

Meat Research Record

Meat Research Laboratory

Division of Food Processing

MEAT RESEARCH RECORD A/89

**PERFORMANCE DATA ON MODIFIED
BRENTWOOD AZ15WL AND AZ40 SHREDDERS
USED FOR HARD OFFALS IN THE MEAT
INDUSTRY**

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SUMMARY

Following successful trials at the CSIRO Meat Research Laboratory on the Brentwood Shredder, model AZ7, several similar but larger machines have been installed in abattoirs around Australia.

Production information, on the AZ15WL and the AZ40, has been received for the size reduction of all rendering materials from the slaughter floor and of boning room by products. The data have been analysed and the expected production rates of these machines are tabulated.

This machine is a capable replacement for older, less efficient types of comminution equipment.

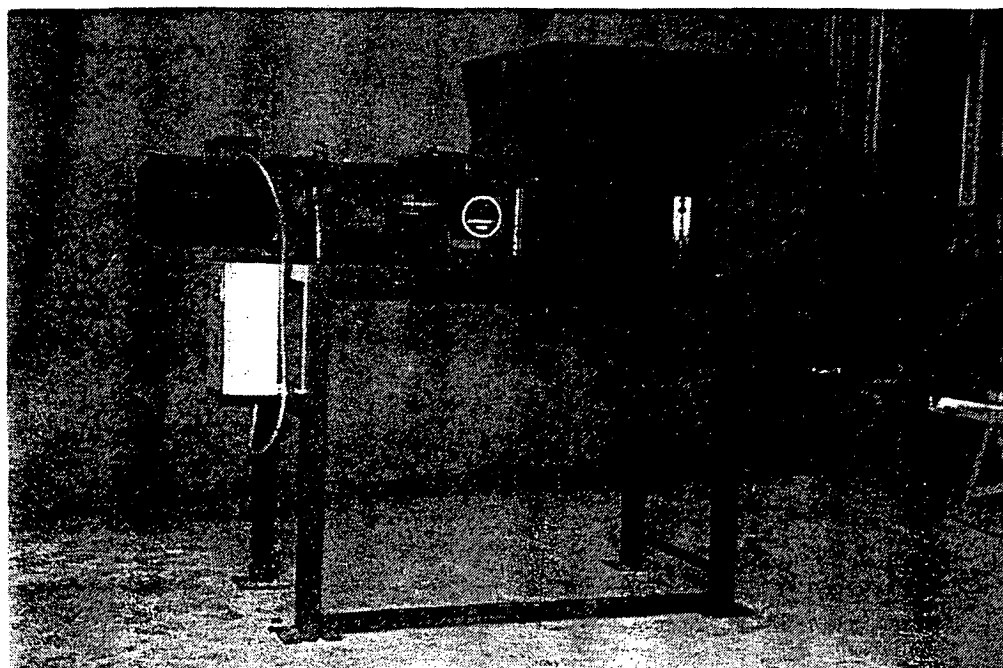
INTRODUCTION

The Brentwood Shredder is a size reduction machine which is designed and manufactured in Australia. It is used by a number of industries to reduce in size a wide variety of materials including metals, plastics, glass, wood, rubber, concrete, and industrial wastes of all kinds.

The shredder is available in four sizes AZ7, AZ15, AZ40 and AZ100. The numbers 7 to 100 indicate that the next higher number (model) is capable of twice the throughput of the corresponding smaller model.

An evaluation of one of these shredders, the AZ7, was undertaken by B.P. Cain and R.G. Hamilton in 1985 (CSIRO Meat Research Record F/85). The results were promising and since the publication of that Record, a number of machines have been installed in meatworks throughout Australia and New Zealand.

Two such machines are the AZ15WL (Figure 1) and the AZ40. Data has been received from the manufacturer and several meatworks concerning the throughput of these models when



*Figure 1. The
Brentwood AZ15WL
Shredder*

they process raw materials for rendering. Each machine was appraised and minimum throughput rates have been suggested. From these results, the suitability of each machine to various production situations can be ascertained.

