



Beef Loin Boning Table

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 but useful items of technology. This kit is designed to provide the essential information to allow processors to carry out suitable modifications and installations at their own sites to improve some aspects of their processing performance. As each processing site has unique design and construction features the information in this kit should be used as a guide only. Some modifications and further developments from this kit, to ensure the successful application at individual sites, are likely. No warranty is given on the outcome of the use of this kit or the information it contains.

DIY Kit # 12 – Beef Loin Boning Table

Manual beef loin boning is currently carried out using one of two alternate systems. With the "table boning" system the loins are boned on a plain table. Boners use their non-knife hand to steady the loin and prevent it from moving on the table. This is awkward and to achieve this boners often need to hold the loin against their apron. The position of the loin will change several times during the loin boning operation requiring a number of changes of grip. Unwanted movement of the loin during the boning process makes the boners task more difficult.

With "side boning" and "on-rail quarter boning" systems, the bone-in loin can be cut from the hindquarter and dropped onto a table where it is boned as for "table boning". Alternatively, the striploin can be removed while the loin is still hanging vertically on the hindquarter. Removal of the striploin in this way is ergonomically poor. As the striploin may be over 600 millimetres long, when it is peeled down the top of the muscle may be up to 1,200 millimetres below the starting point when the final cuts are made. This requires the boner to use excessive bending and lifting. Boners often have to catch, or throw, the striploin muscle, sometimes while bending over.

The beef loin boning table is designed to improve the ergonomics of this task by carrying out all loin boning using the "table boning" technique and by eliminating the difficulties in securing the loin while "table boning" is carried out. The beef loin boning table is in effect a third hand for the boner.

The loin securing turntable can be constructed as a stand-alone, height adjustable unit (shown in Photograph 1) or as a unit that can be fitted into the surface of an existing boning table (shown in Photograph 2). The choice of option is dependent on:

- whether the current boning technique is table or rail
- where the unit would be located in relation to existing boning tables
- whether existing facilities have height adjustment capability
- whether loins with full length ribs are boned. Loins with full-length ribs are easily handled on the stand-alone unit as the long ends of the ribs can hang over the end of the turntable while leaving sufficient rotation to be boned.
- the economics of installation of the boning table.

A number of progressively improved prototype units have been constructed. These have been successfully trialed at a number of abattoirs in both Australia and New Zealand including an export beef abattoir in Queensland. Performance of the unit has been proven under both trial and extended production situations. Long term performance under continuous operation has not been proven.

Description

The beef loin boning table is a work-holding device that consists of a dual clamp mechanism that firmly secures the beef loin. When secured, the loin is free to rotate unrestricted about the vertical axis. It is also able to rotate about the horizontal axis up to 90°.

To operate the clamp requires two buttons to be depressed simultaneously ensuring the safety of the operator. The pneumatic circuit that oversees this action is designed to tolerate slight miss-timing of the operation.

Without this tolerance any miss-timing would be interpreted as a single button push, which opens the clamps.

The clamps are designed with a "nodding" feature such that if the loin is in the incorrect position on the table for clamping, it can be pushed over the clamps without a need for lifting to clear the clamps. The "nodding" feature allows the clamps to simply be pushed below the table surface.

The clamp mechanism is attached to a turntable unit of 600 millimetre diameter allowing the unrestricted processing of loins from sides up to 180 kilograms weight. The position of the turntable is secured by use of a foot operated brake mechanism. This allows the boner free rotation of the loin and securing it in any position. (Rotation of the turntable is shown in Photograph 3.)

The loin can be flipped horizontally through 90° to give free access to both rib bones and chine bones. The horizontal position of the loin is maintained by means of a bias weight that favours the mounting plate in a position horizontal to the table surface. The loins are mounted in the clamps with the mounting plate in the horizontal position. The bias weight is such that when the loin is tipped through 90° the weight of the loin holds the mounting plate in the vertical position. (Vertical orientation of the mounting plate is shown in Photograph 4.) After boning the removal of the striploin reduces the loin weight to the extent that the mounting plate naturally returns to the horizontal position so that the intercostals can be removed from the loin.

The surface of the turntable and fixed table can be constructed from stainless steel or white plastic as used in existing cutting boards. Both are readily removable for cleaning. (Removal of the cutting surfaces for cleaning is shown in Photograph 5.)

Benefits

Benefits obtained by using the loin boning table are:

- improved ergonomics. Conversion of all striploin boning to effective "table" boning eliminates strain related injuries associated with boning over a height range of up to 1,200 millimetres as identified earlier. It also eliminates injuries from catching or throwing the striploin muscle while the boner is in a bent position.

Elimination of the requirement to wrestle with the bone-in loin on a plain table, reduces the over-all effort expended, the grip force that must be applied by the non-knife hand and the possibility of the operating cutting himself.

The ability to adjust height reduces the need for boners to bend their backs or necks while leaning over the work table. Each boner can adjust the table to the most suitable height for him.

- Increased product quality and yield. Trials have demonstrated improved quality and yields at some plants. At one plant substantial savings were demonstrated by reducing the number of downgraded loins. In particular soft-sided loins from carcasses that have not been split accurately down the chine bone can be damaged during mechanical and conventional boning, as they are more flexible. The loin boning table holds these as rigidly as loins from correctly split carcasses.

Management at another plant noted that the bones appeared cleaner with the loin boning table and estimated the increased yield at 0.5%.

Quality and yield increases have not been accurately verified but some improvements can be expected as the table is a tool that will assist boners in their efforts to obtain good yield and product quality.

- improved product hygiene. The reduction in manual handling of the loin during boning, including the elimination of contact with the boner's apron during manual holding, would be expected to improve the hygienic status of the finished striploin.

Cost-Benefit Analysis

A budget cost of A\$5,000 per unit has been established for the construction of a unit to be fitted to an existing table. Fitting costs will depend on the table it is to be fitted to and will include the cost to cut a circular hole in the table top and to reinforce the table top to support the loin table mechanism. A budget cost for the A\$10,000 per unit has been established for the construction of a free-standing, height adjustable unit.

The difference between a well boned and poorly boned loin can be more than 100 grams of meat. This meat is normally recovered as trimmings, but at a reduced value. Assuming an average yield increase of 20 grams per loin at a loin table throughput of 320 loins per day and a value difference of A\$5 per kilo of striploin over trimmings, the increased annual revenue is estimated at \$7,300.

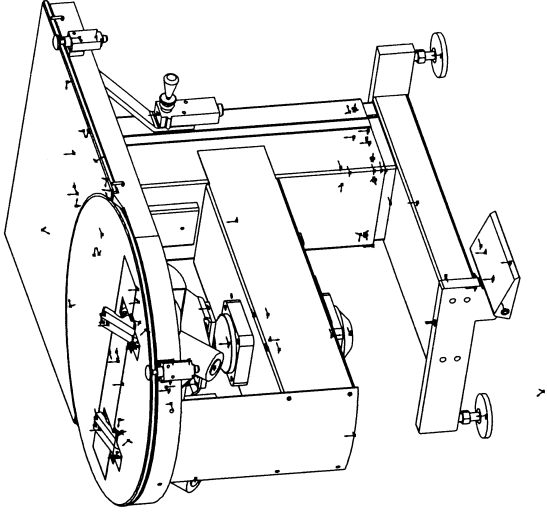
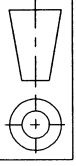
Based on this revenue, a payback period of less than one year for a unit fitted to an existing table, and less than a year and a half for a free-standing unit, can be expected.

