BELANDRA PTY LTD

BEEF SPRAY CHILLING

PRESENTATION

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PRESENTED - 2000

Presentation

1. Introduction

2. Conventional Chilling

3. Spray Chilling

4. Cost – Benefits

5. Regulations

6. Question Time

Introduction

The aim of this presentation is to compare the traditional dry cooling method for chilling hot beef sides with that of wet spray chilling.

The second section will provide an overview of the installed Belandra beef chillers this type we will term as traditional dry chillers.

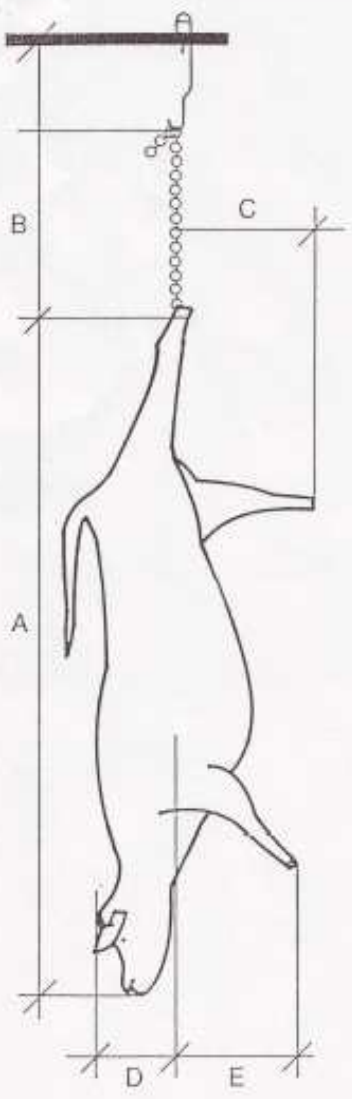
The third section will provide an overview of a spray chilling system in comparison with dry chillers. This will cover the installation, operation and general principles.

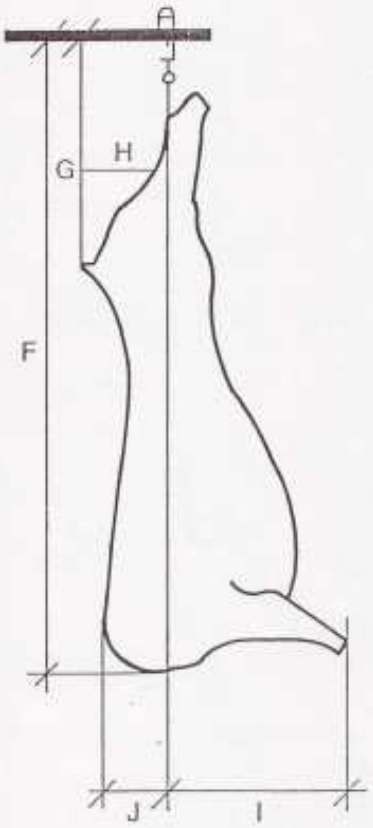
Section four provides a list of the advantages and disadvantages related to spray chilling systems, showing the cost benefits from spray chilling.

The final section covers the requirement for spray chillers and their needs to comply with certain construction and processing regulations (AQUIS) this section provides a summary of the compliance requirements.

Upon conclusion you may ask questions, however during this presentation if some points require clarification, please indicate so that your question may be attended to during the presentation.