The purchase price, ex factory, of an AZ15WL and the AZ40 are in the range \$32,100 and \$57,600 respectively, as of July, 1989.

THE MACHINES

The Brentwood Shredders are both simple and robust. The cutting chamber contains two horizontally mounted contra rotating shafts. The shafts are hexagonal section, 60mm A/F for the AZ15 and 95mm A/F for the AZ40. The cutters are made from heat treated alloy steel and are in the shape of a circular disc with protruding hook(s). They are mounted in an overlapping, staggered formation on each shaft with spacer rings between the cutters to ensure positive location. The shafts rotate with a speed differential of approximately 20%. The slower (43 r.p.m.) and faster (52 r.p.m.) shafts rotate clockwise and anticlockwise respectively. Cutting takes place between the slower and faster cutters where they intersect, in a similar action to the old style blade hashers.

The AZ15WL is fitted with a 15 kW, 415V, 3 phase motor. The WL designation indicates that the machine has a wider and longer cutting chamber (490mm x 700mm) than the standard AZ15 (350mm x 400mm). The larger cutting chamber is preferred due to the problem associated with the 'standard' machine whereby large items, such as beef heads, may bridge over the cutters and slow down production. Complete with feed hoppers and four legged stand, the AZ15WL occupies a floor space of 1000 x 1800mm with the top of the hopper 850mm above the machine outlet and 2200mm above the floor level. Total weight of the unit is 740kg. All parts, except for the motor, primary gearbox, shafts and cutters are hot-dipped galvanised. Straight sided feed hoppers are generally recommended and supplied for use in the meat industry.

The AZ40 is fitted with two 15kW, 415V, 3 phase motors, equivalent to 40 horsepower total; thus the '40' designation. The cutting chamber is 480mm wide and 1070mm long. Larger versions with lengths of 1200mm and 1500mm will soon be available. The unit comes complete with a straight sided feed hopper and a six legged stand. As with the smaller machine, hot-dipped galvanising is standard. The floor space required is approximately 1000mm x 3000mm with the top of the hopper 800mm above the machine outlet and 2200mm above floor level. Weight of the machine complete is 1900kg.

CSIRO in conjunction with Eric Magill from Shred Tech Pty Ltd and Jim Badman from Brentwood Engineering, redesigned the cutters on the AZ15WL, as the original ones were found to be unsuitable for meat industry use. The re-profiled cutters are, in fact, similar to those used on the AZ7 which have proved to be very efficient for meat industry by-products. The cutters used on the AZ40 are also virtually scaled-up versions of those on the AZ7. The main design criteria for all these cutters is the strength and the angle of the cutting tips.

All machines can be supplied with either 20mm or 31mm wide cutters of single or triple hook profile. Machines supplied with 20mm cutters are slightly more expensive, due to the extra components involved. Optimum efficiency is obtained by setting up the triple-hook cutters in a 'chorus line' configuration and the single hook cutters in a staggered spiral configuration.

Some of the first Brentwood models used in the meat industry developed a problem where fatty material worked its way past the seals on either end of the main shafts. This was of particular concern on the gearbox end where the lubricant could be contaminated. To stop this occurring, new machines are fitted with a plate and slingers on the gearbox end of the cutting chamber. These slingers ensure that direct pressure cannot be applied to the gearbox

seals by foreign material such as fat and ground bone. This arrangement can be added to the backing plate end of the shafts as well, if requested. Each addition of a set of slingers results in a loss of 50mm in the length of the cutting area.

The electric control box on each machine is fitted with a current overload detector which activates relays to stop and reverse the motor(s) if a jam occurs. After reversing for several seconds, the machine reverts to normal operation. Warning devices are quite often fitted to alert staff of any recurring or major blockages. The control boxes conform to IP56 specifications.

MATERIALS FOR CUTTING

The 'bone cutters' used on the machines were designed mainly for size reduction of all 'bone-in' material from cattle, buffalo, pigs and sheep. These items included heads and hooves from the slaughter floor and skeletal frames from the boning room.

