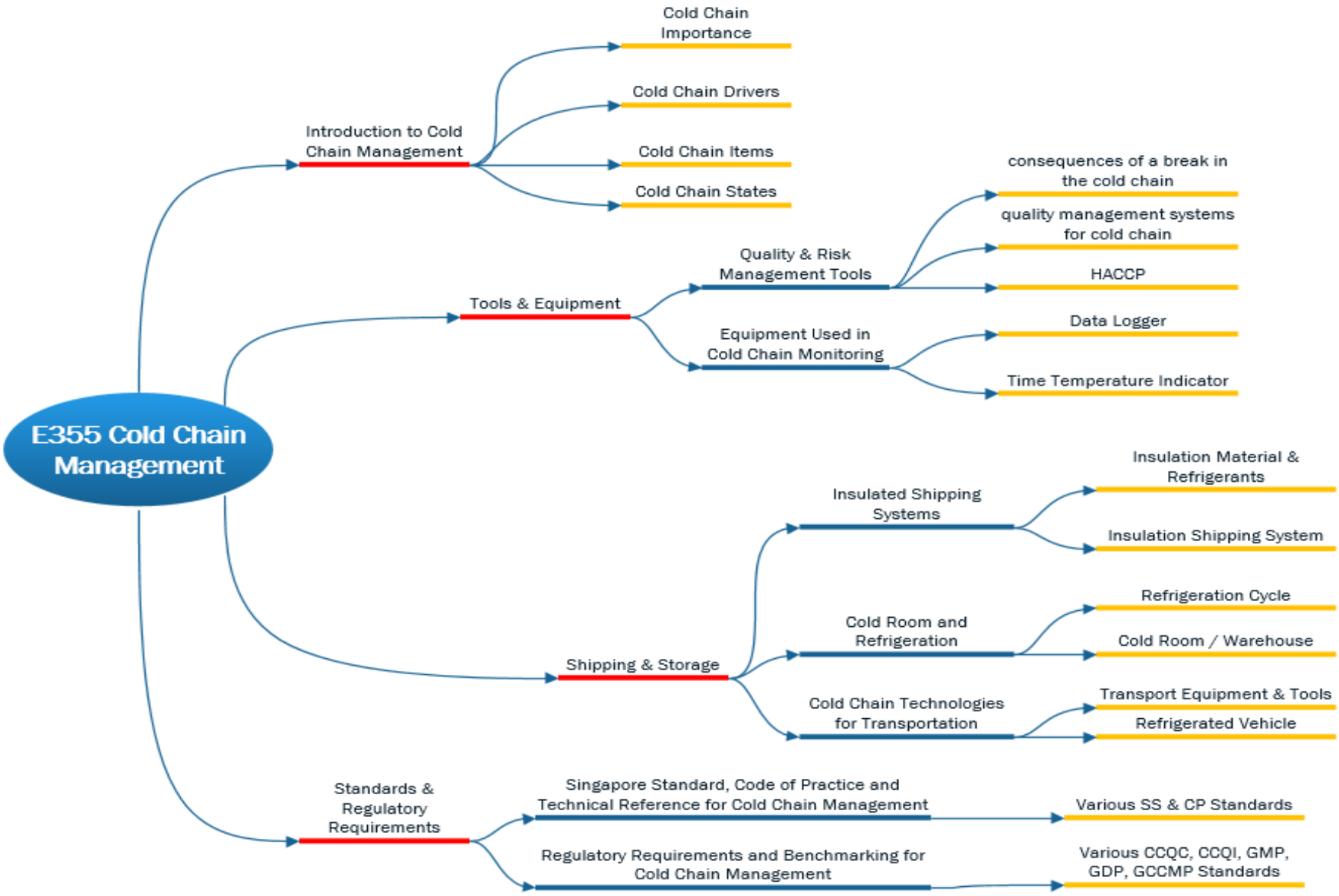
Problem 03

Our meat and fish supply

- Intepret SS 552: 2009 of Code of Practice for Cold Chain Management of Chilled Pork
- Identify the Critical Links in Cold Chain Management of Chilled Pork
- Interpret the Technical Reference TR 49: 2016 for Cold Chain Management of Frozen Fish and Seafood
- Describe different types of Freezers/ Chillers for Cold Product Retailing
- Plan the display of Cold Products and Positioning of Cabinets

