

Reefer Training Course



Reefer Technician Course

- Subject Candidates: Trainee Fitters, Junior Engine Officers
- Duration : 5 days
- Objectives of the Training
- After completion of the training, the trainees should understand the following:
- 1) Personal safety and safe working practice in Reefer containers
- 2) Storage of food supplies, Heat transfer in reefer container
- 3) Refrigeration cycle
- 4) The structure of each component
- 5) Introduction to Reefer Container
- 6) Maintenance works, Gas Charging , Purging, Leak detection including proper use of tools
- 7) Trouble response
- 8) Refrigeration Simulator practical

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Quality Maritime Education

Contents of the course

- 1.1 Personal safety and safe working practice
- 1.2 wear Goggles or safety glasses when handling refrigerants
- 1.3 Never close compressor discharge valve with refrigeration unit in operation
- 1.4 Never apply heat to a sealed refrigerant system or container
- 1.5 refrigerant gas tends to displace air and cause oxygen depletion, resulting in suffocation and possible death
- 1.6.precautions when handling refrigerant oil
- 1.7 Electrical safety when working on refrigerant unit
- 1.8 Use of safety Data Sheet for refrigerant and refrigerant oil

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TECHN ▲ICS Training Institute LLP Quality Maritime Education

Contents of the course

- 2.1 Storage of food supplies, Heat transfer in reefer container
- 2.2 Heat from maturation and fresh air
- 2.3 Types of reefer cargo and care
- 2.4 Basic guideline for handling reefer container

TRAINING INSTITUTE LLP UNALITY MARITIME EDUCATION CONTENTS of the course

- 3. Refrigeration Cycle and Refrigerant
- 3.1 Refrigeration cycle
- 3.1.1 Physical basis of working, Heat measurement, Latent heat ,sensible heat, specific heat, superheat ,sub cooling terms as used in ref cycle
- 3.1.1 Compression
- 3.1.2 Condensation
- 3.1.3 Expansion
- 3.1.4 Vaporization
- 3.1.5 Simple Practical Cycle
- 3.1.6 How to draw a refrigeration Cycle

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TRAINING INSTITUTE LLP ULALITY MARITIME EDUCATION Contents of the course

- 4.1The structure and Basic knowledge of equipment
- 4.2 Compressor
- 4.3 Condenser
- 4.4 Receiver
- 4.5 Expansion valve
- 4.6 Evaporator
- 4.7 Accessories and other components

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Contents of the course

- 5. Introduction to Reefer Container
- 5.1 Outline of Reefer Container
- 5.2 Why Reefer container controlled Atmosphere(CA)
- 5.3 Safety devices
 - De-frost device and control circuit
- 5.4 Check points of Reefer Container during loading on board
- 5.5 Check points of Reefer Container at sea
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Contents of the course

- Trouble Response
- Compressor Motor Burn out
- Faulty High pressure switch
- Low Suction Pressure
- Filter Dryer Faulty, Chocked
- Shortage of Refrigerant
- Leakage of Refrigerant

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Contents of the course

- 8.1 Practical Training
- 8.1.1 Demonstrate use of gauge manifold
- 8.1.2 Use of Low pressure and High pressure switch
- 8.1.3 Use of compound gauge
- 8.1.4 System layout and description of system





Never apply heat to a sealed refrigerant system or container.

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- Fluorocarbon refrigerants in presence of open flame or electrical arc produces toxic gases that are severe respiratory irritants capable of causing death.
- Be sure that all mounting bolts are tight and are of correct length for their particular application
- Use extreme caution when drilling holes in unit. The holes may weaken structural components. Holes drilled into electrical units may cause fire. Holes drilled in to refrigerant unit may cause leakage of gas.
- Use caution when working around exposed coil fins. The fins can cause painful lacerations.