This analysis only takes into account the capital cost of the equipment and the potential increased yield. No value has been established for OH&S improvements, increased quality or increased product hygiene. Inclusion of these items would be expected to dramatically reduce the payback period further.

Drawings

The following engineering drawings, indicating the construction of the beef loin boning table, are appended to this kit:

BHQ1800	Main Assembly
BHQ1803	Outer Column Assembly
BHQ1822	Outer Column Top Plate
BHQ1830	Brake Disk
BHQ1836	Tilt Plate
BHQ1843	Clamp Left Side
BHQ1844	Clamp Right Side
BHQ1848	Table Frame
BHQ1851	Rotary Table Top



ITEM NO.	QTY.	PART NO.	DESCRIPTION
BH-Q1818	1	base	
BH-Q1815	2	mounting plate	
BH-Q1818	2	lower col	
BH-Q1810	1	leg-1	
BH-Q1800	3	A-Justa-foot	Manufacturer
BH-Q1816	1	leg	
BH-Q1814	1	Brake stop	
BH-Q1813	2	Brakeplate bush	
BH-Q1811	1	Brake plate	
	1	100dia cylinder	Norgren
	3	20mm cyl nut	Norgren
	1	Brake valve	Norgren
BH-Q1821	1	outer column	
BH-Q1820	1	outer column	
BH-Q1823	16	wear pad	
BH-Q1825	1	Cylinder shaft	
BH-Q1822	1	upper col top plate	
BH-Q1848	1	1in table frame	
BH-Q1826	4	table top support pad	
BH-Q1842	2	clamp valve spacer block	
BH-Q1849	1	main table top	
	2	clamp valve	Norgren
BH-Q1831	1	table frame support	
	1	rise & fall valve	Norgren
BH-Q1824	1	reg & valve tray	
BH-Q1816	2	clamp right	
BH-Q1843	2	clamp left	
BH-Q1845	2	Clamp locating pin	
BH-Q1839	2	clamp shaft	
BH-Q1840	4	clamp nuts	
BH-Q1846	4	clamp spike	
BH-Q1847	2	tilt plate bush	
BH-Q1850	2	clamp spring bolt	
	2	clamp cylinder	Norgren
BH-Q1841	2	clamp drive pin	
BH-Q1851	1	rotary table top	
BH-Q1835	1	tilt plate support	
BH-Q1835	1	tilt plate support	
BH-Q1832	1	rotary table cross support	
BH-Q1833	1	air capacitor	
BH-Q1838	1	stop pad	
BH-Q1852	1	tilt plate weight	
BH-Q1819	1	brake valve mounting plate	
BH-Q1812	1	brake pad shaft	
BH-Q1827	1	air line cover	
BH-Q1828	1	air clamp brake mount	
BH-Q1829	1	table shaft	
BH-Q1830	1	brake disk	
	1	air clamp brake unit	Manufacturer
	2	bearing cover	Manufacturer
BH-Q1834	1	central pipe	
BH-Q1837	2	Tilt plate stop	
BH-Q1836	1	Tilt plate	

NOTES

- All dimensions in millimeters unless other wise shown.
- General tolerance to be ± 0.15 unless other wise shown.
- Remove all burrs and sharp edges.
- Chamfer all holes $0.5 \times 45^\circ$
- Material-316 Stainless steel.