Conventional Dry Chilling





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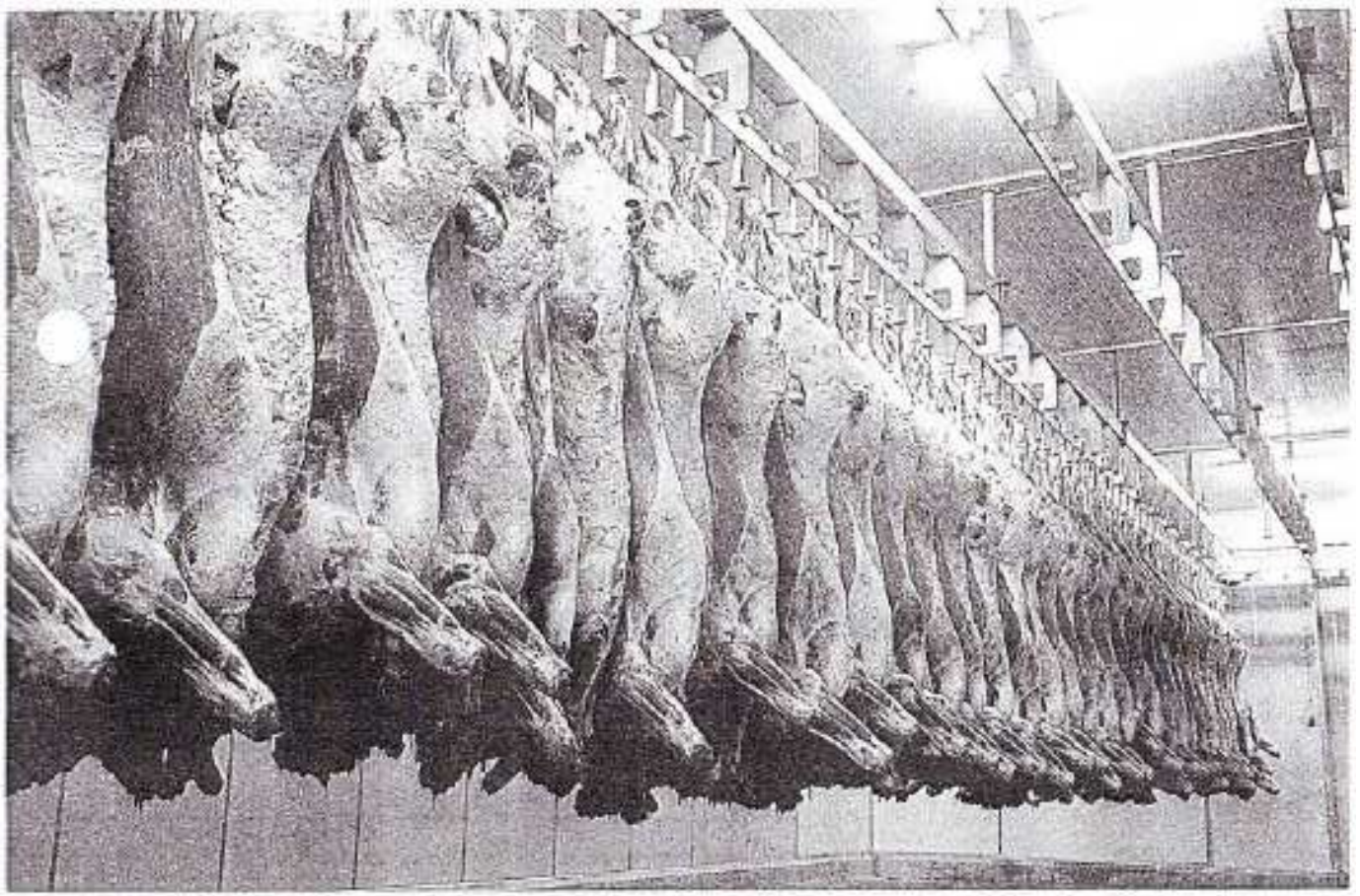
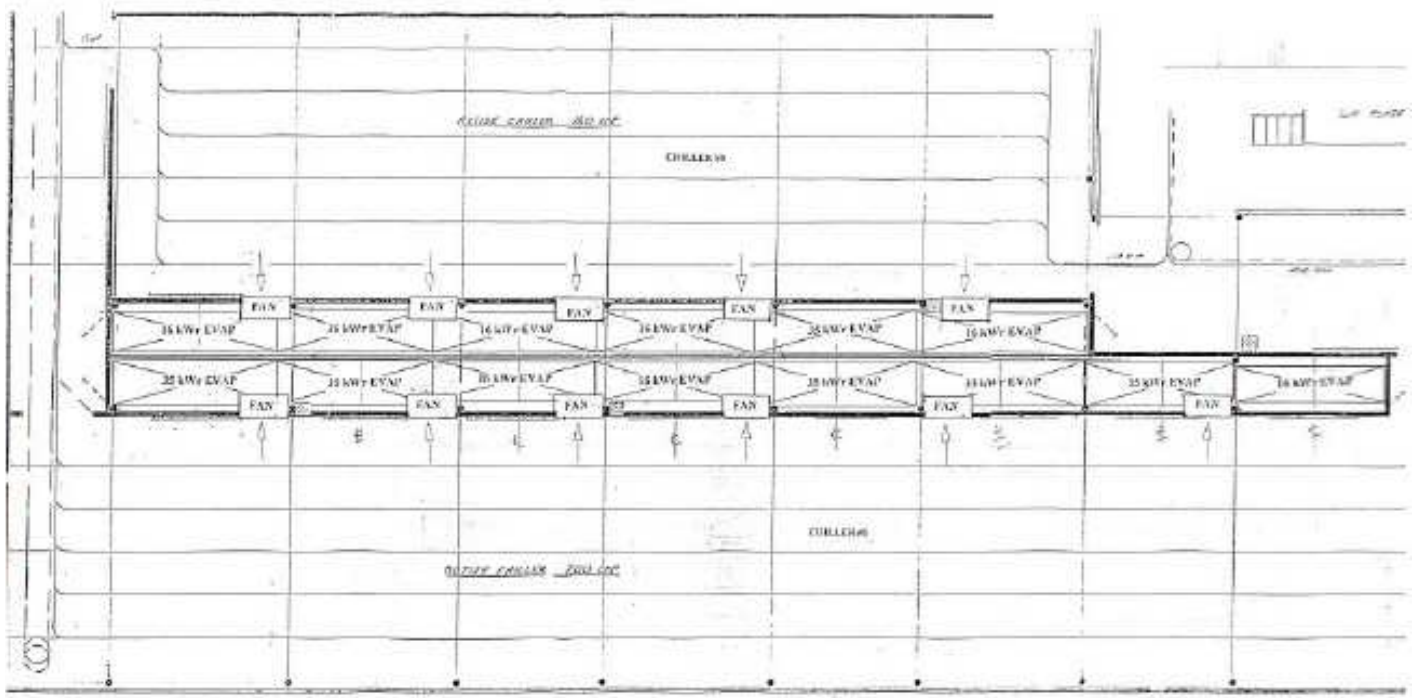
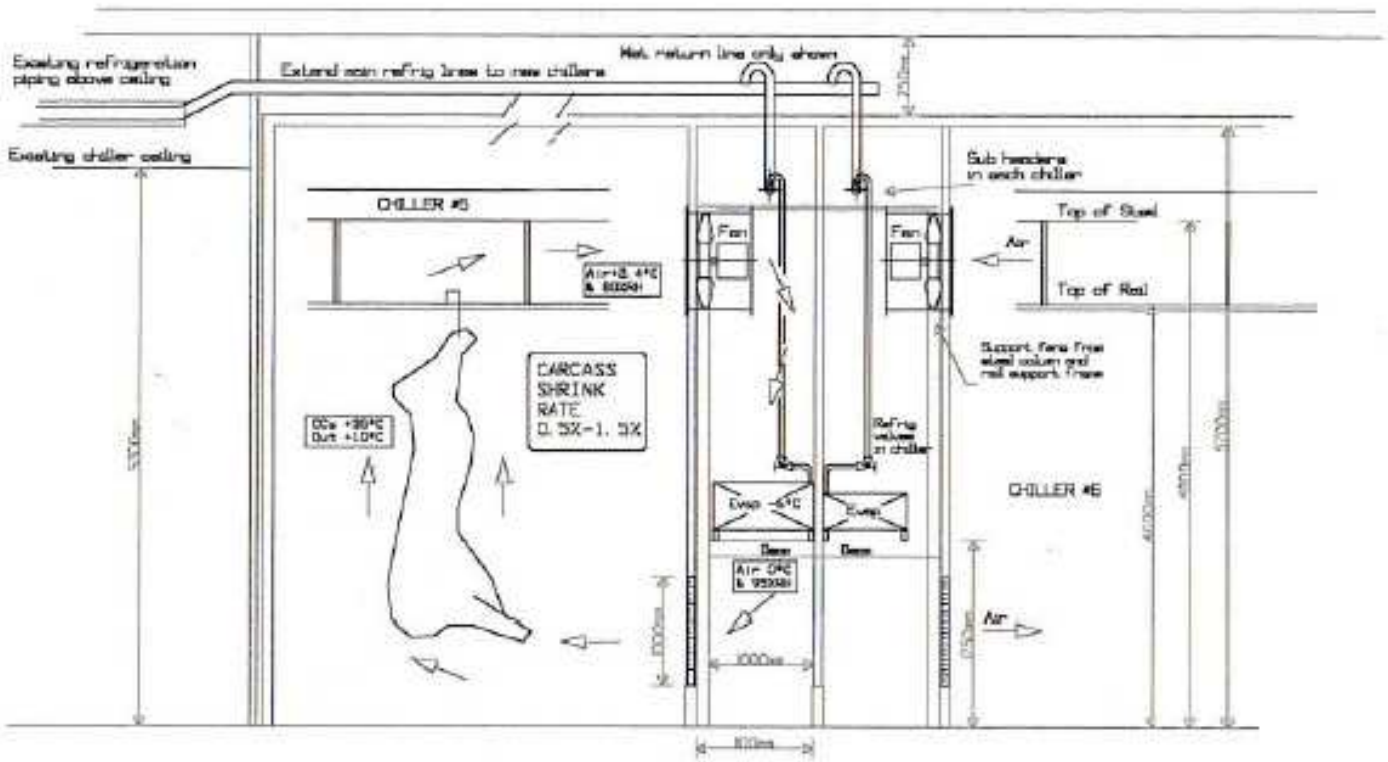


