

## Hybrid Refrigeration System Onboard



Southeast Asian Fisheries Development Center/Training Department (SEAFDEC/TD) undertaking the design and construct of the onboard refrigeration system use for the training vessel namely M.V. PLALUNG by adopted the hybrid technology that can use multi-mode of operation source e.g., from propulsion engine or diesel generator or electricity from the shoreline. In addition, to provide various types of preservation tools onboard more suitable of the fishing gear and target species consisting of Refrigeration Seawater (RSW) and Airblast system. Or use both of RSW and Airblast system in unison. To prolong the freshness at the premium quality onboard base on energy utilization.

### Refrigeration Sea Water (RSW)

Refrigeration Seawater (RSW) is the system are used onboard fishing vessels to preserve freshness. The advantage of the RSW system is both the cost-saving and preserve the catch at premium quality until unloading fish ashore or further processing. Improve cooling efficiency and faster than the use of ordinary ice or the limitation of ice, the catch is cooled down close to the freezing point, to ensuring freshness and fresh quality during transportation onboard.

### Airblast freezer

The use of air flows to improve heat transfer from the product being cooling to the refrigeration system is probably the most common method used in commercial fishing vessels. The natural convection of the air alone would not give a good heat transfer efficiency, therefore, forced convection using fans has been introduced. To enable the product to reach the point in a reasonable time the airflow rate should be fairly high (2-6 m/s). Also, to obtain uniform cooling rates throughout

the freezer, the airflow requires to flows over each fish or fish container.

### Power take-off (PTO)

The power take-off is any of several methods for taking power from a power source, such as the main engine and transmitting it to an application such as a water pump, Hydraulic pump, and/or compressor for the refrigeration system. Usually, the refrigeration system whether in an industrial or on a fishing vessel that uses an energy source to drive the compressor which is either an electric motor or engine to drive the compressor for the refrigeration system but in the M.V.Plalung is a training vessel of SEAFDEC/TD. It is designed to use more than one type of energy source which consisting of ① Main engine ② Electric motor.

### Split shaft power take-offs

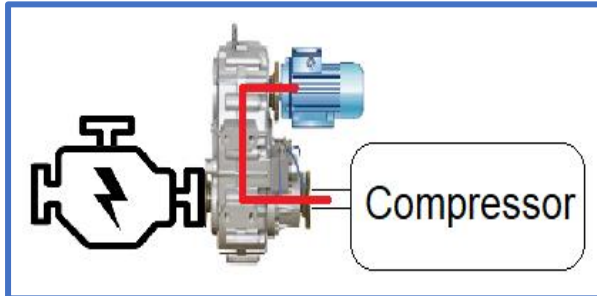
In a fishing vessel, the propulsion engine or diesel generator has greater power delivering and a relatively steady amount of torque at both high and low running speeds. Consequently, the propulsion engine or diesel generator able to drive the compressor for refrigeration by providing enough power take-off as a mechanism to bring its power from at operating speed, therefore just properly matched with the requirement for the refrigeration unit as utilized as the power source. Split shaft power take-offs have many advantages, which can make it an excellent option to capitalizing on the full potential for fishing vessels. The Split shaft power take-offs are equipment as gearbox or power take-off application to allows a single or multiple pumps to be driven from a single prime mover. This Multiple/split type power take-off is a combination of different propulsion technologies. In the Hybrid transmission system, an electric motor performs a function in place of the engine, such as exerting force to the transmission shaft.

### Advantage of split shaft power take-offs

- Multiple outputs.
- Various styles and sizes.
- Standard PTO is driven by pulley for versatility.
- A shiftable compressor can drive both of electric motor and main engine.
- Finally, utilization of fuel efficiency and cost beneficially.
- Waste reduction from fish preservation onboard

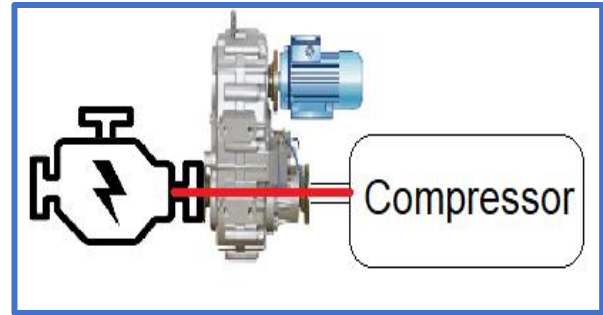


① Hybrid refrigeration system driven by the electric motor



In general, the compressor of the refrigeration system is driven by an electric motor. Which the size of the motor depends on the cooling capacity or cooling efficiency of the compressor. This means that a lot of electricity is needed from the diesel generator. Hence, the demands for electricity are defined as fuel consumption. In case of a fishing vessel moored at the fishing port/jetty. Able to operate the refrigeration system via the electric motor. This is because fishing vessels must run the diesel generator ordinarily or utilize the shoreline power source by the main engine stop. But whenever the fishing vessel leaves the pier/port, and the main engine is in use. The refrigeration system can change the mode of operation to engine mode to drive the compressor.

② Hybrid refrigeration system driven by the propulsion engine



The merit of the refrigeration system is driven by the propulsion engine. Whenever the fishing vessel leaves from the fishing port to the fishing ground or fishing period, will take time to operate the engine. Therefore, using the engine drive mode will result in energy utilization without the need for sources from a diesel generator.

