator OH&S issue and find a fast and cost effective solution will result in lost export market opportunities for the Australian red meat industry.

The current project proposed to develop a pre-production prototype to assist with several tedious and hazardous tasks by substantially modifying a commercial hydraulic apparatus and adapting to specific operational tasks in beef and lamb processing. Specifically the manual assist device was be modified to assist the operator to be multi-tasking and include:

- Lifting, pulling and handling large beef portions (up to 120kg)
- Whole lamb carcasses
- Facilitate safer practices of pulling bones and cuts in chain boning and assisting in lifting large pieces of equipment during clean downs and maintenance activities.

The primary benefits of this project will be reduction of injuries and specifically addressing the immediate need of handling and lifting beef quarters during processing and load out.

The value is in the removal of OH&S risks & costs associated with the manual lifting of beef quarters weighing in excess of 120kgs. The inability to address this urgent and immediate operator OH&S issue and find a fast and cost effective solution will result in significant lost export market opportunities for the Australian red meat industry.

It is very possible that after the initial R&D pilot that further uses within the red meat processing industry will be identified, thus removing more & more OH&S risk and costs. JBS will not be seeking to undertake collaborative R&D on any specific application after the proposed R&D. In the event that more applications are identified JBS, this will be undertaken independently by JBS.

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1 Background

There are numerous tedious and hazardous manual tasks that currently exist in beef and lamb processing. Specifically lifting operations require manual handling by operators of cartons, large heavy pieces and portions of chilled and/or frozen meat that pose occupational and health safety issues when weights and weight distributions exceeds safe operating conditions. Specifically, quarter beef is manually handled at processing and container loading. Recently there are renewed global market interests in quarters and sides of beef which are currently exceeding 90kg. Currently these excessive heavy and dangerous loads are handled and manual lifted at various points of the process and into storage and containerisation. Similarly, there are issues associated with breaking down of beef carcasses including pulling bones and large heavy cuts of meat away from carcass (e.g. aitchbone & knuckle removal). Similar issues are experienced in lamb processing with lifting of whole carcasses and breakdown of carcasses. There is also the need for lifting apparatus required to facilitate washing and clean downs of meat processing equipment in cases where heavy and large equipment components are required to be removed during cleaning.

Previous collaborative research by JBS & MLA developed a manual assist device (Scott's knuckle puller) that provides a hydraulic solution for a specific beef processing application of removal of the Aitchbone and knuckle removal. While the system is considered a commercial success, the technology is localised in the beef chain for one specific application. Also while the Scott's puller is cost effective for this specific application, at over \$50,000 it is not a likely cost effective option for other medial tasks. There are limited cost effective solutions available for beef and lamb processing that provides the flexibility, mobility and multiple applications (see Figure 1).

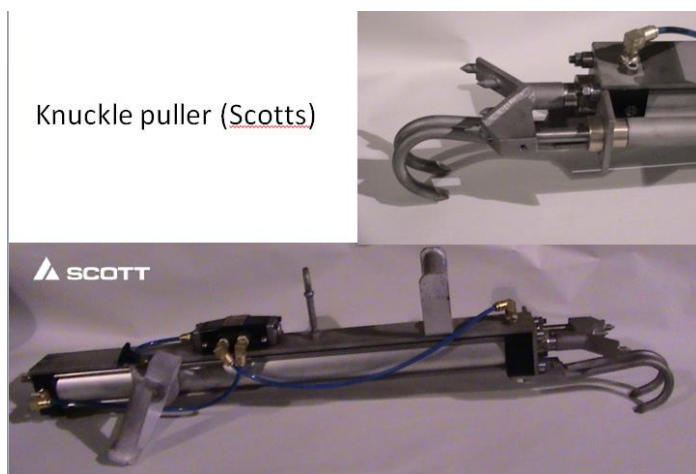


Figure 1. Scotts knuckle puller developed in collaboration between JBS and MLA.

A cost effective and versatile option being considered is adapting with significant modifications existing commercial hydraulic devices that are currently used primarily for lifting and shifting loads on trucks. One such device that was observed during the recent study tour of international technologies at the IFFA 2013 tradeshow with the MLA touring party. A manual assist apparatus made in Spain by Torras provides a simple hydraulic lifting device primarily designed for being immobilised on loading docks or on trucks to move loads on and off. This equipment is available in two sizes with models used mainly for transferring

carcasses or quarters from one position to another or lifting carcasses from a load out dock into a truck/trailer without any manual effort (see Figure 2).

Recently frozen quarter beef has resurrected its popularity with some overseas countries and immediately the OH&S risks associated with manual handling loads that can be between 60kg to 90kg has raised concerns. Without an immediate and cost effective manual assist solution, the risk of lost market opportunities for quarter beef is high with serious implications to company's market access where full consignment rely on quarter beef as well.