Active carcase chiller

see 20 1


FAN
35 kW EVAP
16 kW EVAP



CONVENTIONAL CHILLER SECTION

Typical Beef Sides Chiller

Notes:
Beef sides selected for 18 hour chilling cycle.

Simulation data:

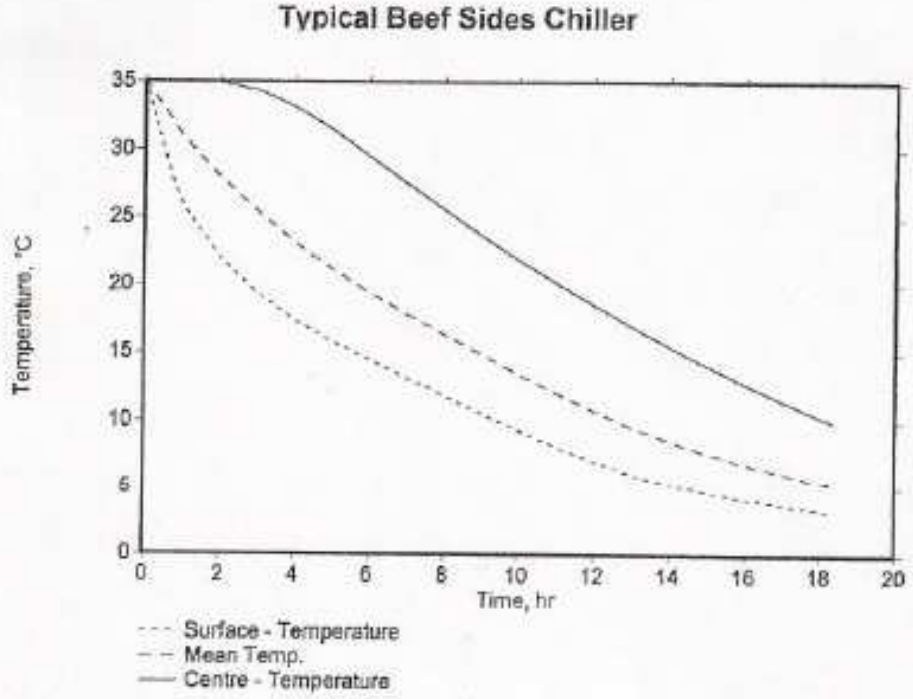
Size/shape:
Beef Side
Whole carcass weight: 210kg