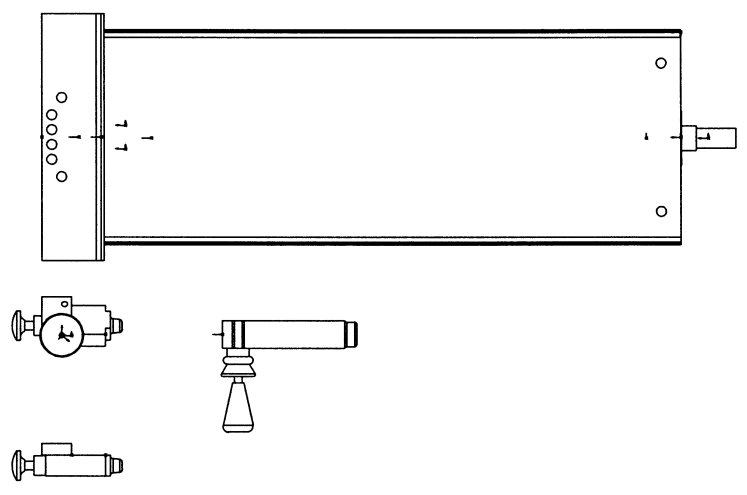
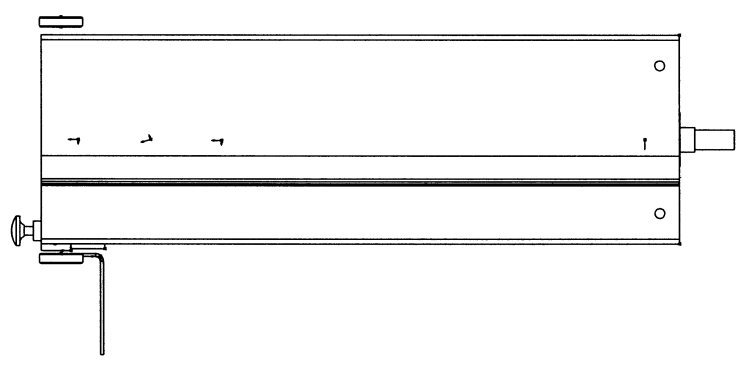
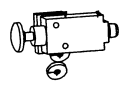
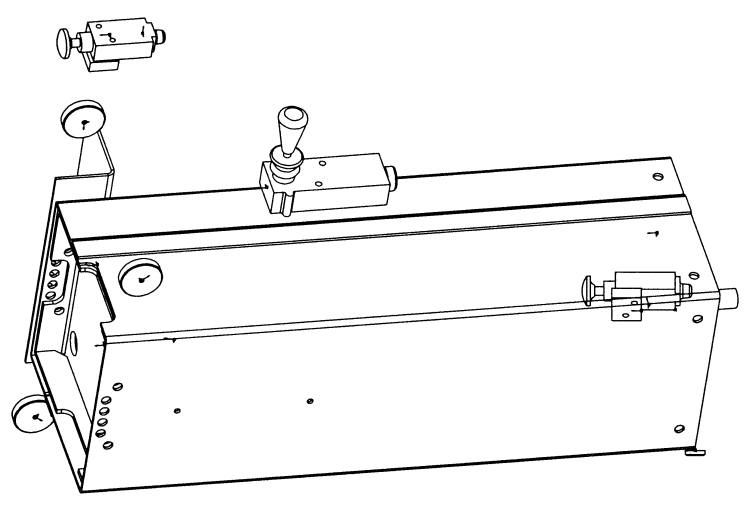
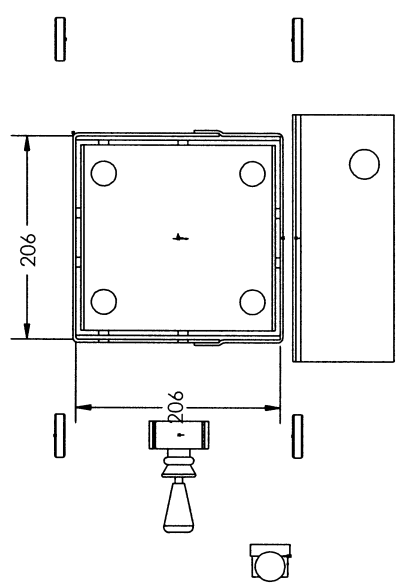
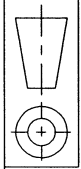
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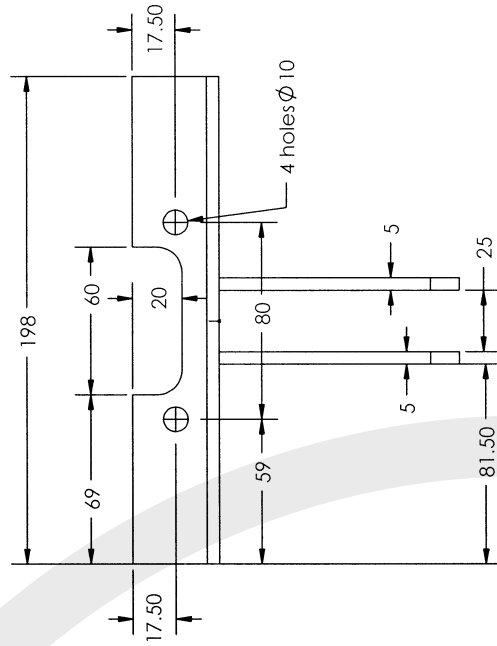
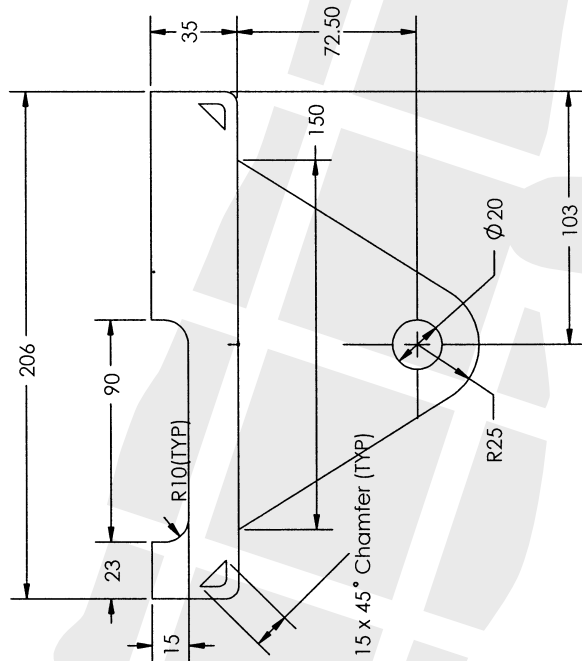
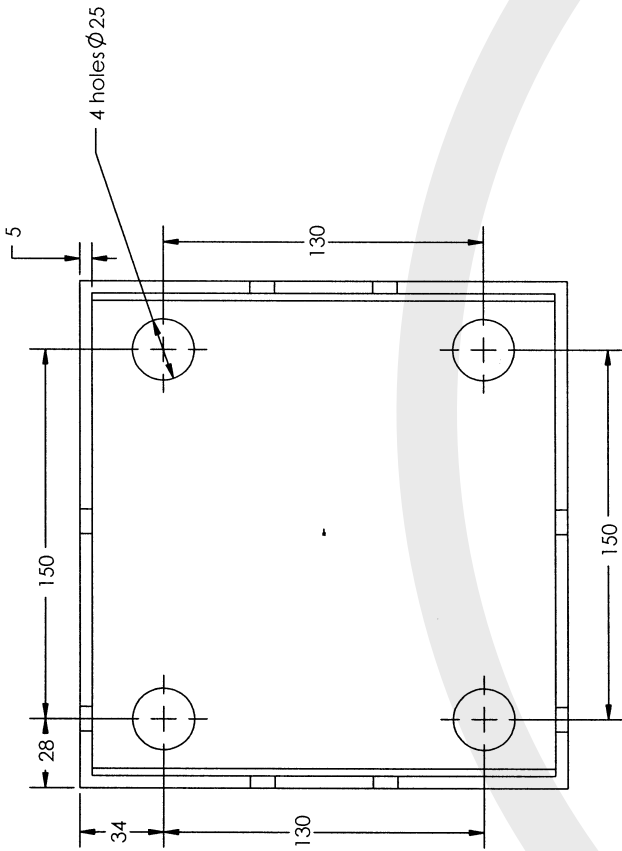
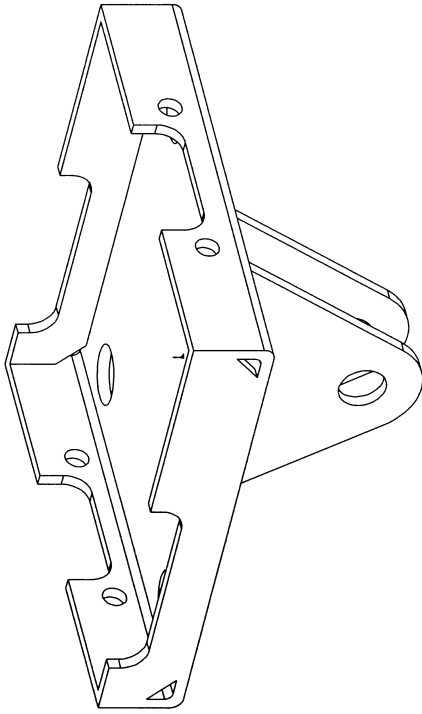
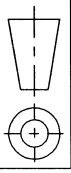
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Main assembly						
BH-Q1800						