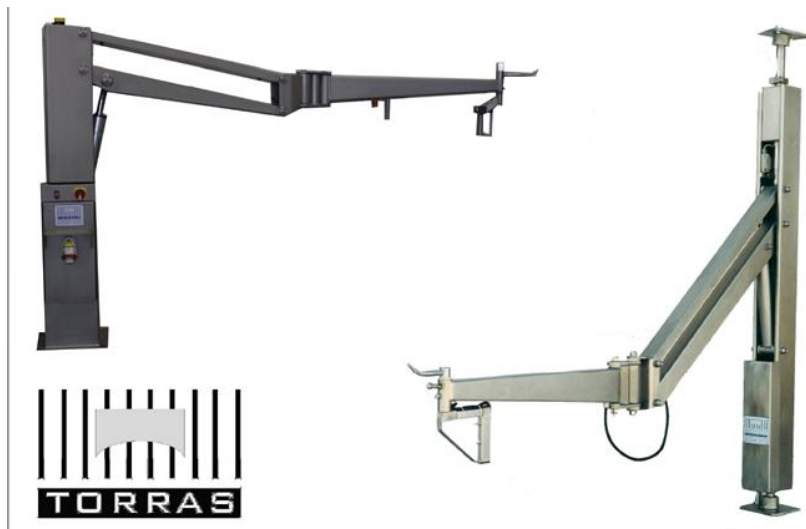


Figure 2. Torras hydraulic lifting systems

The current project proposed to evaluate a system (Torras hydraulic system) that was modified and adapted for manual lifting and bone and cut extractions in beef and lamb processing. The current system has inadequate end effectors and mobility is also an issue. The current project addressed more than a dozen beef and or lamb applications using one Torras stationary model. The modified equipment was evaluated through pre-production pilot trials in defined beef and lamb processing applications.

The following applications were identified to be evaluated in lifting and / or pulling applications as critical:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, aitchbone and large hind and forequarter cuts

In addition to the defined applications, the project trialled several other applications that were identified as part of the pilot testing and evaluation phase. The work was conducted at JBS Brooklyn plant where there is immediate quarter and side lifting market opportunities being investigated. Also by carrying out the trials at JBS Brooklyn it allows a number of other beef and lamb processing applications to be evaluated. The new designs and mechanical modifications of the existing Torras equipment was evaluated and implemented by a specialist JBS technical team including engineers in consultation with an external service provide (as an independent technical advisor).

The overall purpose of the project was to find a simple, cheap OH&S solution for lifting carcasses &/or carcass parts.

2 Project Objectives

The primary objective of the project was to successfully install, trial and utilise the Torras lifter for frozen quarter beef handling. In addition to assessing quarter beef lifting applications, the project was designed to determine other potential applications within the meat processing business in beef and lamb processing.

2.1 Specific Objectives

The outcome of the project was to evaluate a modified commercial Torras lifting device (stationary device) on a range of meat processing and maintenance applications.

The following process was used to modify and evaluate through pre-production pilot trials new lifting systems in a number of defined beef and lamb processing applications:

1) JBS formed a technical group, acquisition of equipment and trial planning. The technical group including an external technical advisor consisted JBS Project Manager, JBS Engineers and JBS Innovation Managers.

2) Evaluate one commercial stationary model of Torras hydraulic lifting equipment for various beef and/or lamb applications.

3) Identify a suite of applications that will be investigated and identify the component changes including end effector, mobility.

4) Designs and mechanical modifications made and evaluated on a range of beef and lamb processing applications including manual lifting of quarter- and/or side-beef.

5) Evaluation through pre-production pilot trials in defined beef and lamb processing applications. In addition to the defined applications that initial trials will focus on, several other applications will be identified as part of the pilot testing and evaluation phase. The following applications have been identified as critical:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts

6) Final report and industry dissemination

2.2 Desired Outcomes

The outcome of the project was that a commercial Torras lifting device (stationary version) was modified, evaluated and implemented into a number of beef and lamb processing operations that have been identified as risky and pose an OH&S issue. Specific applications were evaluated on an immediate renewed market opportunity for quarter and full sides of beef into international markets.