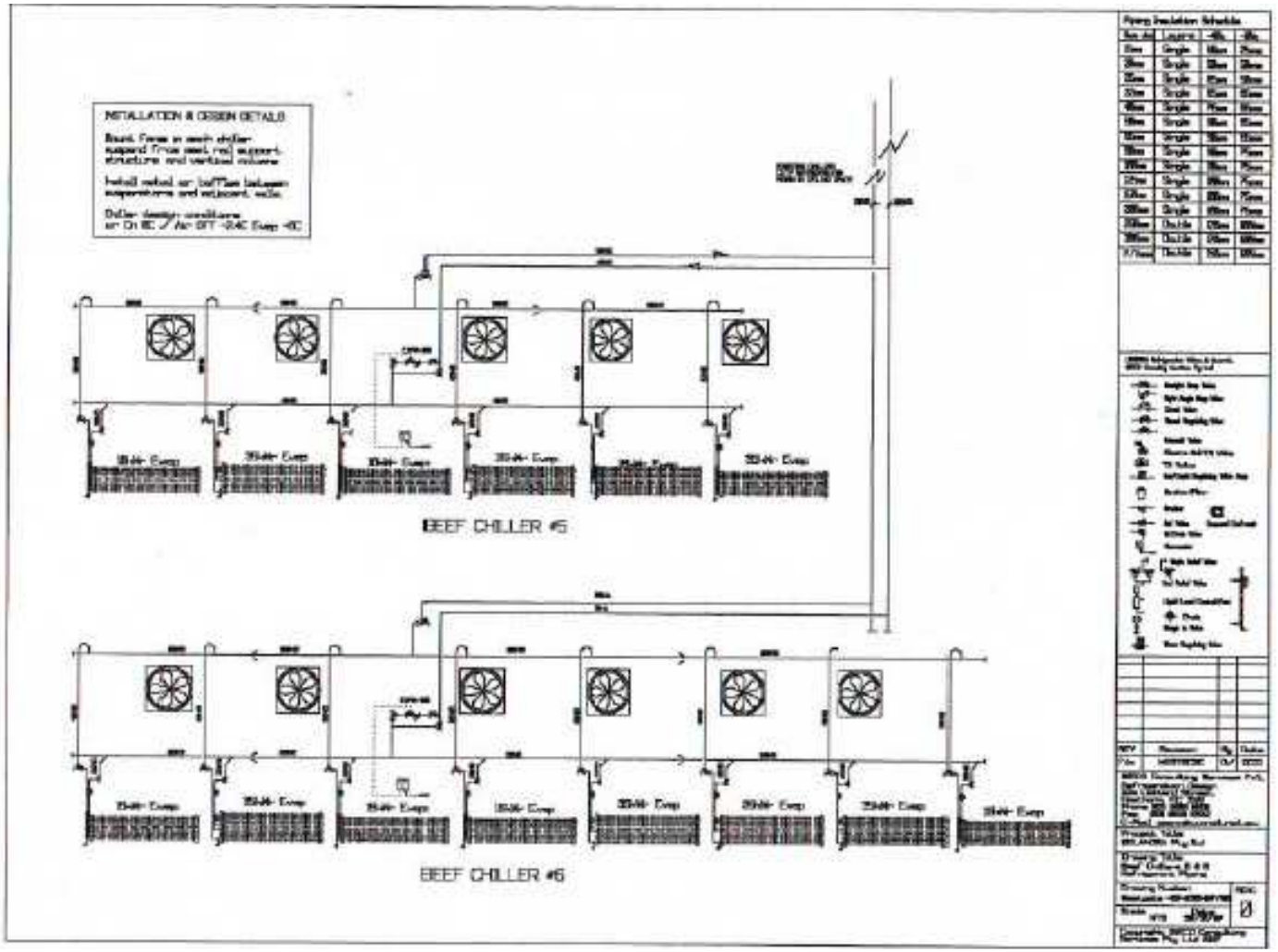
Initial Conditions:
Initial temperature: 35°C

