

# LNG Handling and Facilities



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# Overview

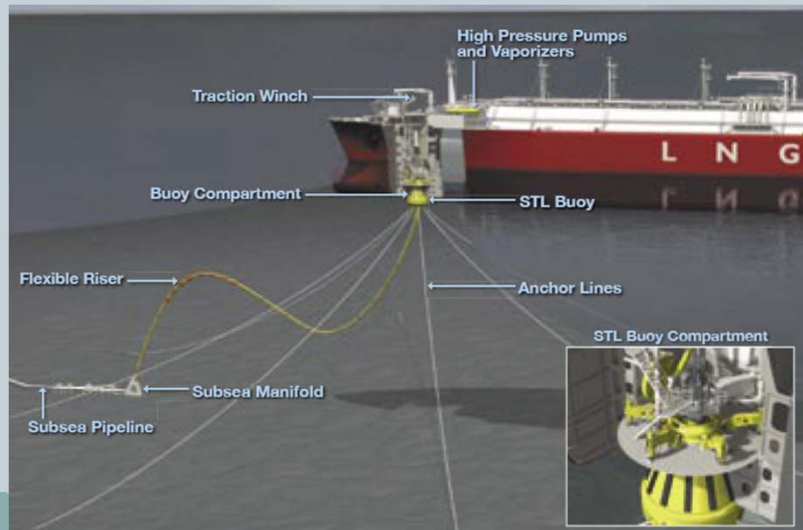
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- **LNG cargo handling**
- **Sea cargo transfer**
- **Loading arms**
- **Regasification equipment**

# LNG cargo handling

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- Ship either tied to a pier *or* anchored at sea
- LNG offloaded either in gaseous or liquefied state
- LNG pipes or mooring buoy facilitates cargo transfer
- NG vapour return line needed for liquid NG pumping
- Avoid gas hydrates during subsea pumping
- Equipment ought to withstand thermal cycling