Soft offal such as the rumen, omasum, livers, kidneys, intestines, etc., as well as whole sheep carcasses and condemnations, may be processed through the shredders fitted with the 'bone cutters'.

Both machines can handle whole carcasses such as sheep or pigs without difficulty. Beef sides may require pre-reduction before being processed.

RESULTS AND DISCUSSION

BONE-IN MATERIAL

AZ15WL

The data from several meatworks using the AZ15WL are listed in Table 1.

Different selections of cutters are made in relation to the requirements of the plant. The most common configuration of the cutters appears to be a 50% combination of single and triple hooks with a width of 31mm. If heads and hooves alone are the feed material to the Brentwood Shredder, the use of all single hook cutters is recommended. These will produce a uniform, reduced particle size of about 15-20 mm cubed. Single hook cutters, when used for boning room material, may, however occasionally allow split rib and bolar bone pieces to pass through without adequate size reduction. Through experimentation, it was found that if single and triple hooks were fitted in combination, the incidence is reduced but not eliminated. This is mainly of concern where pneumatic conveying is employed.

Using all triple hook cutters generally increases the throughput rate with the power of the motor being the limiting factor. In this case, however, there may be a tendency for beef heads to ride on the hooks. Therefore this configuration is not recommended when heads constitute a high proportion of the input material. The use of these cutters will often result in a slightly smaller particle size, depending on the material being processed.

The use of 20 mm wide cutters slows down the production rate of the machine due to the fact that a larger size reduction of the product takes place. However, the resultant smaller particle size is beneficial for minimising (a) the cook times if a dry rendering system is used; or (b) the load on the Weiler grinder (or similar) for a wet rendering system.

For all cutter variants, throughput of material is slightly less when heads are processed. This is due to their bulk and the extra time required for the hooks to gain a purchase on

TABLE 1: Rate of production of raw material through a Brentwood AZ15WL Shredder

CUTTERS	MATERIAL	PROCESS RATE	COMMENTS
31mm single hook	Heads, hooves and other bones	4-5 tonnes/hr	This is the minimum rate for average sized cattle circa. 200kg dressed weight
31mm single hook	Hooves and other bones	5-6 tonnes/hr.	This is a faster rate than the above as no heads are involved
31mm, 50% single, 50% triple	All bone-in material and soft offal	Up to 6.5 tonnes/hr	The machine load increases with triple hook cutters, and power consumption increases
20mm single hook	Heads, hooves and other bones	3-4 tonnes/hr	Particle size is smaller therefore throughput is less
20mm single hook	Heads, hooves and other bones	3-4 tonnes/hr	Particle size is smaller therefore throughput is less
20mm single hook	Hooves and other bones	4-5 tonnes/hr	
20mm single hook	Soft offal	up to 6 tonnes/hr	Recommended for wet rendering system only
20mm single hook	Whole sheep (hide on)	12 sec/each	

them. Hooves and other bones are 'grabbed' more readily. The amount of material in the feed hopper does not significantly alter the throughput rate. Jamming of the cutters does not occur often and when it does the overload circuit of the control box ensures that normal operation is soon resumed. Tough, resilient items like horns and hooves are the most likely cause of temporary jamming.

AZ40

Table 2 details the data from a number of meatworks using the AZ40 "bone cutters".

TABLE 2: Rate of production of raw material through a Brentwood AZ40 Shredder

CUTTERS	MATERIAL	PROCESS RATE	COMMENTS
31mm single hook	Beef heads, hooves and other bones	9-10 tonnes/hr	Rate for small stock will be slightly higher
31mm single hook	Hooves, shins	12 tonnes/hr	
31mm single hook	Soft only	16 tonnes/hr	
31mm, 50% single, 50% triple	All slaughter floor material	12-16 tonnes/hr	Triple hooks increase throughput
31mm, 50% single, 50% triple	Beef heads	6-7 tonnes/hr	Heads are not 'grabbed' as well as shins
31mm, 50% single, 50% triple	Hooves and shin bones	14 tonnes/hr	
31mm, 50% single, 50% triple	Soft only	17-18 tonnes/hr	
31mm, 50% single, 50% triple	Whole sheep (fleece on)	8-10 sec/each	
20mm, 40% single, 60% triple	Boning room beef bones	9+ tonnes/hr	

Again, different configurations of cutters are available, each with an advantage in certain areas. As with the AZ15WL, combinations of 31mm single and triple hook cutters are the most common.