Personal Safety while working on Reefer Container

- Use caution when working with refrigerant or refrigerant system with any closed confined area with limited air supply (for example trailer, ship container or ship hold) as refrigerant gas tends to displace air and cause oxygen depletion, resulting in suffocation and possible death
- Use caution and follow manufactures suggested practice when using scaffolding and ladders
- When exposed to atmosphere in their liquid state, fluorocarbon refrigerant evaporate rapidly, freezing anything they contact
- First Aid: In the event of Frost Bite the objective of First Aid is to protect the frozen area from further injury, to warm the affected area rapidly and to maintain respiration
- EYES: Contact with liquid immediately flush eyes with large amount of water and get prompt medical attention

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Personal Safety while working on Reefer Container

- SKIN : contact with skin flush area with large amount of lukewarm water.Do not apply heat. Remove contaminated clothing and shoes. Wrap burns from frost bite with dry sterile bulky dressing to protect form infection and injury.Get Medical aid
- INHALATION: Move victim to fresh air and use CPR or mouth to mouth ventilation if necessary. Stay with victim until medical assistance arrive.

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Precautions for Ref OIL

- Refrigerant OIL handling
- Observe the following precautions when handling refrigerant oil:
- Do not allow refrigerant oil to contact your eyes
- Do not allow prolonged or repeated contact with skin or clothing
- To prevent irritation you should wash thoroughly immediately after handling refrigerant oil. Rubber gloves are recommended when handling Polyol Easter based refrigerant oil.



Precautions for Ref OIL

- When compressor is removed from the unit , oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be maintained in the replacement compressor.
- DO not use standard synthetic or mineral oil to the refrigeration system. If Easter based oil becomes contaminated with moisture ,or motor burn out contaminants, dispose off properly –DO NOT USE!!

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Electrical safety

- Electrical safety :
- When servicing or repairing refrigerant unit ,the possibility of severe or even fatal injury from electrical shock exists.
- Lethal voltage potential can exist in the power cord, inside the control box, inside any high voltage junction box,, at the motors ,and within wiring harness.
- PRECAUTIONS:
- Be certain that unit ON/OFF switch is switched OFF before connecting or disconnecting the refrigeration unit power plug
- Be certain the unit power plug is clean and dry before connecting to power source.
- Precautions for serving units where microprocessors are fitted:
- Be careful of electrostatic discharge as this may cause significant damage to electronic components of the ref unit

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Precautions for Welding

- Precautions against welding of units: Whenever electric welding is to be performed on any portion of the refrigeration unit container or container chassis with the refrigeration unit attached it is necessary to ensure welding current are not allowed to flow through the electronic circuits of the unit
- . Procedures must be followed. .Disconnect all power to the electrical unit.





TOROUE TECHNICS TRAINING INSTITUTE LLP TRAINING INSTITUTE LLP Storage of food supplies

- Understanding the conditions needed for storage of perishable food
 products
- Recent data shows that there is large amount of food product loss. Globally approximately one –third of all food produced for human consumption is lost or wasted.
- There are several methods to store perishable food products
- The products can be salted, dried, laid in sugar, smoked, cooked, pickled, packed in vacuum and even buried in the ground. All of these methods change the quality of the products.
- The products will not appear as fresh food after any of these treatments and they will change shape and colour.
- As an alternative cooling and freezing can be used as storage methods

TECHN ICS TRAINING INSTITUTE LLP OUALITY MARITIME EDUCATION Storage of food supplies

If meat has to be stored for a longer period, it has to be placed in a room where the temperature ,depending on the kind of meat, is kept in the range from-10degC to -30degC

Table shows storage temperature:

Kind of Meat	Short Time Storage	Long Time Storage
Poultry	-1.0 degC	-22/-18degC
Fish	+1.1degC	-22/18degC
Lamb	-1/0degC	-18/-12degC
Beef	-1/+1.5degC	-22/18degC

The above table shows that the needed temperature ,when storing foodstuffs, amongst other things is dependent on storage time and kind of food.