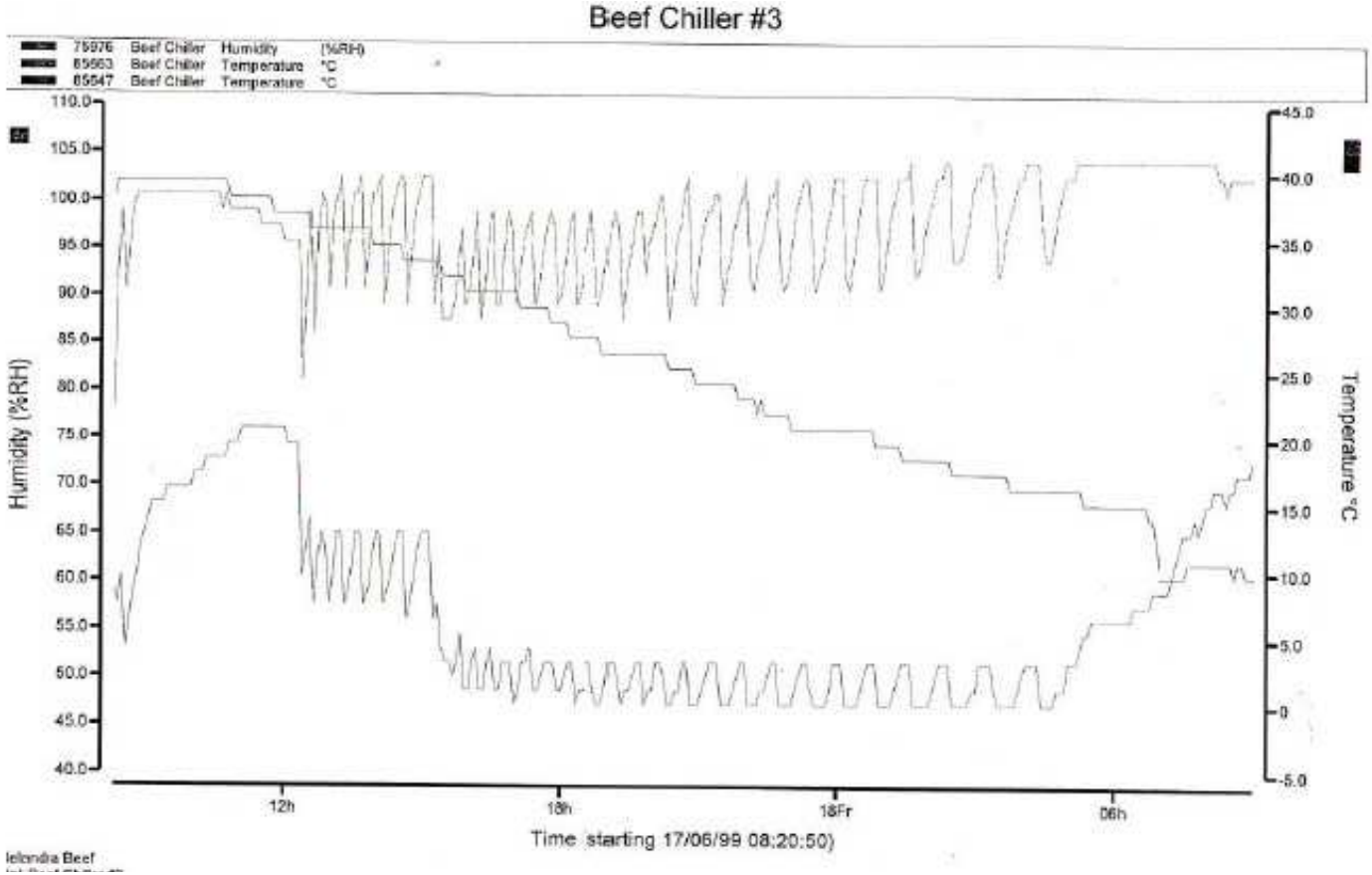
Boundary Conditions:
Boundary: Surface
Heat transfer medium: Air
Wrapping type: Bare