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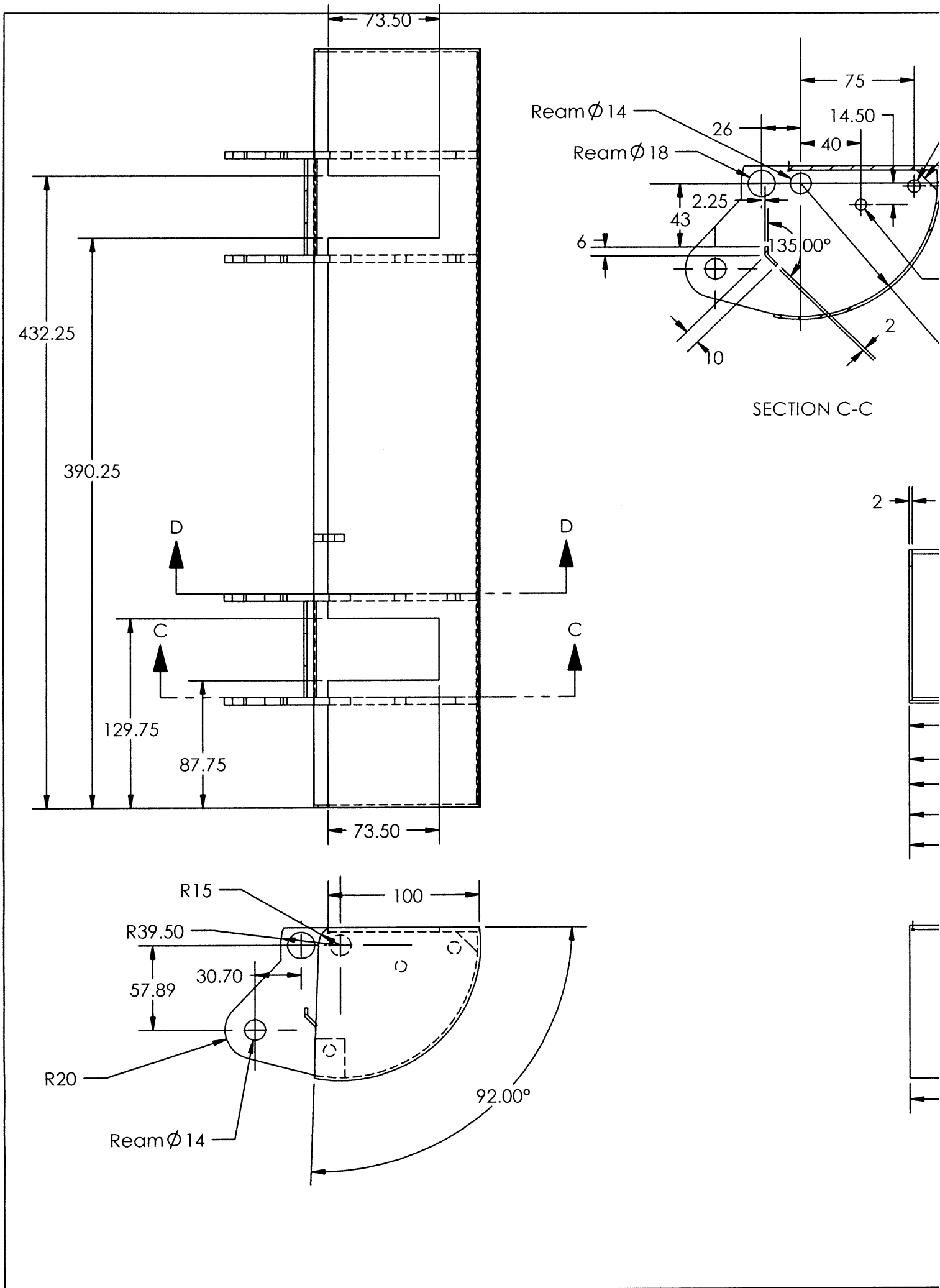
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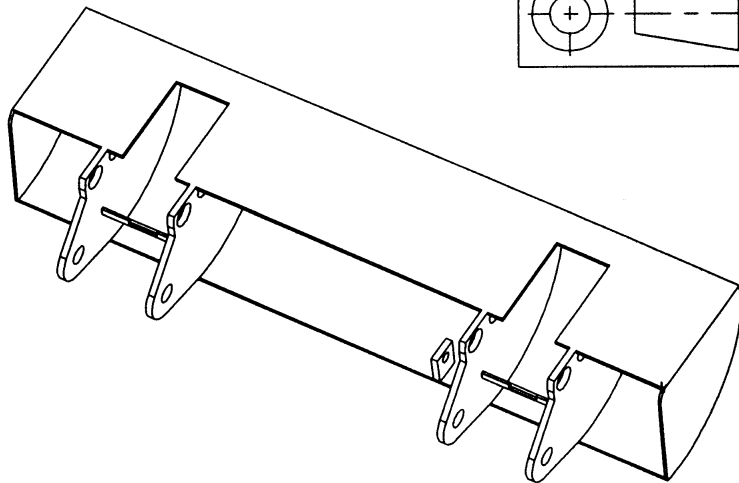
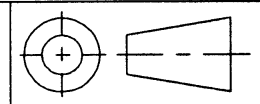
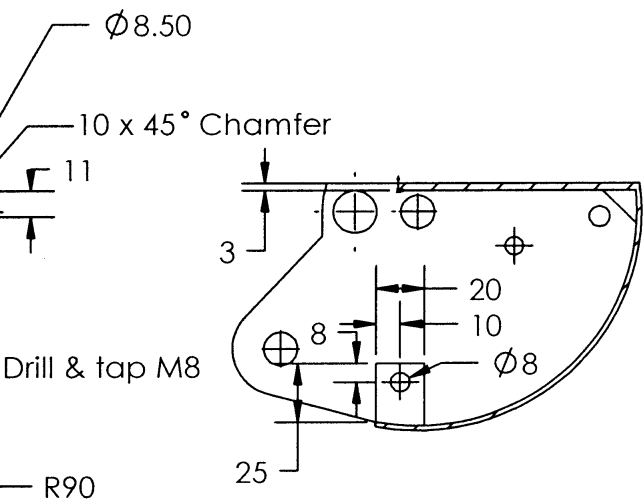