E355 Cold Chain Management - Topic Tree



SS 552: 2009 Code of Practice for Cold Chain Management of Chilled Pork

- SS is developed by SPRING Singapore, AVA, NEA, ECR Singapore and industry
- SS 552 : 2009 was previously TR20: 2005, it was upgraded to SS in 2009
- Objective – To establish and implement best practices in cold chain management of chilled pork and to uphold safety, quality and wholesomeness of chilled pork.
- Benefits of complying to the SS 552:2009
  - Reduce wastage due to spoilage
  - Shelf-life of meat is extended with proper management
  - Greater protection of public health
  - Increase consumer confidence in chilled pork

Responsibilities of Whole Cold Chain

- Chilled pork shall be maintained between 0 to 4^{o}C at all stages within the entire supply chain; however, during delivery if the surface temperature of the packaging is momentarily raised to 10^{o}C but the core temperature of the chilled pork remains at 4^{o}C, the consignment is considered acceptable
- Chilled pork must meet customer specification and AVA's requirements, and be produced in accordance with on-site food safety requirements
- Documentation integrity must be maintained between establishments
- Temperature monitoring/recording devices shall be used and regularly calibrated with times of calibration recorded
- All chilled pork sides shall carry a unique identification number, date and time of slaughter for product traceability purposes

Six (6) Links of Chilled Pork Cold Chain Management

Pig Farm

Abattoir

De-boning Plant

Interfacing Transport

Retail Outlets

Consumers

General Requirements of a Pig Farm

- First link in cold chain management
- Certified and inspected by AVA
- All pigs destined for slaughter shall be healthy, free of infectious diseases such as *Trichinella spiralis* & FMD
- Conditions under which pigs are raised for meat production shall be conducive to production of safe and wholesome pork
- Feed for pigs shall not include garbage or swill
- AVA has the ability to prevent or control the movement of pigs to abattoirs from areas of sanitary restrictions

From Pig Farm to Abattoir

- Pigs sent to abattoir must be able to be traced back to their place of production
- AVA shall have access to all information on the production history that is relevant to the processing and inspection of slaughter pigs
- All pigs presented to the abattoir shall be unloaded from the transporting truck to move on their own to the holding pen to detect any signs of sickness
- Identification of pigs is a prerequisite to adequate veterinary control and appropriate information systems are necessary to optimize the use of available data

Abattoir

- Normally assumes second link, interfaced by the transport link to the farm
- All abattoirs in which the pigs are to be slaughtered shall be HACCP-certified and approved by AVA
- Upon slaughter and passing inspection, the carcasses shall be subjected to a blast chilling process to be followed by an equilibrium chilling process to bring down the core meat temperature to 4^{o}C or less as quickly as practical and preferably within 24 hours of slaughter.
- In local abattoir, the pig carcasses are blast chilled at -8^{o}C or below for 90 minutes to bring the temperature down to 3.5^{o}C or below before bringing core temperature further down to 1.5^{o}C within 18 hours.

Chilled Pork Processing / De-boning Plant

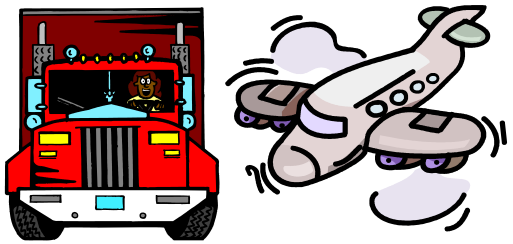
- This third link is used to receive chilled carcasses for de-boning and cutting from the abattoir
- All machinery, equipment and devices along the production lines shall be properly and hygienically maintained, and in good repair and working order
- Layout of plant shall be forward flow with no criss-crossing from preliminary receiving and handling through processing and transfer to the packaging department
- Temperature-controlled docks shall be used for loading and unloading

Requirements at De-boning Plant

- Check that chilled pork temperature at unloading and loading is between 0 – 4^{o}C
- In the case of imported pork, data loggers shall be removed and returned to the exporter by express airbag
- Chiller store temperature shall be maintained at 0 – 4^{o}C, and temperature of de-boning room set at or below 15^{o}C
- All process of each batch of carcasses shall be completed within 30 minutes once out of the chiller room.
- Data logger intervals shall be no greater than quarter hourly
- Log shall be maintained showing time of departure, arrival and temperature at all points where readings are taken.

