

A GUIDE TO A CATTLE SLAUGHTERHOUSE

1 - PRESENTATION

1-1 Nature of the Activity

The slaughterhouse transforms live cattle into meat carcasses (and/or quarters) and by-products (blood, fat, meat scraps and bones, "white" offals - head, bowels, feet..., "red" offals - livers, hearts, lungs - and leather). The by-products can be processed on the site.

The slaughterhouse assures sanitary control of the cattle that is to be consumed and guarantees excellent hygienic conditions at the time of slaughter and during the preparation of the carcasses.

The slaughterhouse can be set up close to stock farms, areas of consumption (near large cities) or shipping areas in the case of export (near a port, railroad junction...).

1-2 Alternatives

* Raw Materials :

The following slaughterhouse was designed especially for the slaughter of large cattle, but one can consider from the start the possibility of slaughtering calves on the same line. To slaughter sheep and hogs, one must install specific complementary lines.

* Finished Products :

- Refrigerated or frozen products : the products (and by-products) can be marketed either refrigerated or frozen. The advantage of freezing or a freezing tunnel (+ store-room for frozen stock) must be determined case by case.
- Degree of valorization of the products :
 - . carving : the slaughterhouse can market full carcasses, half carcasses and quarters. One can easily plan a meat carving unit adjacent to the slaughterhouse which can prepare bags of 1 to 3 kg (see "a Guide to a Meat Carving Unit")
 - . treatment of offals : one can foresee the de-fatting of the bowels, the treatment of the skin (salting, trimming, cutting up), the treatment of the fat...

* Technology :

The technological alternatives depend essentially on the engineering and construction of the slaughterhouse and the equipment.

- **Construction** : the following chart shows the possible options for the principal sections of the slaughterhouse (cattle sheds, slaughtering hall, offal unit, refrigeration units).

	Cattle sheds	Slaughtering hall	Offal unit	refrigeration units
Framework	unimportant	preferably metal	metal stockage of leather : wood	metal
Posts	unimportant	concrete or metal	concrete or metal	metal
Secondary framework	none	yes, galvanized metal	none	yes, galvanized metal
wall finishings partitions	Brick walls with smooth plaster, ventilation at the top	enamelled sandstone walls-min. 3 m high	enamelled sandstone or smooth partitions in panels	Preferably insulated panels
		rounded corners between floors and walls		
Floors	scored cement	smooth, easy to clean, exemple : resin or tile floor		dust-resistant cement
Roofing	to be determined from available materials			

- **Equipment** :

. for slaughterhouses of a certain size, handling on the line is done with the use of aerial rails (animal suspended). The system can be mechanized or simply on a slope (transfer by gravity).

One can also foresee a conveyor belt for the circulation of "red" offals and the aerial rail system in the cold rooms (mechanized or not).

. The work platforms can be elevatory, which allows one to process animals of different sizes conveniently (eventually calves and large cattle).

For very large units, one can consider a conveyor belt for the transfer of skins.

No matter what options are chosen, one must perform the same order of operations :

- . fell , haul, hang animal on the rail
- . bleed, collect the blood
- . cut off the horns, work on the head
- . cut first leg, then second
- . work on udders, chump end

- . work on flanks, neck, cut off fore legs
- . remove skin from top to bottom
- . split the sternum
- . eviscerate the abdomen
- . eviscerate the thorax
- . split the vertebrae, cut off the head
- . inspection
- . final trimming.

1-3 Types of Possible Units

Three classes of size and corresponding levels of mechanization will be described :

Unit A : 10 - 15 animals per hour - handled with gravity

Unit B : 20 - 25 animals per hour - handled with gravity

Unit C : 30 - 35 animals per hour- mechanized network

2 -TECHNICAL AND ECONOMIC GUIDE

2-1 Description of the Unit

2-1-1 Finished Products

UNIT	A 10 to 15 animals/hr	B 20 to 25 animals/hr	C 30 to 35 animals/hr
Products made	Carcasses, quarters and by-products unprocessed	Same as A	Same as A
Method of preservation	Refrigerated	Same as A	Same as A
Production (in carcass weight) - daily - annual (35 hours per week and 280 kg per carcass)	25 t 6000 t	55 t 11 000 t	75 t 15 000 t

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS		
		UNIT A 6000 t/year	UNIT B 11 000 t/year	UNIT C 15 000 t/year
Stabling of animals	Barnyard or cubicles	cubicles	cubicles	cubicles
Handling slaughtering	aerial or ground gravity or mechanized	aerial gravity	aerial gravity	aerial mechanized
Conveyance of "red" offals	by cart or conveyor	cart	cart	conveyor
Transfer of skins	by belt or cart	belt	belt	belt
Removal of skins		top to bottom	Same as A	Same as A
Sweating of carcasses	manuel conveyance or by conveyor	manual	manual	conveyer
Work platform	Static or elevatory	static	elevatory	elevatory
Refrigerated rooms	Sweating Sweating + storing	Sweating + storing	Same as A	Same as A