3 Methodology

3.1 Milestones Schedule

The following were the project milestones:

No	Milestones
1	MS1 Acquire & install. Assign a technical advisor and project group
2	MS2 – Design and mechanical Modifications to one lifter model (stationary version) to include lifting and pulling applications (minimum of 10 applications will be investigated).
3	MS3 Pre-production trials and commercial proving.
4	MS4 Assessment & final report. Final report to include evaluation and commercial considerations of up to 10 applications of a modify commercial lifting device

3.2 Method of modifying and pilot trials

The following process was used to modify and evaluate through pre-production pilot trials new lifting and pulling systems in a number of defined beef and lamb processing applications:

- 1) JBS to form a technical group including an external technical advisor, acquisition of equipment and trial planning.
- 2) Evaluate a modified Torras hydraulic machine (stationary version) for various beef and/or lamb applications.
- 3) Identify a suite of applications that will be investigated and identify the component changes including end effector
- 4) Designs and mechanical modifications made and evaluated on a range of beef and lamb processing applications including manual lifting of quarter- and/or side-beef.
- 5) Evaluation through pre-production pilot trials in defined beef and lamb processing applications. In addition to the defined applications that initial trials will focus on, several other applications will be identified as part of the pilot testing and evaluation phase.

The technical project group including an external technical advisor consisted of JBS Project Manager, JBS Engineers and JBS Innovation Managers assessed the commercial device and developed plans to modify the commercial equipment for lifting and pulling applications. The following applications have been identified as critical:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts
- Final report and industry dissemination.

4 Results and Findings

4.1 Pre-production pilot trials

Modifications made to the end effector to allow lifting and pulling applications. The hook device had to be modified as a puller not lifter for the aitchbone and knuckle pulling trials.

The Torras lifter demonstrated that set up at the correct height and working radius that it could clearly demonstrate worth as an OH&S solution for beef quarter handling, beef boning assist and heavy lifting in the maintenance workshop (refer to Figures 3 – 8).



Figure 3. Commercial lifting trials at JBS Brooklyn using mobile hydraulic lifter as manual assist in the workshop environment.



Figure 4. Commercial lifting trials at JBS Brooklyn using mobile hydraulic lifter to demonstrate safe lifting of beef quarter beef.



Figure 5. Commercial trials at JBS Brooklyn using mobile hydraulic lifter to demonstrate aitch bone pulling on beef.



Figure 6. Commercial trials at JBS Brooklyn using mobile hydraulic lifter to demonstrate aitch bone pulling on beef.



Figure 7. Commercial trials at JBS Brooklyn using mobile hydraulic lifter to demonstrate boning assistance on beef butts.



Figure 8. . Commercial trials at JBS Brooklyn using mobile hydraulic lifter to demonstrate boning assistance on beef butts.

4.2 Commercial trials and potential applications in beef and lamb processing

Through commercial testing a wide range of commercial beef and lamb processing applications as well as maintenance usages were evaluated as being critical requiring manual assist assistance. The following applications were trialled and considered practical usage in lifting, pulling and transferring product:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts
- Pulling aitch bone & knuckles during beef boning
- Lifting fresh & frozen beef hind quarters in and out of freezer stillages
- Lifting lamb carcasses (several lamb carcasses at once are possible)
- Maintenance applications including motors, gear boxes, pumps and other standalone heavy lifting equipment applications

While the applications of the current lifting device (ie Torras lifter) were validated over a wide range of commercial applications, the unit is limited to lifting quarter beef in chiller and/or freezer lifting applications (Refer to Figure 9). Lifting chilled and frozen quarter beef with the modified stationary version of the equipment is currently being used daily in commercial operations at the JBS Brooklyn plant.



Figure 9. Hanging beef quarters at JBS Brooklyn.

Note current commercial Torras equipment (stationary version) was substantially modified on the end effector only. The commercial unit is supplied with a hook that was designed and limited to lifting applications only. To be commercial viable for meat processing applications, the unit was modified for pulling downwards instead of lifting upwards. See photograph below (Refer to Figure 10).



Figure 10. Commercial unit supplied with hook for lifting applications only

The modified end effector is a basic design for pulling fabricated from stainless steel. (Refer to Figure 11).



Figure 11. Commercial unit with modified end effector to allow pulling applications

It is noted that if the mobile version of the equipment was available that a wider range of commercial applications would be possible using a single piece of equipment. In addition, currently the need to lift beef quarters at JBS Brooklyn is limited, and JBS is considering options to relocate the stationary modified version to an alternative site to lift sides of beef.

4.3 Benefits & Value to the Industry

The value is in the removal of OH&S risks & costs associated with the manual lifting of beef quarters weighing in excess of 120kgs. The inability to address this urgent and immediate operator OH&S issue and find a fast and cost effective solution will result in significant lost export market opportunities for the Australian red meat industry.

4.4 Achievement of Project Milestones

All the objectives of the project were tested with satisfactory outcomes. Unfortunately the JBS Brooklyn site only ordered the fixed Torras lifter. The portable lifter model was not purchased and as a consequence was not tested. It too should have an OH&S benefit to the industry.