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- For maximum storage life, the storage temperature and the pre treatment of the product have to be ideal. Both too high and too low temperature will shorten the storage life of the commodities.
- heat will be transferred from the outside air through the insulation on the walls to the storage room in accordance to the temperature difference
- If there is no refrigeration unit in the storage room to remove the transferred heat, then the temperature in the room will increase until it remains the same as the outside air temperature.

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Heat

- Heat is a form of energy, primarily created by the transformation of other type of energy into heat energy.
- The measurement of temperature has no relation to the quantity of heat.
- The basic unit of heat measurement is either joule or watt in the metric system



Sensible heat equation: Q = m XC X (T2-T1) Where Q is heat ,or enthalpy in joules m = mass of substance C= Specific heat of a substance T2=Final temperature T1=Initial temperature T0rque Technics Training Institue Mumbai

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Latent Heat

 Latent heat of evaporation; a change of a substance from liquid to vapour or from vapour back to liquid involves latent heat of evaporation. Since boiling is only a rapid evaporating process it is also called the latent heat of boiling or for the reverse process the latent heat of condensation

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Latent heat

 Latent heat of fusion :a change of a substance from solid to liquid ,or from liquid to solid involves the latent heat of fusion. when one kilo of ice melts it absorbs 335 K joule of heat and if one kilo of water is to be frozen into ice it has 335 K joule of heat to be removed

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Latent Heat

 When one kilo of water boils or evaporates it absorbs 2257.9Kjoule and to condense steam to one kilo of water 2257.9 Kjoule heat must be extracted from it.

Reefer Container



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If container controls are set for freezing the ventilation shaft must always be closed.



If the container is set to freezing, the ventilation hatch should be closed at all times.



Reefer Container

- General Description:
- Reefer container is an all-electric, one piece, self contained refrigeration unit with bottom air discharge each unit is designed to cool and heat large containers for shipboard or overland transit.
- Each refrigeration unit is equipped with 60 ft power cable for operation on 460-380VAC/3ph/60-50Hz

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- An automatic phase correction system provides the proper electrical phase sequence for compressor, condenser fan and evaporator fan motor operation
- Unit features include a semi hermatic compressor with liquid injection system.
- A water cooled condenser receiver tank







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TORQUE TECHNICS UTAINING INSTITUTE OF TOT Food Stuff

- Heat From Maturation and Fresh Air
- Example; Respiration Reaction inside fruit such as apple:
- [C6H12O6 + 6O2 = 6CO2 + 6H2O + HEAT]
- [Glucose is a 6-carbon structure with the chemical formula C6H12O6. It is all over as source of energy for every organism in the world and is essential to fuel both aerobic and anaerobic cellular respiration.]
- Commodities such as fruits and vegetables are all living organisms where the internal processes (chemical and biological) will continue after harvesting. The respiration process will continue, which means they will absorb oxygen(O2) from the surrounding atmosphere and give off carbon dioxide (Co2). This process generates heat, called maturation heat, which is one of the reasons for an increase in the

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Example of Reefer Container Specification

Air Cooled Condensing

Return air to	460/230V, 3 Phase, 60 Hz Power			380/190V, 3 Phase, 50 Hz Power				
evaporator	Net Cooling Capacity		Power Consp	Net Cooling Capacity			Power Consp	
coll Inlet	Watts	Kcal/hr	BTU/hr	kW at 460V	Watts	Kcal/hr	BTU/hr	kW at 380V
1.7 C (35 F)	10,700	9,202	36,520	10.4	8,560	7,362	29,216	8.22
-17.8 C (0 F)	5,600	4,816	19,115	5.7	4,480	3,853	15,292	4.50

*System net cooling capacity with a 37.8 C (100 F) ambient air temperature and R-134a.

