

CARGO HANDLING EQUIPMENT AT PORTS




Ports, which are critical to trade and economic vitality, depend on a wide range of vehicles and machinery to move goods. Cargo handling equipment (CHE) is central to port operations.

The range of CHE is vast. For material arriving at and departing from ports in shipping containers (container cargo), CHE includes top handlers, side handlers, reach stackers, straddle carriers, gantry cranes, forklifts, terminal tractors, and yard trucks. Bulk cargo, ranging from steel and lumber to cement and salt, is handled with loaders, cranes, and forklifts.






Historically, most port equipment has been powered by diesel or gasoline, with emissions contributing to poor air quality affecting not only port workers but also those who live and work in neighboring communities. Diesel- and gasoline-powered port equipment also produces greenhouse gas emissions, contributing to climate change.






Increasing, CHE may be powered by alternative fuels, such as electricity, hydrogen, compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG). This fact sheet describes CHE types, their functions, and the fuel types currently available to power them.


Cargo Handling Equipment and Fuel Types

Equipment	Example(s)	Description	Fuel Types
Automated Guided Vehicle	 Shutterstock 1812970162	Automated guided vehicles (AGVs) use guidance technology (guide wire, lasers, cameras, etc.) to transport cargo without an onboard driver. AGVs used for freight transport typically have freight-handling capabilities similar to either small forklifts or yard trucks.	Electric
Chassis Rotator	 Photo courtesy of Big Red, Inc.	Chassis rotators are heavy-duty forklift trucks with a "flipper" attachment used for handling and storage of container chassis. Chassis are rotated so they can be stored in configurations that minimize space use and potential for damage. Also known as chassis flippers.	Diesel
Container Crane	 Shutterstock 739896253	Container cranes are a type of large dockside gantry crane found at container terminals and used for loading and unloading intermodal containers from container ships. Also known as ship-to-shore (STS) cranes, STS gantry cranes, harbor cranes, or container-handling gantry cranes.	Diesel Electric



Equipment	Example(s)	Description	Fuel Types
Forklift	 <p>Shutterstock 1512392330</p>	<p>Forklifts are powered industrial trucks that use two forks attached to a mast to lift and move materials over short distances. They are diverse in size and lift capacity, ranging from 1 to 40 tons. Types include pallet jacks, warehouse lifts, side loaders, top lifts, reach stackers, and rough terrain lifts.</p> <p>Also known as lift trucks or fork trucks.</p>	Gasoline Diesel CNG LPG Electric Fuel cell
Log Stacker	 <p>Source: https://commons.wikimedia.org/wiki/File:Logging_Port_Chalmers.jpg </p>	<p>Log stackers transport logs or similarly shaped materials using a hydraulically powered claw with two or more opposing levers, known as a grapple.</p>	Diesel
Material Handler	 <p>Photo courtesy of Sennebogen LLC</p>	<p>Material handlers transport materials using an interchangeable attachment. Often cables are wrapped around cargo and attached to a bar or hook, allowing the material handler to operate much like a crane.</p>	Diesel Hybrid Electric
Mobile Crane	 <p>Shutterstock 260356430</p>	<p>Mobile cranes run on either wheels or tracks and use hoist ropes and a hook to lift and lower heavy objects and transport them.</p>	Diesel Electric
Pallet Jack	 <p>Shutterstock 625194704</p>	<p>Pallet jacks are used to lift and move pallets. Pallet jacks are the most basic form of a forklift and are intended to move pallets within a warehouse.</p> <p>Also known as pallet trucks, pallet pumps, pump trucks, scooters, dogs, or jiggers.</p>	Electric

Equipment	Example(s)	Description	Fuel Types
Reach Stacker	 Shutterstock 1845086836	<p>Reach stackers use an overhead attachment on a telescopic boom to move and stack loaded containers. They can reach over multiple rows to load containers.</p>	Diesel Electric
Rubber-Tired Gantry Crane	 Shutterstock 652261168	<p>Rubber-tired gantry (RTG) cranes use a cross-beam supported on vertical legs that move on rubber tires to move and stack loaded containers. A rail-mounted gantry (RMG) crane is similar to an RTG and typically used in larger operations.</p>	Diesel Hybrid Electric
Side Handler	 Shutterstock 1804967983	<p>Side handlers use an overhead telescopic boom to lift and move cargo containers sideways by "grabbing" the sides or top and bottom of the longest side of a container. They are used to move and stack empty containers.</p> <p>Also known as side loaders, side picks, or empty container handlers.</p>	Diesel LPG Electric
Straddle Carrier	 Shutterstock 302933312	<p>Straddle carriers move a container by straddling it and lifting from the top. They can stack up to four containers. Their advantage is their ability to move containers without the assistance of cranes or forklifts.</p> <p>Also known as saddle trucks.</p>	Diesel Hybrid Electric
Terminal Tractor	 Shutterstock 671684932	<p>Terminal tractors are semi-tractors used to move containers on semi-trailers within a cargo yard, warehouse facility, or intermodal facility.</p> <p>Also known as shunt trucks, spotter trucks, spotting tractors, utility tractor rigs (UTRs), yard trucks, yard tractors, yard shifters, yard birds, yard dogs, yard goats, yard horses, yard jockeys, and mules.</p>	Gasoline Diesel CNG LNG Electric

Equipment	Example(s)	Description	Fuel Types
Top Handler	 <p>Photo courtesy of Kalmar</p>	<p>Top handlers use an overhead attachment on a straight mast to move and stack loaded containers. They can be used in place of or in conjunction with RTGs to lift heavy containers within a terminal.</p> <p>Also known as top loaders, top picks, top lifts, and loaded container handlers.</p>	Diesel Electric

Cargo Handling Equipment and Fuel Types

Equipment	Gasoline	Diesel	CNG	LNG	LPG	Hybrid	Electric	Fuel Cell
Automated Guided Vehicle							✓	
Chassis Rotator		✓						
Container Crane		✓					✓	
Forklift	✓	✓	✓		✓		✓	✓
Log Stacker		✓						
Material Handler		✓				✓	✓	
Mobile Crane		✓					✓	
Pallet Jack							✓	
Reach Stacker		✓					✓	
Rubber-Tired Gantry Crane		✓				✓	✓	
Side Handler		✓			✓		✓	
Straddle Carrier		✓				✓	✓	
Terminal Tractor	✓	✓	✓	✓			✓	
Top Handler		✓					✓	

Other Resources

- U.S. Environmental Protection Agency, "Cargo Handling Equipment (CHE) Best Practices to Improve Air Quality": <https://www.epa.gov/ports-initiative/cargo-handling-equipment-che-best-practices-improve-air-quality>
- California Air Resources Board, "Cargo Handling Equipment": <https://ww2.arb.ca.gov/our-work/programs/cargo-handling-equipment>
- Argonne National Laboratory, AFLEET Tool: <https://afleet.es.anl.gov>

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