# STS cargo transfer

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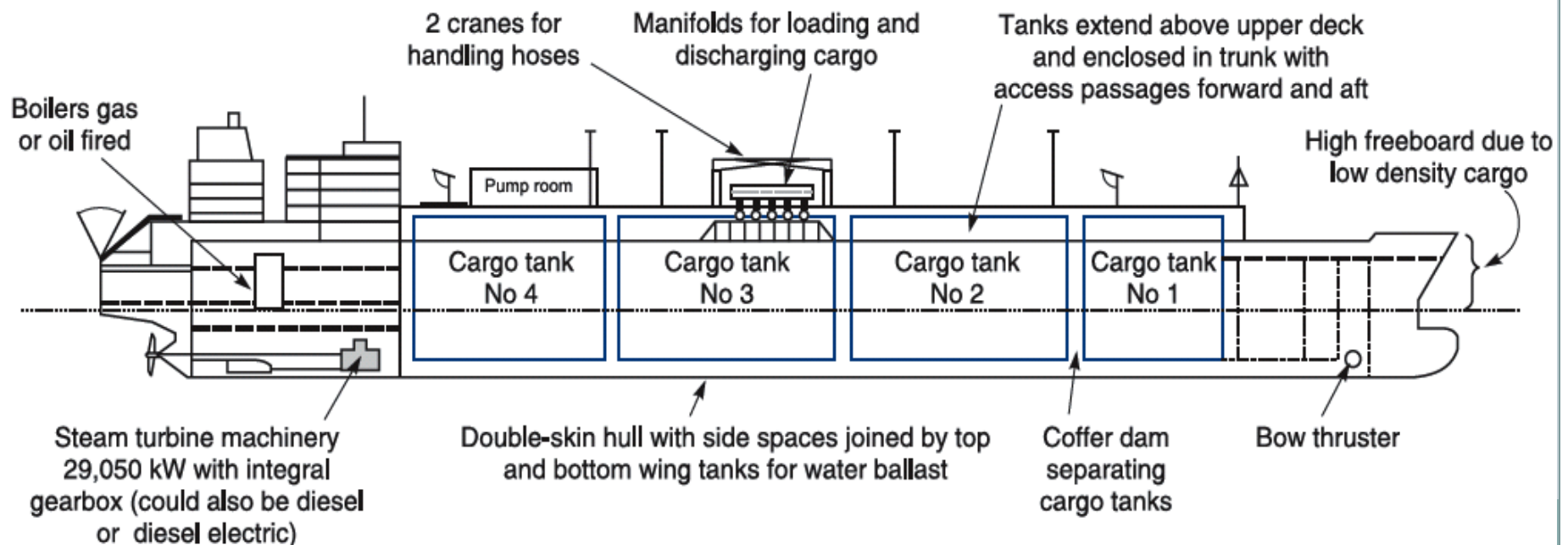
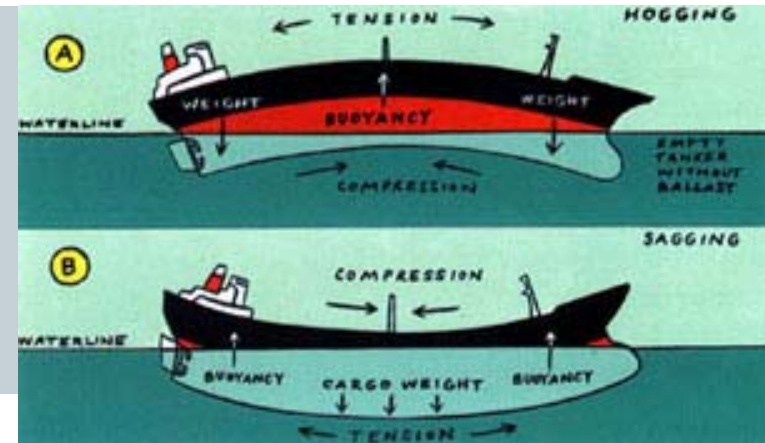
- Transfer of cargo btw two anchored, moored or drifting vessels
- Not to be confused with naval *underway replenishment*
- Extensively used in industry for oil/products transfer