Time (hr)	Temperature (°C)
6	4
12	0

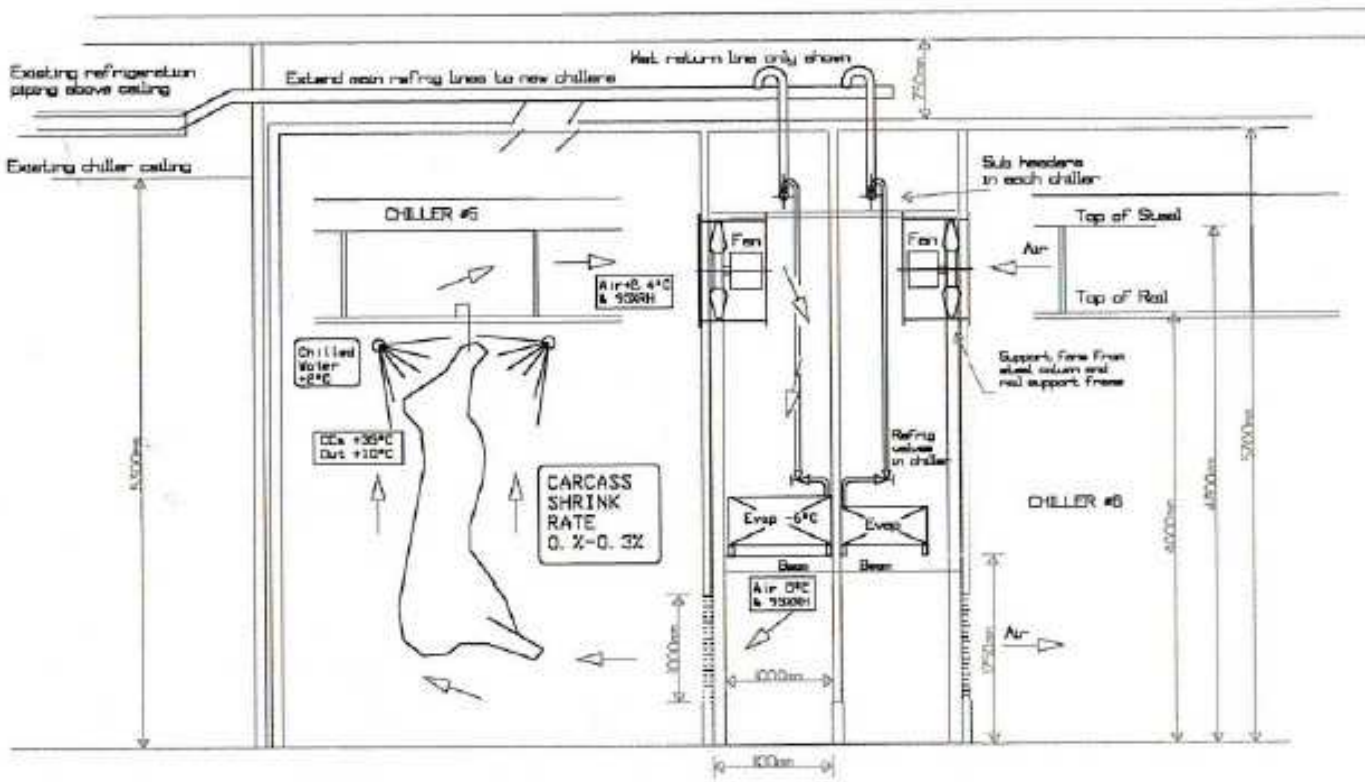
Time (hr)	Velocity (m/s)
6	0.6
12	1.1



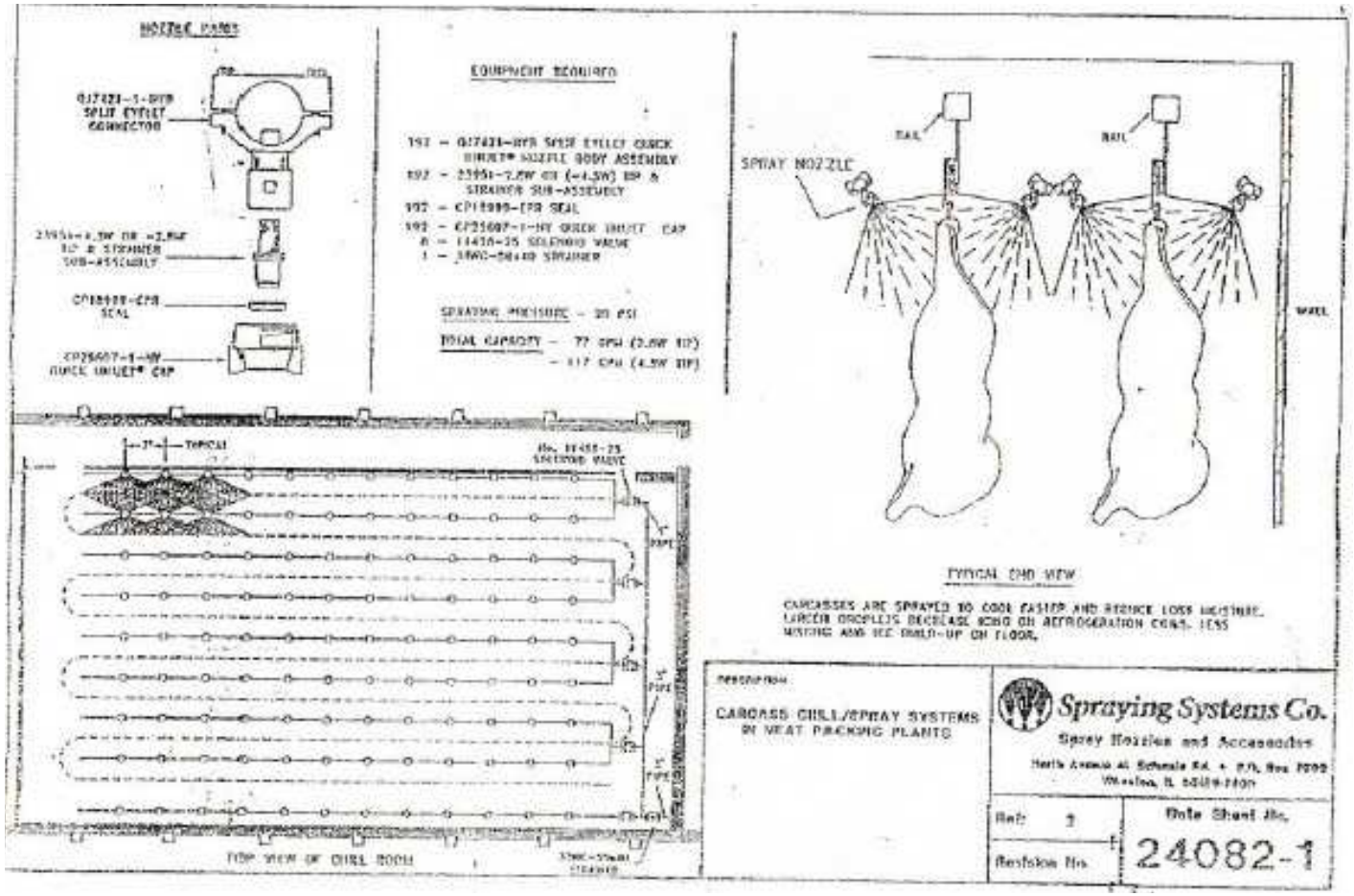

INSTALLATION & ORIGIN DETAILS
BEEF CHILLER #5
BEEF CHILLER #6


Beef Chiller #3
75976 Beef Chiller Humidity (%RH)
85863 Beef Chiller Temperature °C
85847 Beef Chiller Temperature °C
Humidity (%RH)
Temperature °C
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
-5.0
12h
18h
18Fr
06h
Time starting 17/06/99 08:20:50)

Spray Chilling



TYPICAL SPRAY CHILLER SECTION


NOZZLE PARTS
EQUIPMENT REQUIRED
SPRAY NOZZLE
RAIL
RAIL
WALL
TYPICAL END VIEW
CARCASSES ARE SPRAYED TO COOL FASTER AND REDUCE LOSS MOISTURE.
LARGER DROPLETS DECREASE KONG OR REFRIGERATION COILS. LESS
MISTING AND SEE BUILD-UP ON FLOOR.
TOP VIEW OF CHILL ROOM
CARCASS CHILL/SPRAY SYSTEMS
IN MEAT PACKING PLANTS
Spraying Systems Co.
Spray Nozzles and Accessories
Ref: 2
Revision No.
Data Sheet No.
24082-1

Observations of Spray-Chilling Operations Oversees

H.K. Wee ~ NIRM2

The chillers were thoroughly cleaned about once a month by completely wiping down the ceiling, floor, rails, etc. I did not observe any physical signs of rust.