This project was initially due in December 2013, and was extended (as requested) to 31st December 2014. As the scope has reduced to only one device being tested rather than 2, and the project has been further delayed, the project will need to be varied or terminated.

The project was subsequently varied to allow testing of one Torras model only.

5 Conclusions/Recommendations

5.1 Conclusion

The Torras lifter has clearly demonstrated that it delivers OH&S benefits in certain aspects of the industry.

It is very possible that after the initial R&D pilot that further uses within the red meat processing industry will be identified, thus removing more & more OH&S risk and costs. JBS will not be seeking to undertake collaborative R&D on any specific application after the proposed R&D. In the event that more applications are identified JBS, this will be undertaken independently by JBS.

The following meat processing applications were evaluated in the project as being critical requiring manual assistance technology:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts
- Maintenance related activities.

The following applications were trialled and considered practical usage in lifting, pulling and transferring product:

- Beef quarter lifting (dock, load out and relocate from boning room to load out)
- Whole lamb carcasses
- Pulling beef knuckles, Aitchbone and large hind and forequarter cuts
- Pulling aitch bone & knuckles during beef boning
- Lifting fresh & frozen beef hind quarters in and out of freezer stillages
- Lifting lamb carcasses (several lamb carcasses at once are possible)
- Maintenance applications including motors, gear boxes, pumps and other standalone heavy lifting equipment applications

While the applications of the current lifting device (ie Torras lifter) were validated over a wide range of commercial applications, the unit is limited to lifting quarter beef in chiller and/or freezer lifting applications. Lifting chilled and frozen quarter beef with the modified stationary version of the equipment is currently being used daily in commercial operations at the JBS Brooklyn plant.

The Torras lifter was successfully used for all applications.

5.2 Recommendations

i) Modified end effector (Recommendation #1)

- Note current commercial Torras equipment (stationary version) was substantially modified on the end effector only.
- The commercial unit is supplied with a hook that was designed and limited to lifting applications only.
- To be commercial viable for meat processing applications, the unit was modified for pulling downwards instead of lifting upwards.
- The modified end effector is a basic design for pulling fabricated from stainless steel.

ii) Mobile unit with enhanced capability over stationary version (Recommendation #2)

- It is noted that if the mobile version of the equipment was available that a wider range of commercial applications would be possible using a single piece of equipment.
- In addition, currently the need to lift beef quarters at JBS Brooklyn is limited, and JBS is considering options to relocate the stationary modified version to an alternative site to lift sides of beef.

iii) Processing and/or maintenance applications (Recommendation #3)

- Through commercial testing a wide range of commercial beef and lamb processing applications as well as maintenance usages were evaluated as being critical requiring manual assist assistance.

iv) Other potential applications (Recommendation #4)

- It is very possible that after the initial R&D pilot that further uses within the red meat processing industry will be identified, thus removing more & more OH&S risk and costs. JBS will not be seeking to undertake collaborative R&D on any specific application after the proposed R&D. In the event that more applications are identified JBS, this will be undertaken independently by JBS.

6 Appendix – Torras Lifter Specifications

6.1 Torras Lifter Specifications (Model BMI)

AN OLEODINAMIC ARM FOR MEAT LOAD MODEL BMI



BRAZO DE CARGA MODELO BMI
LOADING ARM
BRAS DE CHARGE



- Constructed totally in stainless steel and according to effective norm.
- Oleodynamic operation
- Lifting capacity: 300Kg. max.
- Maximum Length: 3.170mm.
- Minimum Length: 2.720mm.
- Max. /Min. altitude: 2.700/950 mm.
- Rotation: 360° (Exclusive)
- Exclusive Fixation by its base of 400 x 400.
- Installed electrical Power: 1.5KW. 240/400V. Three-phase.
- 50/60 Hz.
- Electric panel in a IP67 plastic box
- Electrical Manoeuvre to 24 V.
- Production: 4 cycles / min.
- Possibility of adapting different types from subjection.
- Total Weight: 300Kg.
- Total Volume: 2,0m³

6.2 Torras Lifter Specifications (Model - HYDRAULIC LOADING ARM FOR REFRIGERATOR TRUCKS MODEL BCI)

HYDRAULIC LOADING ARM FOR REFRIGERATOR TRUCKS MODEL BCI



BRAZO PARA CAMION FRIGORIFICO MODELO BCI
LOADING ARM FOR REFRIGERATOR TRUCKS
BRAS DE CHARGE



- Specially designed for refrigerator trucks
- Made in stainless steel with CE mark.
- Capacity: 180Kg.
- Length: 2200mm.
- Power: 800 W. 24 V. DC.
- Height max. / min.: 2150 / 500mm.
- Weight: 80Kg.