- Pneumatic *fenders* facilitate STS: avoid metal contact, min. friction & absorb motions



# Sea LNG cargo transfer

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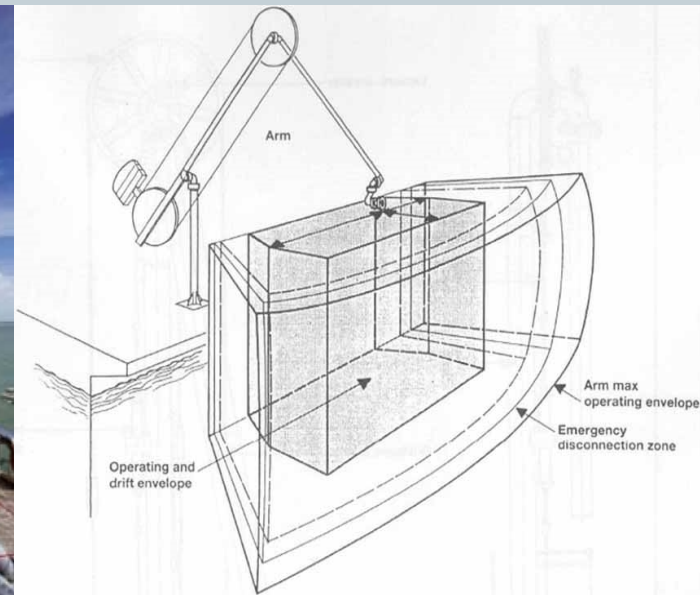
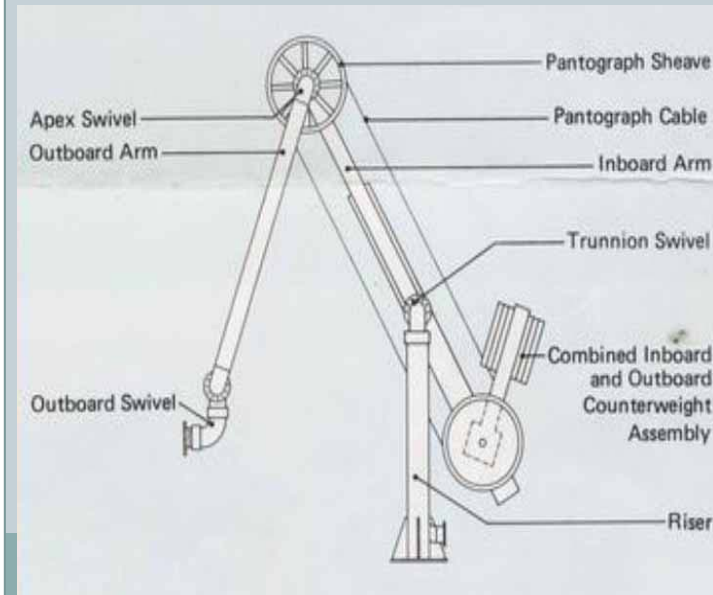
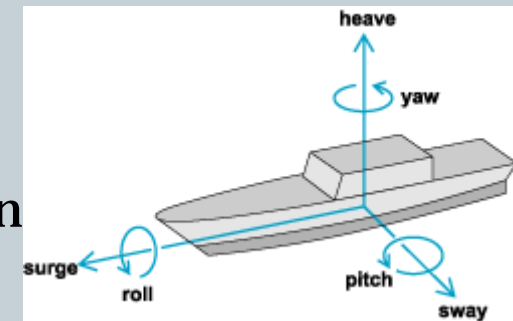
- Loading of ship factors in vessel stability
- LNG loaded into different tanks
- Ballasting concurrent with LNG loading