Interfacing Transportation Modes

- Currently, import of non-vacuum packed chilled pork has only been approved for chilled pig carcasses by air from Australia
- Every shipment by air is recommended to have at least 1 Electronic Product Code (EPC) global tag or similar device attached to the core of the chilled pork to monitor any breaks of the Cold Chain during distribution and transportation
- Typical transportation model for chilled pork deboned locally would be
  Abattoir -> Road transport (by freight forwarder)->
  Airport -> Air transport (by airline) ->
  Road transport (by FF)-> De-boning plant
- For road transport,
  - All pork carcasses/sides shall be transported in a refrigerated vehicle
  - Loading of produce into truck shall not exceed
    30 minutes per pallet of 4.2 tons



Exporting Freight Forwarder

- To ensure compliance with standards and requirements of AVA
- International freight forwarder is to ensure Unit Load Device(s) (ULD) can be used for transporting chilled pork and deliver ULD to Cargo Terminal Operators (CTO) before close-out time for acceptance by airline
- Prepare documents including the critical ones such as Invoice, Health certificate, Airway bill & Cargo Clearance Permit, at least two hours before flight or per local practices.
- Check core temperature upon loading into ULDs, at receiving, at dispatch to CTO, unloading from ULDs, and on arrival at de-boning centre, with logs to be maintained that shows all points where readings are taken

Ground handling agents

- HACCP or equivalent including IATA perishable cargo regulations shall be adopted.
- It is recommended that the ULD be unloaded and towed to cold room or pickup point within 60 mins after aircraft is choked.
- Contingency plans need to be in place in the event of extended delays that are likely to cause product to rise above 4^{o}C.
- Documentation of unloading procedures shall be established and adhered to.

In-Flight and Airport (Singapore)

- IATA Perishable Cargo Handling Manual shall be followed
- For safety and security reasons, only temperature loggers approved by the airline shall be used
- If dry ice is used, usage shall comply with the required Dangerous Goods handling requirements and not exceed the uplift limit permitted by airline
- ULD to be unloaded from aircraft to tarmac within 45 mins of landing, and towed to cold room or pickup point within 60 mins
- ULD shall be presented to forwarders based on the following sizes and time after presentation of documents:

1. < 3 tons: within 40min
2. 3 – 5 tons: within 50min
3. > 5 tons: within 60min

Retail Outlets

- Fifth link in cold chain management – consists of supermarkets and wet market stalls
- All supermarkets are recommended to implement HACCP while all chilled pork stalls in wet markets shall comply with National Environment Agency (NEA) Regulations
- Operators of these premises shall ensure that personnel engaged in the handling comply with appropriate hygiene regulations stipulated by NEA
- Upon receipt, chilled pork shall be immediately transferred from the refrigerated truck to chiller stores or refrigerated display cabinets.
- Inventory of chilled pork shall be supplied on a FIFO basis