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P.O. Box 617, Hamilton, ph. (07) 855 6159, fax (07) 855 3833		Date: N.Z.S.		Scale: N.B.	Drawn: K.B.	Checked: r
<p>NOTES</p> <p>1. All dimensions in millimeters unless other wise shown.</p> <p>2. General tolerance to be ± 0.15 unless other wise shown.</p> <p>3. Remove all burrs and sharp edges.</p> <p>4. Chamfer all holes 0.5 x 45°</p> <p>5. Material: 316 Stainless steel.</p>		<p>THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF MIRINZ. NO PART OF THIS DRAWING OR THE INFORMATION CONTAINED HEREIN MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF MIRINZ. (C)</p>		<p>DATE: 31-3-98</p> <p>BY: N.Z.S.</p> <p>CHECKED: K.B.</p>		<p>Project: BHQ1803</p>
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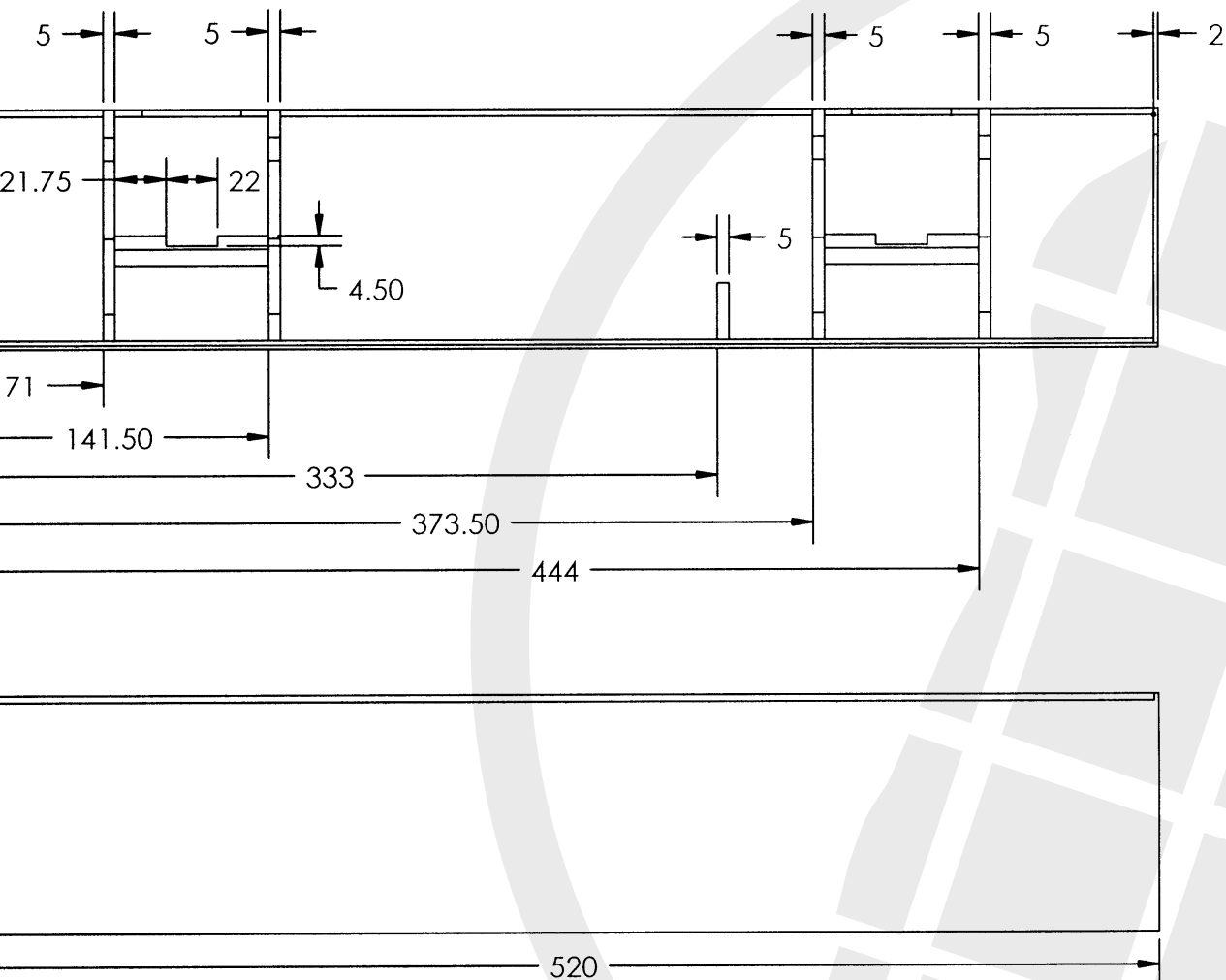


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5. Material: 316 Stainless steel.		Part Name: Beef Hindaquarter		Rev. 01	
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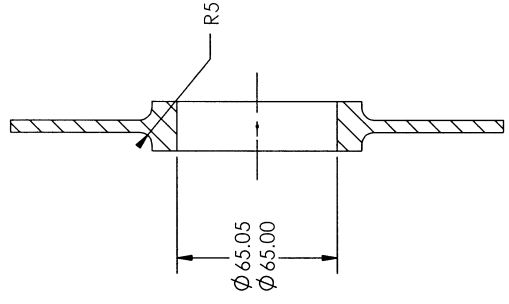
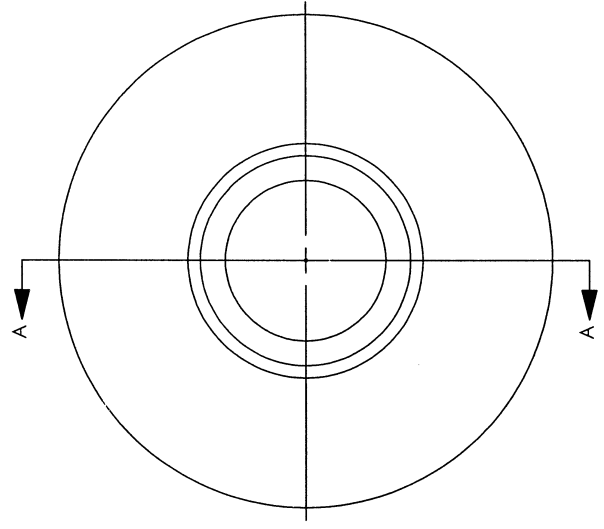
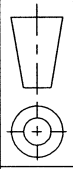




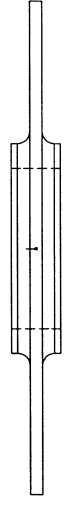
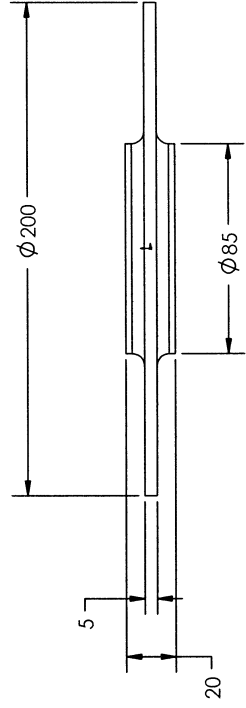
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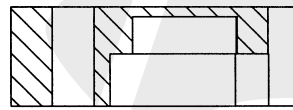
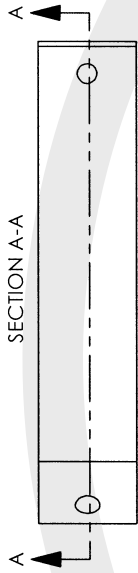
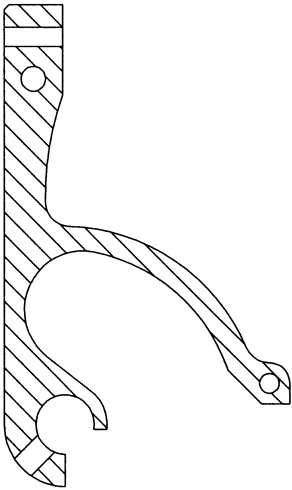
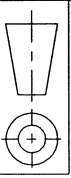
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1. All dimensions in millimeters unless other wise shown. 2. General tolerance to be \pm unless other wise shown. 3. Remove all burrs and sharp edges. 4. Chamfer all holes 0.5 x 45° 5. Material-316 Stainless steel.		P.O. Box 617, Hamilton, ph. (07) 855 6159, fax (07) 855 3833					
Job Name	Beef Hindquarter	SIZE	A3	DWG. NO.	REV.	r	
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CAD FILE:		Tilt plate					



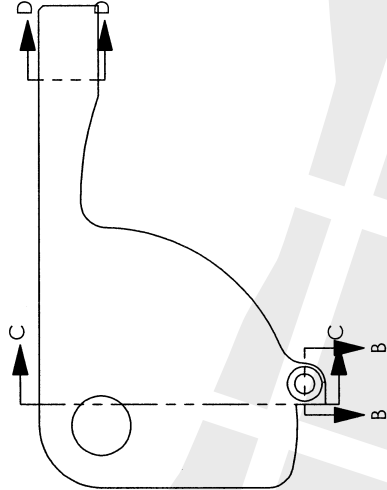
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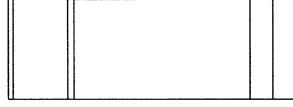
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Brake disk		BHQ1830			
CAD FILE					