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Example of Reefer Container Specification

Evaporator Airflow	zvaporator Airflow							
External Static	460/2	30V, 3 Pha	se, 60 Hz P	ower	380/1	90V, 3 Phas	e, 50 Hz P	ower
Pressure (water	High	High Speed Low Speed			High	Speed	Low Speed	
column)	m³/hr	ft³/min	m³/hr	ft³/min	m³/hr	ft³/min	m³/hr	ft³/min
0 mm (0 in.)	6,560	3,860	3,170	1,865	5,500	3,240	2,730	1,608
10 mm (0.4 in.)	5,870	3,458	1,770	1,040	4,630	2,727	950	560
20 mm (0.8 in.)	5,000	2,940	_	_	3,760	2,215	-	_
30 mm (1.2 in.)	4,430	2,610	_	_	2,980	1,755	1	_
40 mm (1.6 in.)	3,640	2,144	-	-	1,880	1,108	-	-

TORQUE TECHNICS UTRAINING INSTITUTE LLP OULLITY MARITIME EDUCATION Reefer Container Cargo

KNOWING YOUR CARGO

Maintaining freshness is of utmost importance during shipment. Perishable commodities need to be shipped under optimum conditions to ensure they arrive in prime form. Perishable commodities can be broadly categorized as:

Chilled cargo	Frozen cargo	Special and miscellaneous cargo				
Fresh fruit and vegetables	Frozen meats and poultry	Chemical and biological products				
Fresh meats, poultry and seafood	Frozen prepared foods	Batteries				
Dairy products and eggs	Frozen concentrates	Photographic film and materials				
Fresh juices	Frozen fruits and vegetables	Pharmaceuticals				
Confectionery products	lce-cream	Tobacco products				
Bulbs, live plants and cut flowers	Frozen seafood	Live animals e.g. bull frogs				



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Chilled Cargo

Chilled Cargo

Chilled cargo refers to commodities which need to be shipped above product freezing temperatures. Some chilled cargoes are more sensitive than others because their characteristics and the factors affecting their shelf lives vary. Other chilled commodities have relatively short shelf lives and require careful attention during transportation.

Reefer containers will automatically control refrigeration using the supply air sensor to detect and manage temperatures within a 0.5°C (0.9°F) range, or better, under most conditions.

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TORQUE TECHNICS TRAINING INSTITUTE LLP OUALITY MARITIME EDUCATION Types of Chilled cargo

Types of chilled cargo include:

- Fresh fruit and vegetables
- · Fresh meats, poultry and seafood
- Dairy products and eggs
- Fresh juices
- Confectionery products
- Bulbs, live plants and cut flowers



Frozen Cargo

Generally, frozen cargo refers to commodities or food stuffs which need to be shipped and stored at -20°C (-4°F), the optimum temperature for protection against spoilage and the growth of disease-forming organisms.

Certain frozen cargo needs to be transported at temperatures lower than -20°C (-4°F) to maintain quality, texture and flavor. Commodities with a high fat content, such as ice-cream and surimi, should be transported at -26.1°C (-15°F) or lower.

Low temperatures preserve the quality of frozen food (e.g., aroma, flavor, texture and appearance) and protect it from spoilage. However, proper temperature management of frozen commodities can only be achieved if the products are properly frozen, packaged and correctly stowed for transit.

Types of frozen cargo include:

Frozen meats, poultry and seafood
Frozen prepared foods

Frozen concentrates

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TORQUE TECHNICS ULLITY MARTING INSTITUTE CALIFORNIA Shipment Information

Booking

During the booking process, customers should provide the following critical shipment information:

- Product(s) being shipped
- Origin and destination
- Quantity, weight and cubic measurement
- Type of packaging: boxes, drums, pallets, hanging carcass, etc.
- Preferred carrying temperature (specify in °F or °C)
- Fresh-air exchange requirements (specify in cfm or cmh)
- Preferred relative humidity setting (specify in %)
- Regulated or controlled atmosphere requirements
- Available pick-up date at origin
- Required delivery date at destination
- Special handling requirements (e.g. cold treatment)

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Cargo check by : Satellite Monitoring and Remote Temperature Tracking



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