Cutting and Display at wet markets

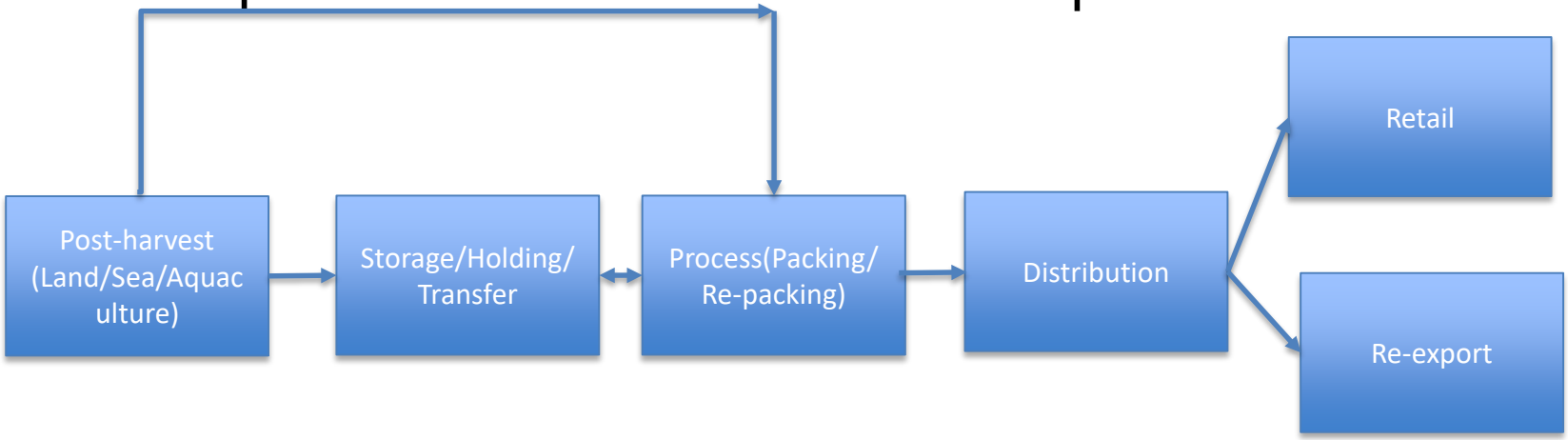
- Target: To maintain core meat temperature of 0°C – 4°C
- Conduct unloading of chilled pork from refrigerated trucks in such a manner that pork is not exposed to higher ambient temperature for 15 minutes.
- Close the display cabinet door at all times to maintain the core meat temperature between 0°C – 4°C, except for the purposes of retrieving and keeping chilled pork.
- Complete the cutting process within 15 minutes after chilled pork is taken out from chiller cabinet and return to chiller cabinet immediately thereafter to maintain core meat temperature of 0°C – 4°C
- Comply with NEA regulatory requirements

Cutting and Display at Supermarkets

- Target: To maintain core meat temperature of 0°C – 4°C
- Carry out cutting process at 15°C or lower and complete within 30 minutes after chilled pork is taken out from chiller room and return to chiller room immediately to maintain core meat temperature of 0°C – 4°C
- Close the display cabinet door at all times to maintain the core meat temperature between 0°C – 4°C, except for the purposes of retrieving and keeping chilled pork.
- Locate refrigerated display cabinets of chilled pork stretegically to ensure that customers can only gain access to end of their shopping and perishable product are not removed from refrigerated shelves for an excessive period of time.

Cold Chain Management of frozen fish and seafood

- Singapore imports frozen fish and seafood from around the world. They are highly perishable.
- TR: 49:2016 covers the proper cold chain management of raw and minimally processed frozen fish and seafood in a single entity.
- The following shows the different stages of storage, handling, and movement involved in a typical cold chain of frozen fish and sea food from the time of harvesting till the final point of sale to consumer or export.



Post Harvest of fish

- It is essential that fresh fish and seafood as well as their products that are to be chilled shall be held at a temperature of 0°C to 4°C.
- Sufficient icing, chilled or refrigerated water systems where appropriate should be employed to ensure that fish and seafood are kept chilled at a temperature of 0°C to 4°C.
- Frozen fish and seafood should be stored at -18°C or below.

Handling of raw fish/seafood - Receiving

- Receiving personnel/fish handler should be knowledgeable of the source of fish/seafood, the species and the product specification, which should be provided by the suppliers to ensure a safe source of incoming fish or seafood.
- Harvested fish and seafood should be iced and chilled to between 0°C to 4°C without undue delay.
- Icing of fish and seafood is an essential step and methods include the use of ice slurry (1 part ice: 1 part water), the use of refrigerated water (2 parts of water: 1 part of fish and seafood) or super-chilled seawater (-2°C) for a vessel fitted with holding water.
- The fish should be stored in shallow layers and surrounded by sufficient finely divided ice or with a mixture of ice and water before processing.