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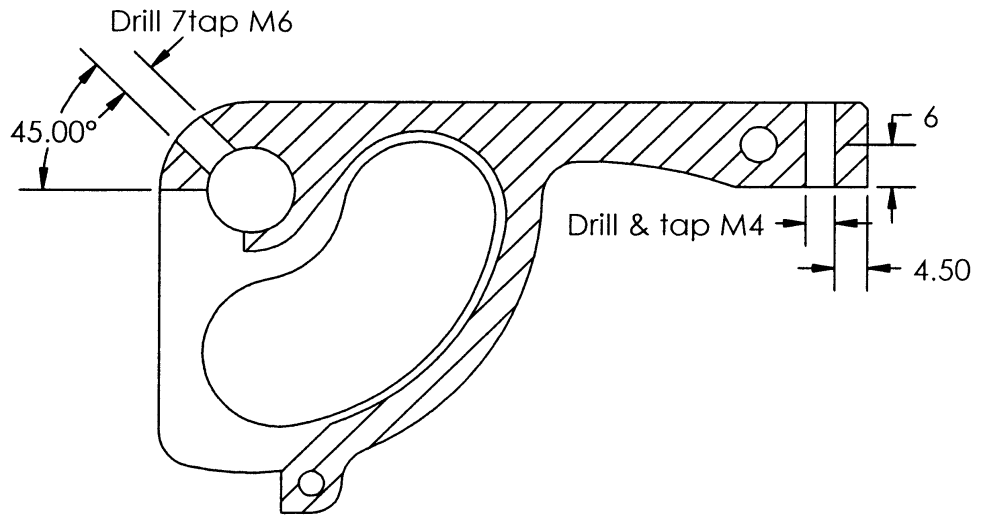


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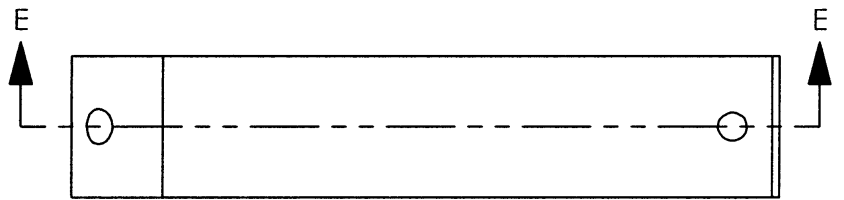


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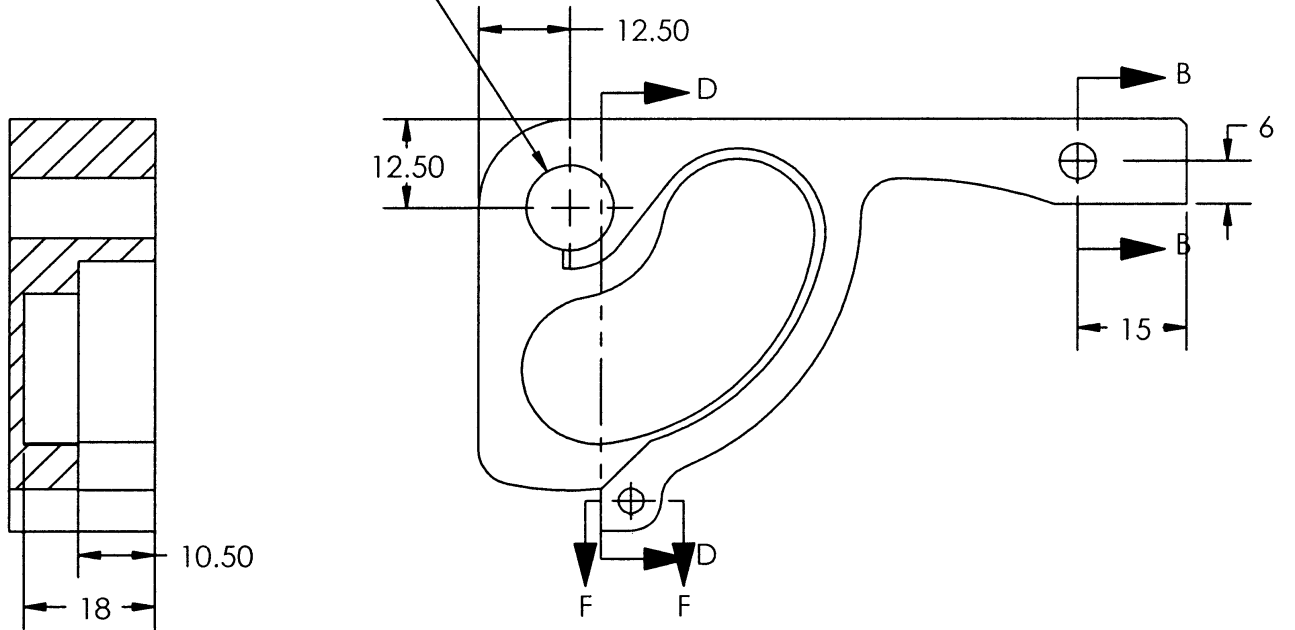
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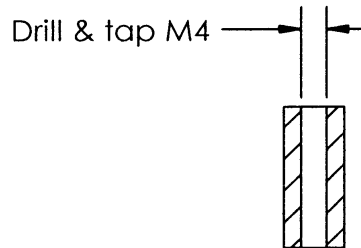
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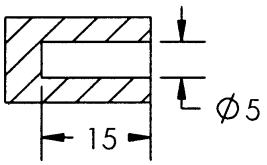
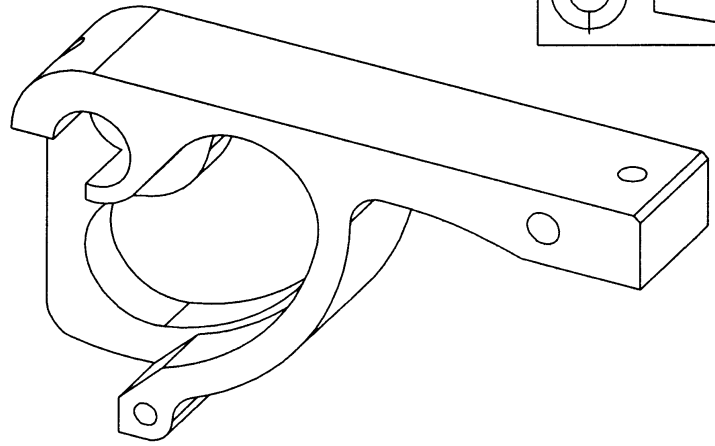
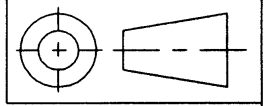
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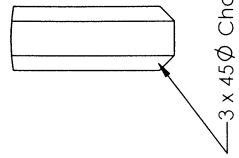
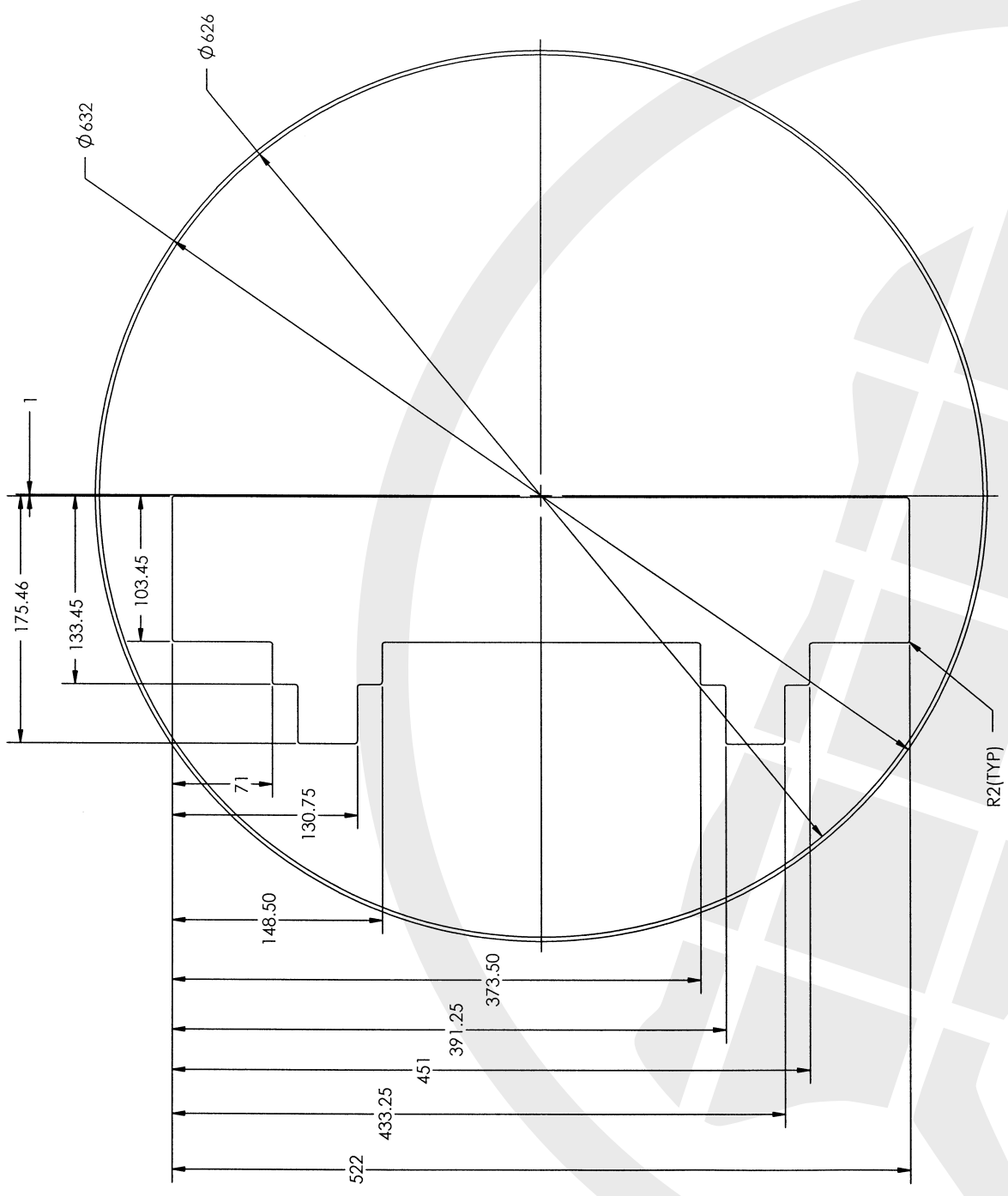
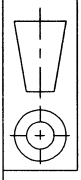
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SECTION B-B



