MetaFridge™ Protected by ColdSafe™ Technology

The MetaFridge vaccine refrigerator does not depend on direct contact with ice to provide controlled cooling. Instead, it uses an insulated block of ice—or ice bank—to create a steady feedback system that maintains a safe temperature range for storing vaccines, even during a power failure.

ColdSafe Technology works by using a precisely tuned thermo-syphon to conduct heat away from the vaccine chamber, keeping the temperature between 2-8 °C. During a power failure, the system can maintain this temperature without moving parts or electricity for as long as 5 days.

The thermo-syphon consists of a roll-bonded aluminum sheet with liquid-filled vapor channels that is wrapped around the vaccine chamber. As the liquid absorbs heat from the vaccine chamber, it turns to vapor and rises to the top of the thermo-syphon. This rising vapor is cooled by the ice block that sits just above the vaccine chamber. When the vapor condenses back into a liquid, it releases its absorbed heat and falls back through the channels, cooling the vaccine chamber.

A fully frozen ice-block in a MetaFridge will provide reliable and perfectly calibrated cooling in the storage chamber for up to 5 days in ambient temperatures as high as 43 °C without any electricity as long as the vaccine chamber is sealed and the ice tank is properly insulated.

ColdSafe Technology mimics the Earth's own water cycle where water evaporates from a warm ocean to form clouds of vapor at colder elevations, which then condenses and falls to the sea as cooling rain.

CS COLDSAFE™ Technology

Inventing for Humanitarian Impact

Millions of people suffer and die each year in poor countries from causes that humanity has the scientific and technical ability to solve. Funded by Bill Gates and focused on a shared vision with Nathan Myhrvold, Global Good invents technology to solve some of humanity's most daunting problems. We do this by collaboration with leading humanitarian organizations, forward-looking governments, research institutions, and corporate and private sector partners that bring our inventions to market.

Reliable Vaccine Storage in Unreliable Power Conditions

- Maintains vaccines at 2-8 °C using patented ColdSafe Technology
- Allows 5 days of holdover at 43 °C ambient temperature
- Operates on less than 2 hours of power per day
- Reaches safe storage temperature within 6 hours after installation
- WHO PQS Grade-A user-independent freeze protection

Integrated Power Protection

- Integrated protection during voltage spikes and brown-outs
- Internal voltage stabilizer allows operation with a wide range of voltage inputs

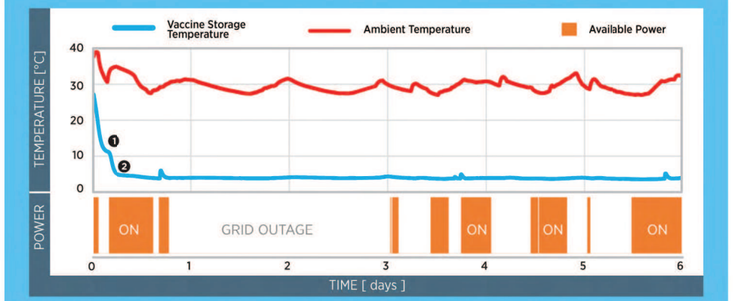
Onboard Monitoring

- Measures and records performance data to enable diagnosis of issues
- Holdover indicator allows users to proactively protect vaccines
- Visual and audible alarms report temperature excursions or an improperly closed door
- Integrated 30 DTR display shows temperature and alarm history
- Optional telemetry module enables remote monitoring and alerts

Smart Design, Durable Construction

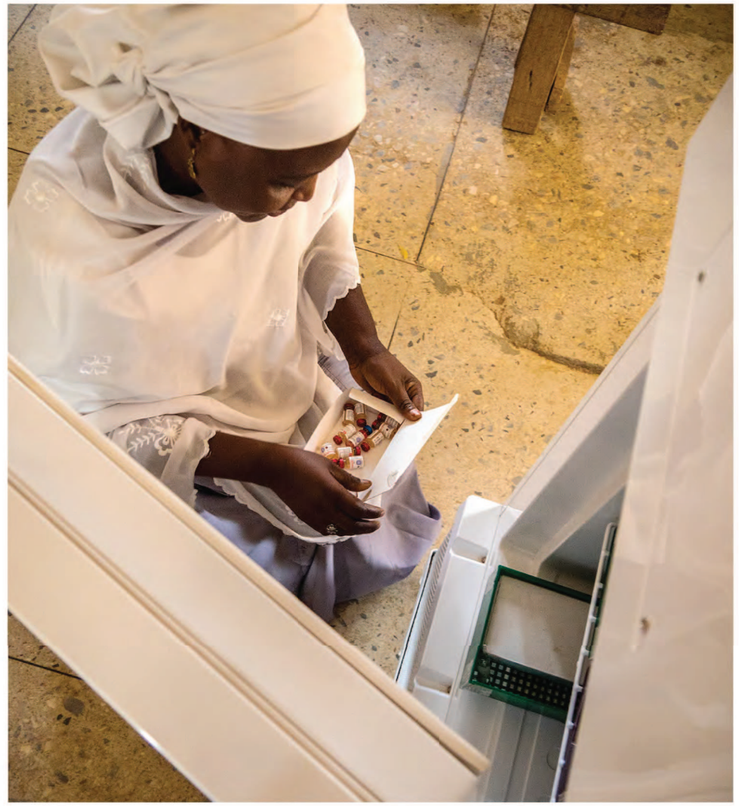
- Upright and front-opening for easy access
- Compact form factor and lifting handles allow easy transport
- Integrated plastic base prevents corrosion from wet floors
- Condenser guards and rodent-proof grates protect components

Field Testing and Performance Data



1. Vaccine chamber temperature reached 2-8°C within 4 hours of installation.
2. After 6 hours of power, unit built up multiple-days of holdover and continued to operate within spec despite multiple power outages over following days.

- More than 40 units were tested in Kenya, Nigeria, and Ethiopia for 3-6 months, all with remote monitoring
- Units were installed in urban and rural areas typically served by Solar Direct Drive units
- 99% of reported fridge temperatures were between 2-8 °C:
  - Temperature excursions were due to frequent or prolonged door openings and power outages of more than 7 days
  - Local users were alerted by holdover indicator ahead of outage-related excursions and were able to relocate vaccines
- Units operating in Kenya with moderate ambient temperature averaged 45 minutes per day of compressor run time

MetaFridge™
VACCINE REFRIGERATION

Safe, Rugged, Reliable in the Real World