Handling of raw fish/seafood - Facility

- The facility for sorting and grading should be capable of maintaining the temperature of the fish and seafood at between 0°C to 4°C.
- Gutted fish and eviscerated seafood should be drained and well iced or appropriately chilled in clean containers and stored in specially designated and appropriate areas within the processing facility which maintain the temperature of the fish and seafood at between 0°C to 4°C.
- Fish fillets should be well iced or appropriately chilled in clean containers, protected from dehydration and stored in appropriate areas within the processing facility which maintain the temperature of the fish and seafood between 0°C to 4°C.

Handling of raw fish/seafood - Storage

- The core temperature of the frozen fish and seafood should be monitored regularly for completeness of the freezing process at a temperature of -18°C.
- The storage temperature is to be maintained at a constant -18°C or below.
- Shipping temperature is to be maintained at a constant -22°C or below but shipping temperature at -18°C or below is also acceptable.
- Storage facility should be capable of maintaining the temperature of the fish and seafood at or below -18°C with minimal temperature fluctuations. Ensure maximum holding temperature is not higher than -15°C or the core temperature of the fish and seafood does not exceed -15°C.
- Frozen fish should be packaged in close-fitting, moisture-proof packages.

Process (Packing/Re-packing) – Time, temperature control and Handling

- All machinery, equipment and devices in the production line, in a frozen fish and seafood plant should be properly and hygienically maintained and in good working order.
- A HACCP programme should be implemented to assess hazards and establish critical control systems that focus on prevention rather than relying principally on final-product testing.
- The temperature of the defrosted frozen fish and seafood shall not exceed -12°C. The fish and seafood shall be frozen immediately upon completion of the minimal processing.
- Processing room and packing room temperature should be maintained at 15°C or below to prevent frozen fish and seafood temperature fluctuation caused by ambient heat.
- All steps in the packaging process should be performed without delay and under conditions (e.g. chilled packing room) that will prevent contamination, deterioration and the growth of pathogenic and spoilage micro-organisms.
- The packaging material should be sound and should provide appropriate protection from damage and contamination

Distribution - Facility

- It is recommended that the traders and/or cold room operators are equipped with an anteroom at 15°C or below to facilitate the loading of cargo onto the refrigerated trucks.
- The interfacing area between freezer/anteroom door and truck door should be covered in order to prevent heat exchange between the ambient temperature and the freezer.
- Loading time into the refrigerated trucks should be limited to a maximum of 1hr (not more than 30 min if operator has no anteroom)
- Sorting and re-palletizing of frozen fish and sea food products in cartons could take place in the anteroom before uploading onto the refrigerated vehicles. It should be equipped with temperature recording devices.
- Prior to the loading of goods into the truck, it shall be pre-cooled to the temperature of -18°C or lower. Truck doors should be closed in the event of delay, to prevent excessive heat exchanges.
- The refrigerated trucks should maintain temperature of frozen fish and seafood during transportation at a temperature of -18°C or lower (brine frozen fish at -9 °C or lower)

Distribution – Unloading of goods

- Unloading of goods at DC or seafood factories
- Good should be unloaded immediately from refrigerated trucks upon arrival at the client's premises.
- Unloading time from refrigerated trucks to the cold room including checking time should be limited to a maximum of 1hr (not more than 30 min if operator has no anteroom)
- Unloading of goods at retail outlets
- Good should be unloaded immediately from refrigerated trucks upon arrival at the retail outlets.
- Unloading time from refrigerated trucks to the cold room including checking time should be limited to a maximum of 30 min.

Retail

- Retail outlets should designate a clean and hygienic area for the unloading and receipt of frozen fish and seafood, allowing proper verification of documents and checking of temperature.
- Freezer stores shall be maintained at -18 °C or below. The temperature in the horizontal, open freezer display cabinet or “island” freezer shall be maintained at -15 °C or below.
- Temperature for display cabinets should be monitored regularly (e.g. twice daily). It is recommended to retain records of temperature monitoring and verify the freezer temperatures with a temperature monitoring device regularly (e.g. weekly).
- All temperature monitoring devices should be calibrated annually.