NOTES		MEAT INDUSTRY RESEARCH INSTITUTE OF N.Z. (INC) (MIRINZ)				
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CAD FILE:		Beef Hindquarter	A3		r	
		Clamp left side	Date	BHQ1843		
			2:4:98			
			Scale			N.T.S.
			Drawn			KB
		Checked				



DETAIL A
SCALE 1:1

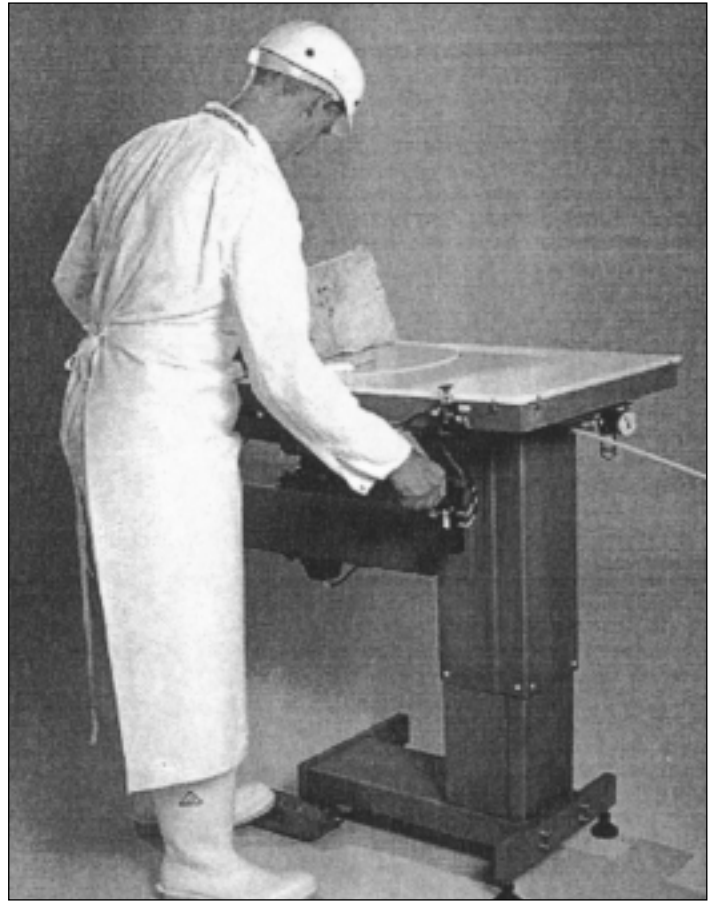
MEAT INDUSTRY RESEARCH INSTITUTE OF N.Z. (INC) (MIRINZ)		JOB: Beef Hindquarter		SITE: A3		DWG. NO: 2498		REV: r	
P.O. Box 617, Hamilton, ph. (07) 855 4159, fax (07) 855 3833		Scale: N/A		Drawn: KB		Checked:		BHQ1851	
NOTES		1. All dimensions in millimeters unless otherwise shown.		2. General tolerance to be ± 0.15 unless otherwise shown.		3. Remove all burrs and sharp edges.		4. Chamfer all holes 0.5 x 45	
5. Material: UNMAY		THE DRAWING AND THE INFORMATION HEREON REMAINS THE PROPERTY OF MIRINZ. THE DRAWING AND INFORMATION ARE NOT TO BE COPIED BY ANY MEANS UNLESS PRIOR WRITTEN PERMISSION HAS BEEN OBTAINED FROM MIRINZ. (C)		CAD FILE		Rotary table top			