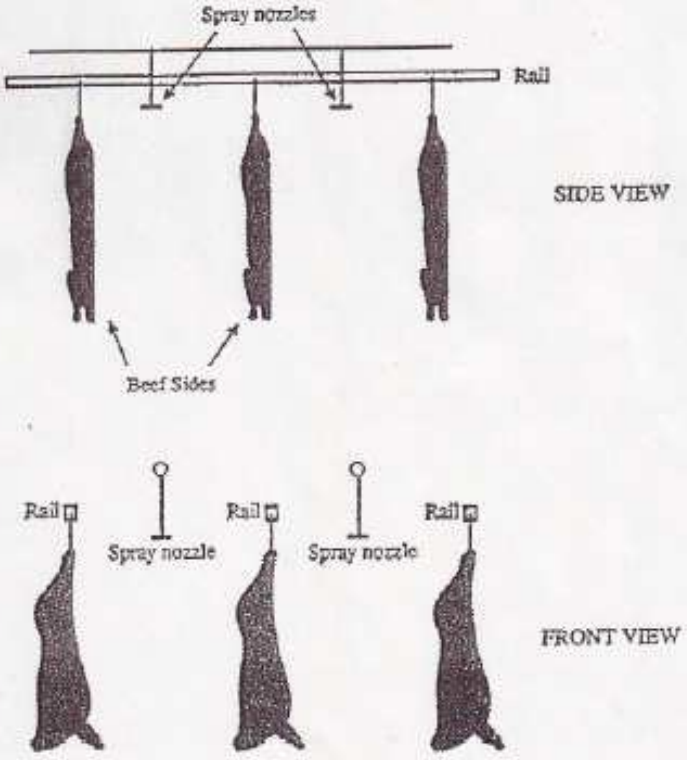


Figure 2. Schematic drawing of the spray nozzle arrangement in the spray-chiller at the Canadian beef plant.

ASHRAE

CHAPTER 11

MEAT PRODUCTS

Spray Chilling Beef

(A) Spraying cold water intermittently on beef carcasses for 3 to 8 h during chilling is currently the normal procedure in commercial beef slaughter plants (Johnson *et al.* 1988). Basically, this practice reduces evaporative losses and speeds chilling. Regulations do not allow the chilled carcass to exceed the prewashed hot carcass mass. The carcass is chilled to a large extent by evaporative cooling. As the carcass surface tissue dries, moisture migrates toward the surface, where it evaporates. Eventually, an equilibrium is reached when the temperature differential narrows and reduces the evaporative loss (Locker *et al.* 1975, Heitter 1975).

(B) When carcasses were shrouded, a once frequently used method for reducing loss of mass (shrink), typical evaporative losses ranged from 0.75 to 2.0% for an overnight chill (Kastner 1981). Heitter (1975) reported that the Chlor-chill system reduced shrink by 0.5 to 1.25%. Allen *et al.* (1987) found that spray-chilled beef sides lost 0.3% compared with 1.5% for nonspray chilled sides. Those authors stated that although variation in carcass shrink of spray-chilled sides was influenced by carcass spacing, other factors, especially those affecting the dynamics of surface tissue moisture, may be involved. Carcass washing, length of spray cycle, and carcass fatness also influence the variation in shrink. With sufficient care, however, carcass cooler shrink can be nearly eliminated.

(C) Loin eye muscle color and shear force are not affected by spray chilling, but fat color can be lighter in spray-chilled compared to nonspray chilled sides. Over a 4-day period, color changes and drip losses in retail packs for rib steaks and round roasts were not related to spray chilling (Jones and Robertson 1989). Those authors also concluded that spray-chilling could provide a moderate reduction in carcass shrinkage during cooling without having a detrimental influence on muscle quality.

(D) Vacuum-packaged inside rounds from spray-chilled sides had significantly more purge, *i.e.*, air removed, (0.4 kg or 0.26%) than those from conventionally chilled sides. Spacing treatments where foreshanks were aligned in opposite directions and where they were aligned in the same direction but with 150 mm between sides both result in less shrink ($P < 0.05$) during a 24-h spray-chill period than the treatment where foreshanks were aligned in the same direction but with all sides tightly crowded together (Allen *et al.* 1987). Some studies with both beef (Hamby *et al.* 1987) and pork (Greer and Dilts 1988) indicated that bacterial populations of conventionally and spray-chilled carcasses were not affected by chilling method (Dickson 1991). However, Acuff (1991) and others showed that use of a sanitizer (chlorine, 200 mg/kg, or organic acid, 1 to 3%) significantly reduces carcass bacterial counts.

(E)