Re-export

- It is recommended for the exporters and/or cold room operators to equip an anteroom at 15 °C or below to facilitate the loading of cargo onto the refrigerated container.
- The interfacing area between freezer door and container door should be covered in order to prevent heat exchange between the ambient temperature and the freezer.
- Loading time to the refrigerated container should be limited to a maximum of 2hr (40 ft) and 1 hr (20 ft) refrigerated container.
- In the case of sorting and re-palletizing at the ambient temperature environment, the maximum time should be limited to 60min (40 ft) and 30min (20 ft) refrigerated container.

Consumers

- Final link of the cold chain:
- Purchase of perishables such as chilled pork, frozen fish or seafood should be the last stop before going cash counter.
- Storage of meat, frozen fish or seafood in insulated bags with coolant blocks or return home immediately to deposit chilled product promptly into the home refrigerators
- Store the chilled pork between 0 to 4^{o}C, otherwise its shelf life will be shortened
- Frozen fish and seafood should not be kept out of the freezer for an excessive period of time. Freezer temperature should be maintained at -18^{o}C or below.
- Do not cross-contaminate between raw meat and cooked meat to prevent food poisoning





Cold Chain Management of frozen fish and seafood

- The following shows the summary of the temperature requirements:

Description	Temperature requirements
Ante room	15^0C or below
Refrigeration Truck for frozen fish	-18^0C or below
Refrigeration Truck for brine frozen fish	-9^0C or below
Freezer stores at retail outlet	-18^0C or below
Open freezer/island freezer at retail outlet	-15^0C or below

Common Types of Freezers/Chillers

Front Open / Closed Display

Front Open / Open Display

Open Top Chest Freezer

Open Top Island Freezer Counter

Common Types of Freezers/Chillers

Counter Top

Serve-over Display

Salad Bar Reefers

Stainless Steel Freezers

Under Counters

Display Cabinets

Functions: For displaying and preserving the content simultaneously

Characteristics of a Good Display

- Guarantee good product temperature control, whatever the external ambient conditions, and complying with standards
- Prove to be an efficient seller, so the foodstuff must be visible and easily accessible for the customer
- Cost effective, not only in terms of initial investment, but also in running costs; therefore, its energy consumption is extremely important
- Easy access for loading, this reduces the staff-hours required to re-stock the shelves

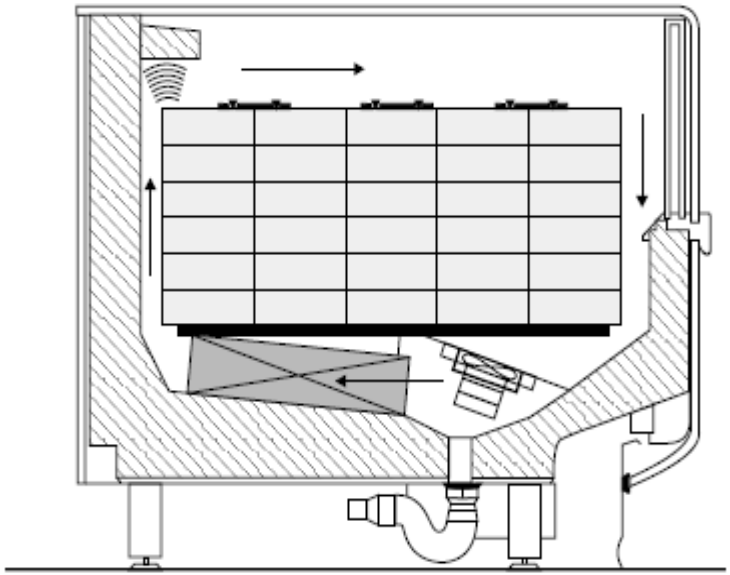
Freezers/Chillers Considerations

- Operating Temperature
- Internal Volume
- External Dimension
- Temperature Control
- Power Consumption
- Alarm/Visual Alerts
- Construction Materials
- Ambient Temperature
- Location of Compressor
- Modular Designs
- Ease of Cleaning
- Accessories e.g. trays & baskets
- Maintenance Cost
- Supplier Reliability