# LNG loading arms

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- Why loading arms & not a flexible hose?
- Loading arms permit the safe & fast transfer of LNG
- Material: Al, SS, 9% Ni steel
- Hydraulically operated
- Usually two arms for loading & one for vapour return
- Emergency release coupling



# LNG Loading arms (2)

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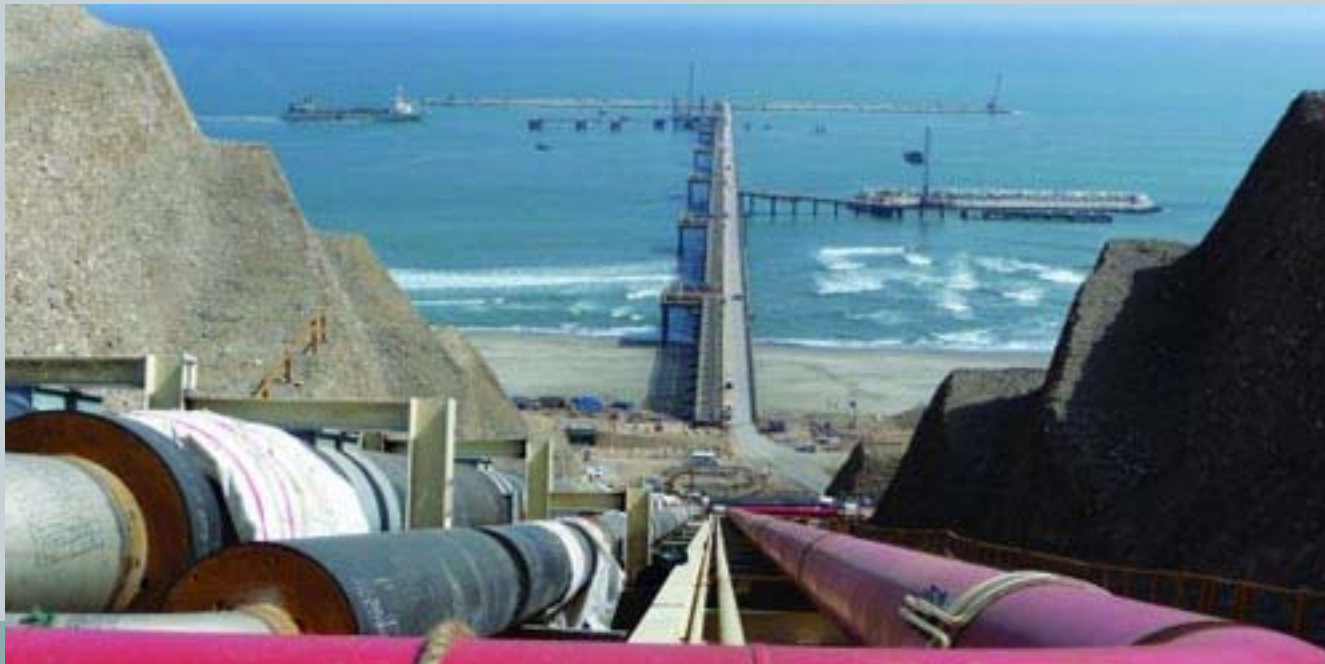
- **Interconnections:**
  - Simple bolted connections
  - Quick Connect/Disconnect Couplings (QCQD)
- **QCDC are hydraulically operated**
- **Discharge/loading rate dictated by material & structural limitations**
- **High capacity pumps discharge rate: 10,000m<sup>3</sup>/h**