1994 ASHRAE Refrigeration Handbook (SI)

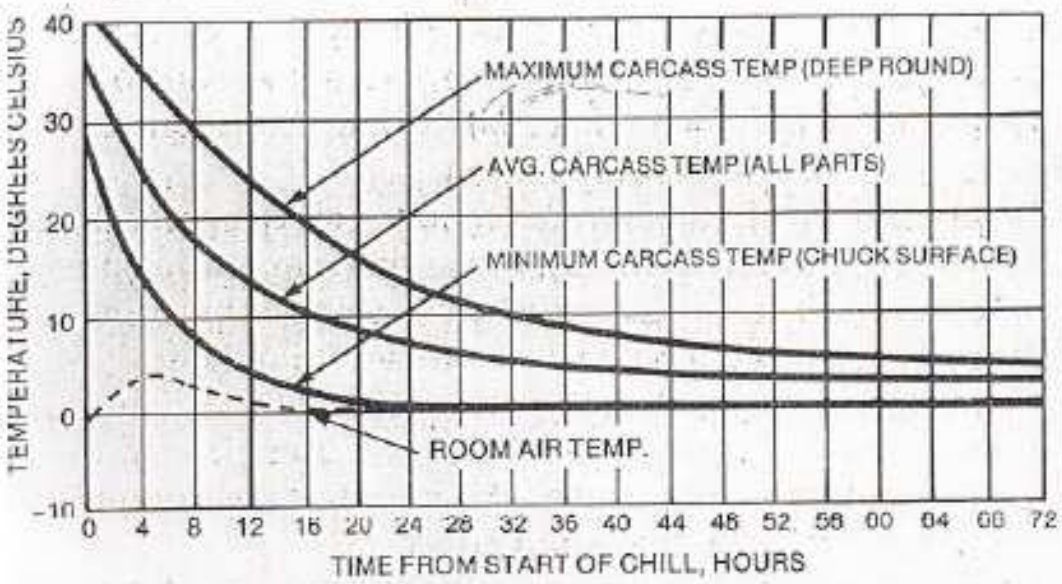
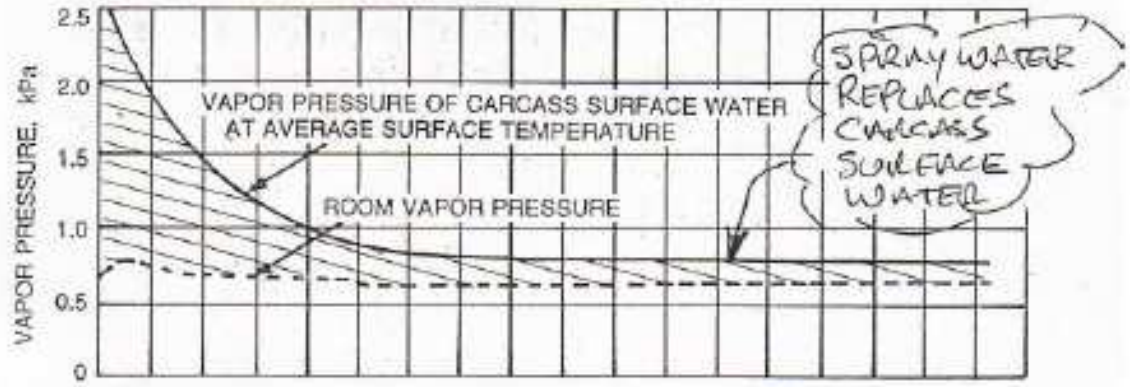


Fig. 2 Beef Carcass Chill Curves



Cost – Benefits

Cost – Benefits

Advantages:

1. The main advantage of the spray chilling system in comparison with conventional dry chilling is the reduction in product shrink (weight loss).

   Conventional dry chillers experience an average weight loss during the chill cycle in the order of 1.5%.

   The Belandra chillers have recorded weight losses on average of 1.3%. Based on an annual production rate of 130,000 cattle per year at an average dressed weight of 210kg, this represents a total weight loss of (130,000 x 210 x 1.3%) = 350,000 kg or in simpler terms 1650 cattle go down the drain as condensate each year.

   By converting to spray chilling the carcass weight loss will be reduced to about 0.3%. On this basis the weight saved would be 270,000 kg per year at an average cost of say $3.00 per kg this represents a saving of around $800,000.00 per year.

2. Other Advantages, apart from the weight reduction advantage obtained by spray chilling are,

   2.1.1 An enhanced carcass surface lighter colour
   2.1.2 Better air purge from vacuum packed product
   2.1.3 Faster chilling, due to better air surface heat transfer and evaporation
   2.1.4 Increased regulation with regard to meat quality (AQUIS) compliance and reporting, this ensures that the meat quality is monitored more closely resulting in an enhanced product.

3. Disadvantages:

There are several disadvantages related to spray chilling the main ones are as listed,

3.1.1 Additional installation and plant maintenance costs
3.1.2 Increased cleaning and sanitising costs
3.1.3 Increased refrigeration load to chill water and convert carcass surface water vapours to condensate
3.1.4 The additional cost for compliance (AQUIS)

Regulations

Order 10 Now - Australian Export Meat Manual

5. **Spray chilling**

5.1 The procedure by which spray chilling of carcases or portions of carcases is applied must be approved in writing by the Senior Assistant Director, Technical and Regulatory Services Branch, Canberra.

5.2 The procedure by which spray chilling of carcases or portions of carcases is applied must be submitted through the authorised officer in charge at the establishment to Regional Office, for onforwarding to the Canberra Central Office.

5.3 The application must provide sufficient detail to permit approval and must include:

(a) the type and location of equipment used, including the performance specifications for the spray system

(b) the criteria, including performance targets, by which the effectiveness of the treatment will be monitored and controlled

(c) the details of any other treatment that may be used in conjunction with spray chilling to prevent cold-shortening

(d) the procedures to be implemented in the event of interference to spray chilling treatment by way of mechanical failure, industrial dispute or similar cause.

5.4 Only potable water may be used for spray chilling. Water used in spray chilling must not be recirculated and must not be hyperchlorinated.

5.5 Spray chilling must not result in:

(a) condensation, deterioration of chiller structures, or drainage problems

(b) product weight gain

(c) unsatisfactory microbial status of treated product.

5.6 A program to assess the effectiveness of the treatment to control microbial growth, using innocula of nonpathogenic test organisms and undertaken in conjunction with CSIRO Division of Food Research, must be implemented.

5.7 Results of monitoring must be maintained in written form and must be available to authorised officers.

Note on paragraph 5: At the time this entry was prepared, applications and approvals for spray chilling were dealt with as an approved program in accordance with order 300 of the Export Meat Orders; procedures for spray chilling treatments are to be reviewed by CSIRO.