2-2 Economic Analysis

2-2-1 Investments

UNITS	A	B	C
	6000 t/year	11 000 t/year	15 000 t/year
Equipment	Estimated price FOB US \$	Estimated price FOB US \$	Estimated price FOB US \$
Slaughtering line	\$ 500 000	\$ 700 000	\$ 900 000
Offal equipment	\$180 000	\$ 250 000	\$ 440 000
Cool room equipment	\$ 600 000	\$1 000 000	\$ 1,300 000
Secondary framework "Cool rooms + slaughtering"	\$ 80 000	\$120 000	\$150 000
TOTAL EQUIPMENT	\$1,4 million	\$ 2,1 million	\$ 2,9 million
Buildings			
Surface area of buildings			
- stabling area	450 m2	900 m2	1200 m2
- loading yards	100 m2	130 m2	150 m2
- slaughtering hall	310 m2	380 m2	420 m2
- sweating area	130 m2	250 m2	350 m2
- clod room for storage	400 m2	820 m2	1090 m2
- offal unit	570 m2	800 m2	950 m2
- offices, machine shop	480 m2	660 m2	900 m2
Total surface area of buildings	2440 m2	3940 m2	5060 m2
Minimum surface area of land	7500 m2	12 000 m2	15 000 m2
Other investment costs			
- electrical power	400 Kw	500 Kw	700 Kw
- cold (negative calories)	120 000 nc/hr	200 000 nc/hr	350 000 nc/hr
- water (maximum use)	90 m3/hr	120 m3/hr	150 m3/hr
Total investment	\$ 2 to 3 M	\$ 4 to 5 M	\$ 5 to 6 M

2-2-2 Functioning

	UNIT A	UNIT B	UNIT C
	6000 t/year	11 000 t/year	15 000 t/year
Total personnel (maintenance included)	30	35	40
Annual consumption			
- Animals (units cattle)	21 000	40 000	55 000
- Water	70 000 m3	100 000 m3	125 000 m3
- Electricity	150 kwh/t or 900 Mwh	150 kwh/t or 1650 Mwh	150 kwh/t or 2250 Mwh

3 - KEY FACTORS TO THE PROJECT'S SUCCESS

3-1 Supply

One must foresee regular supplying of in the slaughterhouse in order to limit the duration of stabling. Depending on the case, the animals will be led to the slaughterhouse (with weight loss if distance is long) or transported by truck or train (taking into consideration the logistical infrastructure in the choice of a building site).

In the second case, foresee a period of stabling to reduce the consequences of stress.

3-2 Technology and Equipment

The conception is a matter for specialists familiar with the problems of construction, the choice of techniques for production of fluid, process and work methods for slaughtering lines, regulations etc.

The choice of the building site for the slaughterhouse must take into account local criteria (land, geographic location, drainage) and sanitary standards.

These standards aim to separate the "unclean" system (evacuation of scraps, delivery of live animals...) from the "clean" system (carcasses, cleaned and refrigerated offals...).

As for construction, one must underline the importance of the extra cost linked to the exploitation of the slaughterhouse and the equipment suspended from the secondary framework. This secondary framework is closely linked to the equipment and rests either on the principal framework of the building (90% of the cases) or on independent posts attached to the floor (in cold rooms).

Required fluids : cold water, sterilized hot water 45°, hot water 90°, compressed air , cooling fluid (water with glycol or ammonia for above 0° cold).

Vapour : not necessary, except if one plans a secondary treatment of casings (cooking). The majority of the calorific needs will be produced by recovery of heat from the cold system.

Negative cold : the advantage of freezing must take into account the program and standards of hygiene. To avoid overly complex installations, plan on an installation for direct expansion with R22 or R502.

From the first conception of the slaughterhouse, one must foresee the range of animals to be processed in order to eventually install an additional pig or sheep line. A sanitary slaughterhouse is obligatory if it is conceived according to EEC standards. It comprises one room for the manual slaughter of sick animals, another for sanitary carving, a refrigerator for barred meat and another for seized meat.

3-3 Personnel

A training session in hygienic regulations is essential for all personnel (ensure in particular that the meat is not exposed to in the outside air while the trucks are being loaded and that all the equipment and tiling are washed frequently). Personnel must observe strict standards of personal hygiene.

3-4 Quality Control

- The quality of the meat depends on the quality of the livestock
- Veterinary control of livestock and carcasses
- General hygienic plan (including hygiene training for personnel)
- Adequate pre-refrigeration of the carcasses (cooling is a key factor for the quality and good preservation of meat in storage).

3-5 Distribution and Commercialization

Carefully monitor the cold chain and the duration of the forwarding of products to the consumers.

The slaughterhouse will supply meat carving units and distributors.

3-6 Financing

The slaughterhouse is generally looked upon as a public service, open to diverse users. The profit of the slaughterhouse is calculated per head of slaughtered cattle. In this case, there is no stock to foresee and the required working capital need only take into account users' terms of payment.

3-7 Other Specific Problems

Processing Scraps :

The waste from a slaughterhouse is composed of :

- solid waste removed from the waste water
- stercoraceous material
- horns, hooves
- dung from the stables if straw is used and cattle trailers
- sewage

Their storage necessitates at least the construction of a covered manure yard and a slurry manure pit

The difficulty of evacuation and recycling of these wastes can influence the choice of the site.

Water Needs and Treatment :

The unit which consumes large quantities of water (300 - 500 m³/day) and produces large amounts of waste needs either a purification plant, or to work in conjunction with a collective plant after treatment.

4 - INDUCED ACTIVITIES

- A slaughterhouse can be conceived as a tool for both economic development and sanitary control of a line of breeding - slaughtering- marketing of meat.
- The processing of by-products permits the development of various induced activities : working of leather, processing of casings, carcass disposal (tallow, gelatin), blood meal
- A meat carving unit can associate itself with a slaughterhouse if the market demands elaborate and semi-elaborate products.