A comparison of the figures in Tables 1 and 2 shows that the throughput in the larger machine is generally twice that of the smaller machine. An AZ40 will conservatively handle all the slaughter floor material from up to 150 head of cattle per hour. This is derived from an average of 80kg of material per carcass at a process rate of 12 tonnes per hour. By a similar calculation the machine can reduce the bones and fat from a boning room processing up to 120 head of beef per hour. This figure is dependant on the weight of the carcasses.

As with the AZ15WL, the 31mm wide single hook cutters give a particle size of 15-20mm cubed for hard material but larger and less discrete for soft offal. Triple hook cutters increase the throughput significantly and are very useful on this machine, which has a high power input. These cutters also result in a smaller particle size, especially for gut material. The use of 20mm wide cutters will give a greater reduction in particle size, but slows throughput down. The requirements of the rendering department should be taken into consideration when deciding the choice of cutters.

SOFT MATERIAL

Digestive tract material from abattoirs can also be processed through the AZ15WL and AZ40 "bone cutters". However, the machines tend to tear and shred soft material, and size reduction is not quite as good as for hard offal. The gut material is cut into larger and more elongated pieces than the hard material, but the machine can be set up at the factory with tighter tolerances, if required. This will produce a superior cut for soft products.

The use of 31mm (preferably triple hook) cutters gives a larger particle size for the soft material, which is desirable for a dry rendering system. Here, soft and hard materials are cooked together and the soft particles cook more quickly. Smaller pieces can be overcooked and result in larger quantities of fines in the tallow. This problem does not arise in a wet rendering system where the smaller particle size obtained from the use of 20mm cutters (with tighter tolerances) is more desirable.

Condemned soft materials such as livers, hearts and lungs are reduced quite easily. Face pieces will also be reduced although they sometimes emerge as elongated strips. A novel set of cutters has been designed for use in the Brentwood for uniform size reduction of soft material. A report on its performance will soon be available.

GENERAL COMMENTS

Material residence time in either machine is very short and no heating or emulsification of the product occurs.

Small pieces of metal e.g. a gambrel, will pass through both machines without any difficulty or major damage. However, if there is a possibility of larger hard objects, such as rollers, entering the cutting chamber, a warning device or power cut-out should be fitted to the electronic shear pin circuit. This will ensure that the offending item can be removed before damage to the cutters occurs.

The manufacturers recommend that the cutters be sharpened every six to ten weeks, depending on the material processed. This can be performed with the machine intact, using

a small hand held grinder. The cutting tips may require building up by welding every six to twelve months to restore the original profile.

Feedback received from several meatworks that have Brentwood shredders installed indicates that there are no major maintenance problems associated with the machine. One area of concern is the bearing seals on the non-drive end of the shafts. If the aforementioned slingers are not installed, the bearings can become contaminated with waste material. It has been suggested that a 'stand-off' bearing housing arrangement could be employed to solve this problem without the loss of cutting chamber area.

These machines are easily cleaned with a hand-held hose and dismantling is not required if the raw material is for an inedible system.

CONCLUSIONS

The machines:

- are highly suitable as a pre-breaker;
- are energy efficient and relatively quiet in operation;
- require little maintenance;
- are suitable for processing all of the rendering material at abattoirs; the AZ15WL and the AZ40 can handle a kill of up to 450 and 1000 cattle equivalents per day respectively.

The Brentwood Shredder is manufactured by:

- Brentwood Engineering Pty Ltd
Berkely Road
UNANDERRA NSW 2526

and is available from:

- Shred Tech Pty Ltd
PO Box 59
REGENTS PARK NSW 2143

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