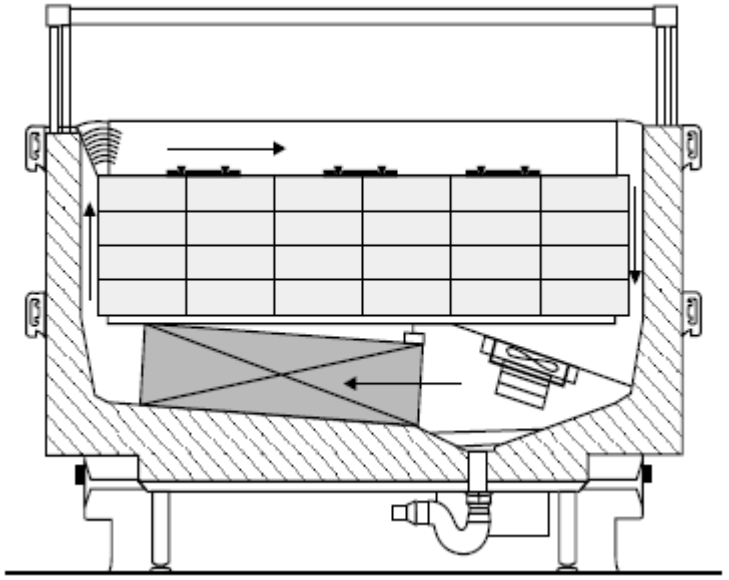
Design of Display Cabinets

- Open-top type
  - Designed for self-service
  - Wall-site unit would allow shopping from one side, while island unit can be accessed from all sides
  - Energy efficient as infiltration of ambient air is relatively insignificant
  - Heat mainly due to radiant heat transfer from surroundings; and convective and conductive heat transfer through walls of display
  - Not effective in terms of display as only the top layer of products is visible; customer has to bend over to pick up packages
  - Does not optimize space taken up