The following engineering drawings, showing detail from the above drawings, are available from the Product and Process Innovation Group of Meat & Livestock Australia:

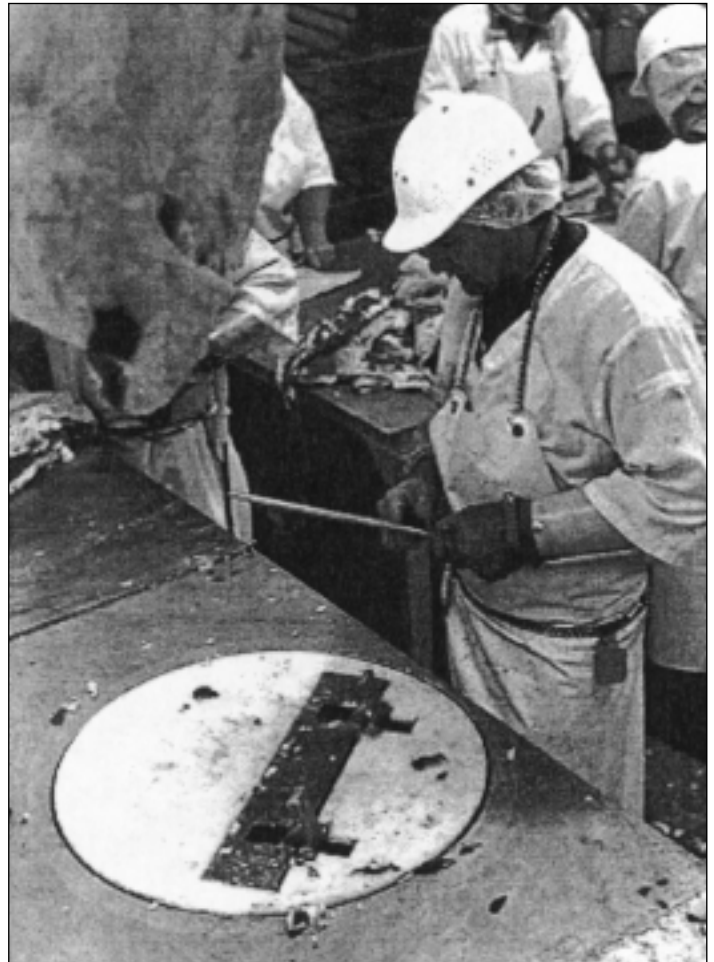
BHQ1810 Brake Leg	BHQ1811 Brake Plate
BHQ1812 Brake Plate Shaft	BHQ1813 Brake Plate Bush
BHQ1814 Brake Stop	BHQ1815 Loin Table Base End Plate
BHQ1816 Leg	BHQ1817 Loin Table Base
BHQ1818 Inner Column	BHQ1819 Brake Valve Mount
BHQ1820 Outer Column	BHQ1821 Outer Column
BHQ1823 Wear Pad	BHQ1824 Valve & Reg Tray
BHQ1825 Cylinder Shaft	BHQ1826 Support Pad
BHQ1827 Air Line Cover	BHQ1828 Brake Mount
BHQ1829 Table Shaft	BHQ1831 Table Brace
BHQ1833 Air Capacitor	BHQ1835 Rotary Table Support Profile
BHQ1837 Tilt Plate Stop	BHQ1838 Tilt Plate Stop Pad
BHQ1839 Clamp Shaft	BHQ1840 Clamp Nuts
BHQ1841 Clamp Drive Pin	BHQ1842 Clamp Valve Spacer Block
BHQ1845 Clamp Locating Pin	BHQ1846 Clamp Spike
BHQ1847 Tilt Plate Bush	BHQ1849 Main Table Top
BHQ1850 Clamp Spring Bolt	BHQ1852 Tilt Plate Weight
BHQ1853 Cylinder Pin	

Photographs

Photograph 1. Prototype stand-alone unit.



Photograph 2. Unit fitted to existing bench top.



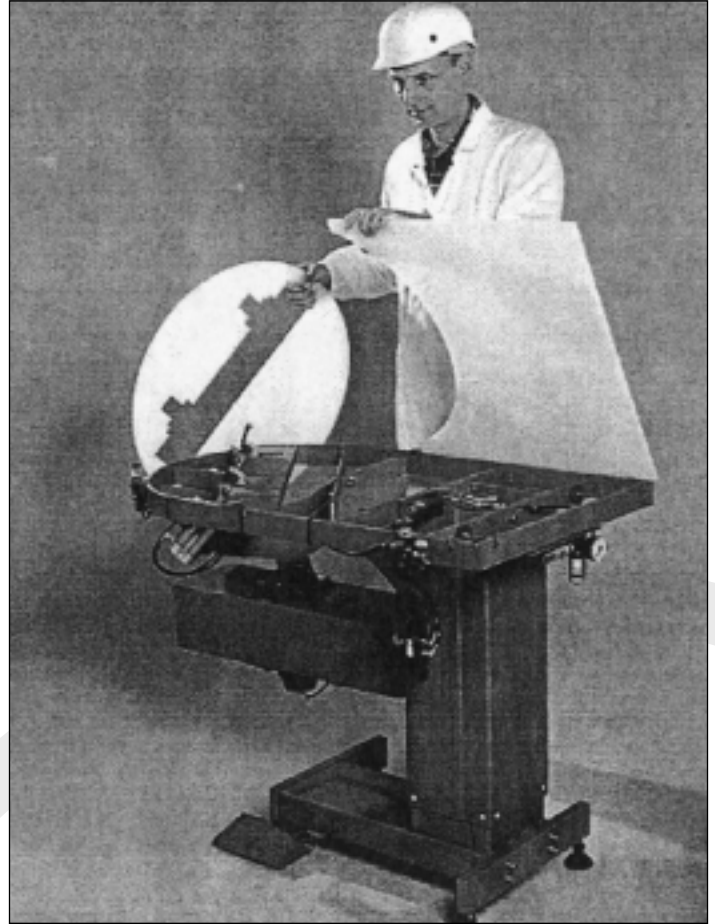
Photograph 3. Rotation of the table about the vertical axis.



Photograph 4. Rotation of the mounting plate about the horizontal axis.



Photograph 5 Stand alone unit with the cutting surfaces removed



Video presentation

Approximately 1 minute of the beef loin boning table in operation showing the important features of design, construction and operation are provided on the Meat and Livestock Australia Technology Transfer DIY Kits' Support Video. Footage relevant to the Beef Loin Boning Table DIY Kit is approximately located between VCR real time counter units 43:20 to 44:15.

Acknowledgments

Meat & Livestock Australia have prepared this kit with support from the Australian Meat Processors Corporation.

Equipment design and development

Carried out under contract for Meat New Zealand and Meat and Livestock Australia by AgResearch.

Equipment installation and operation in Australia

Warwick Bacon Company, Queensland

Equipment availability

Processors who feel that they do not have access to adequate engineering skills and facilities can obtain the constructed equipment from the AgResearch MIRINZ centre:

Tel: +64 7 838 5576

Fax: +64 7 838 5625

Email: phillipsd@agresearch.cri.nz

Contact

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