Open Top Display Cabinets



Wall-site unit

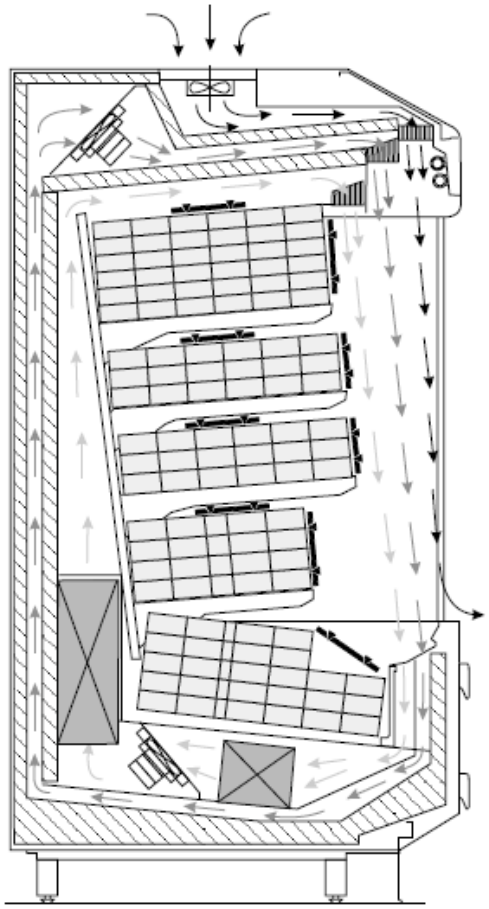


Island-type unit

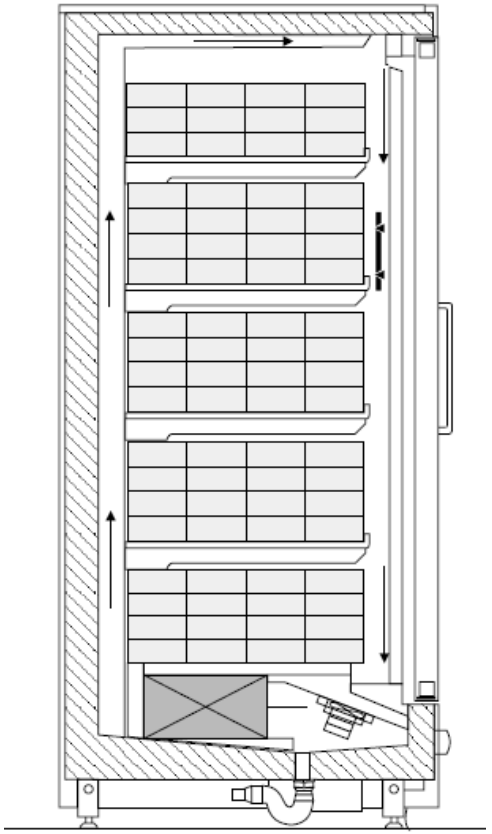
Design of Display Cabinets

- Open Front (Vertical type)
  - Multi-decked to save on space
  - Open front types are most effective in terms of storage efficiency; but is a source of ambient air infiltration, resulting in a high risk of temperature fluctuation and high energy consumption
  - Can be fitted with glass doors to prevent air infiltration
  - Glazing can be added to doors and treated with reflective layer to prevent convective flows and infrared radiant heat from the room
  - Unfortunately glass doors diminish the effectiveness of display function, since consumers need to open them to reach the product
  - While doors are open, incoming air humidity tends to condense on the inside of glass door as soon as it is closed; this can be overcome by triple-glazing the doors and having electric heaters with a de-misting function

Vertical Display Cabinets



Open front



Glass door

Display of Cold Products

- The layout of display is usually for the intention of facilitating First Expiry First Out (FEFO) picking by consumers.
- Consumers will usually pick the following:
  - Product at eye level
  - Product in front is usually picked first
  - Product in the center of the rack
  - Nearest the door opening of display equipment
- Sometimes hiding or facing the expiry date away from the consumer may result in consumer picking earlier expiry product

Positioning of Cabinets

- Cold display shelves should be placed away from direct sunlight, doors, windows, and air diffusers
- Open cabinets must be maintained in an air-conditioned environment,
- For retaining of food quality, frozen food must be located near check-out points, so that they are the last items to be picked up
- Segregation of food products
  - Muslim Halal food cannot be stored with non Halal food
  - Dairy Products cannot be stored with Meat
  - Ready to eat food / Cooked food cannot be stored with raw food

Display of Cold Products

Recommended display layout for open shelf freezer/chillers:

Where 1 is oldest and 5 is latest expiry date

Back

5	**5**	**5**	**5**	**5**
4	3	3	3	4
2	1	1	1	2

Front

Recommended display layout for closed display freezer/chillers:

Where 1 is oldest and 5 is latest expiry date

Back

5	**5**	**5**	**5**	**5**
3	3	3	4	4
1	1	1	2	2

Front Glass Door

Today's Problem

- Proper management of every link of the cold chain constitutes an integral part in the production, storage, transportation of the wholesome and safe chilled and frozen meat to the consumer
- Refer to SS 552 : 2009 as all chilled meat has to comply according to the guidelines stated in the standards
  - This is to ensures the safety, wholesomeness and quality of the chilled/frozen meat is of the highest quality
  - E.g. Chiller store temperature shall be maintained at 0^{o}C – 4^{o}C
- Refer to TR: 49:2016 for storage and retail display requirements for minimally processed frozen fish and seafood.

Today's Problem

- To decide on a suitable display equipment for the frozen / chilled items, consideration should be made on:
  - the type of food and
  - their temperature requirement
  - together with the marketing strategy and space constraint in the supermarket
- Display shelf such as Front Open/ Open Display and Serve-Over Display are recommended as they are able to maintain the temperature better.
- Frozen / chilled food display can be located close to the check-out area to maintain the quality of the food

Learning Objectives

- Interpret SS 552: 2009 of Code of Practice for Cold Chain Management of Chilled Pork
- Recognize and discuss the advantages of adoption of SS 552: 2009
- Identify the six main links in the cold chain management of chilled pork
- Interpret the Technical Reference TR 49: 2016 for Cold Chain Management of Frozen Fish and Seafood
- Describe the different freezers/chillers for retailing of cold product
- Plan the display of cold products and positioning of cabinets