# Pipe systems

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- Need to withstand cryogenic temperatures w/o brittle fracture
- Accommodate expansion/contraction (4mm/m in Al)
- Usually SS 18/8 (Cr/Ni) or extruded Al
- Insulation: polyurethane foam
- Water ingress poses problems to insulation

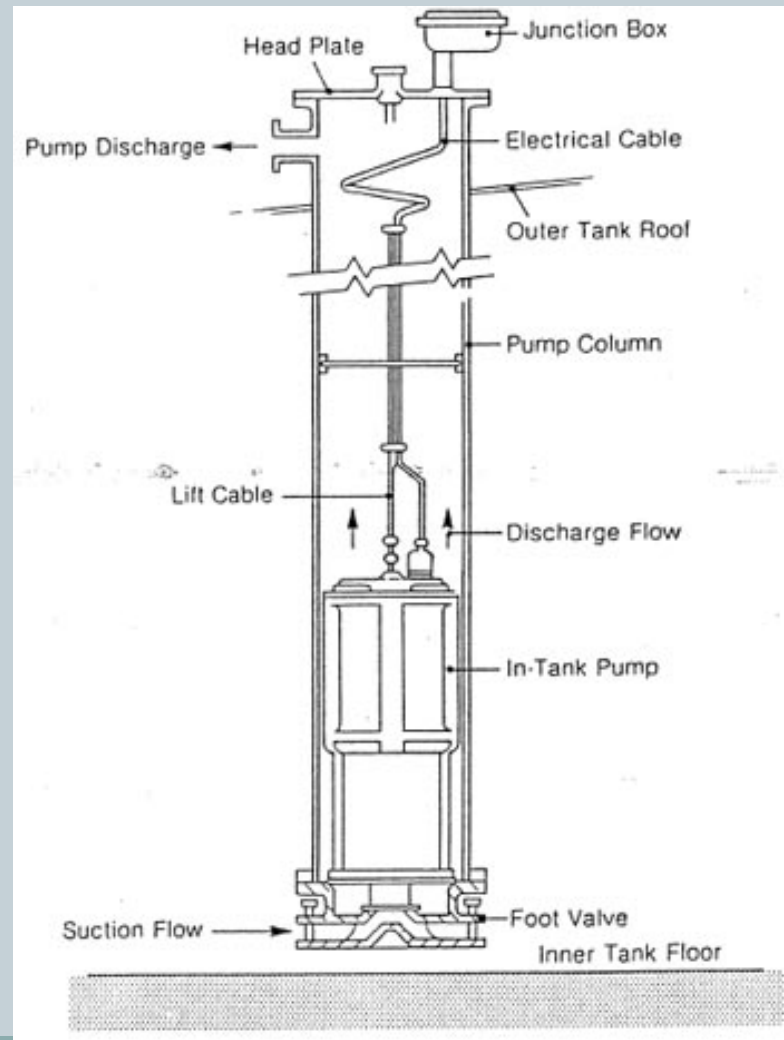




# LNG pumps

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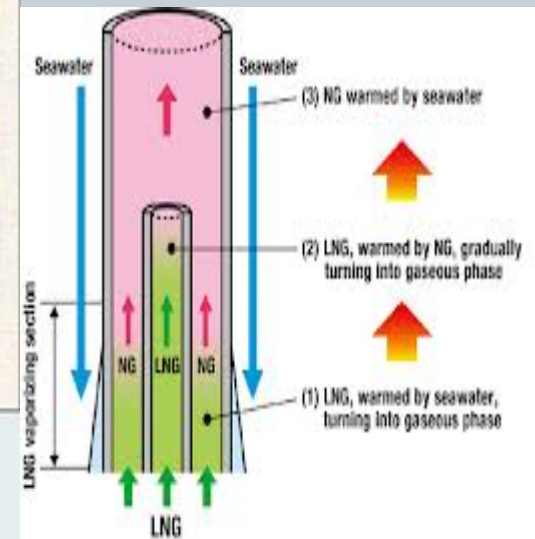
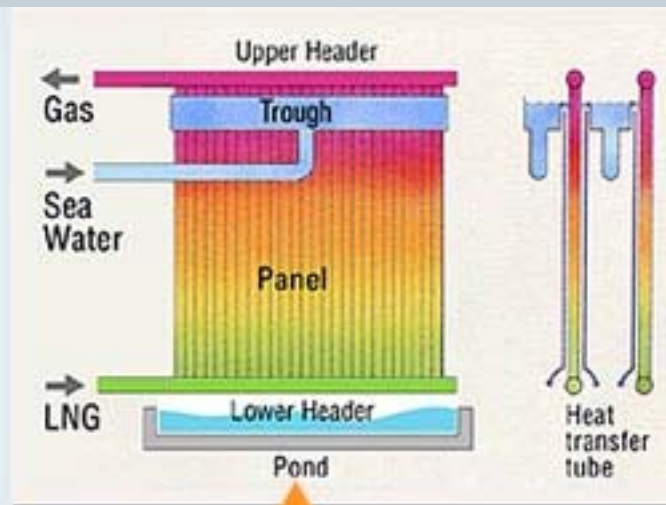
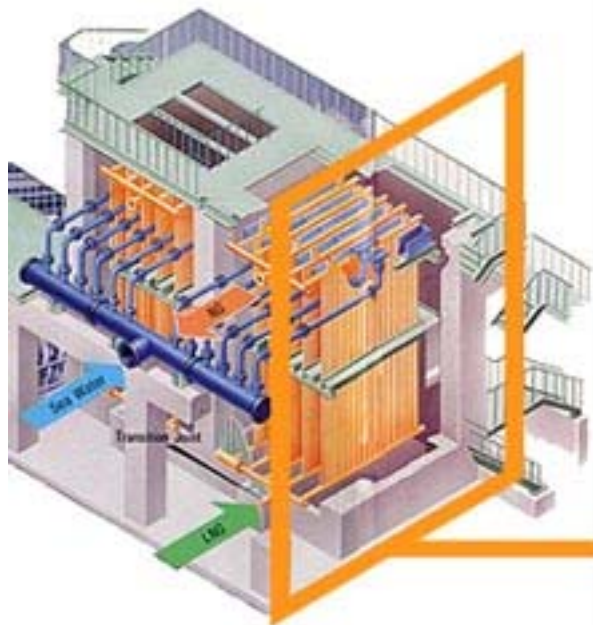
- **External motor type**
  - Rate of 20-100 tonnes/h
  - Difficulty of sealing drive shaft to motor
  - Impeller from SS 18/8 or bronze
- **Submerged motor type:**
  - Pump directly coupled to motor
  - Completely submerged in LNG
  - Made of SS
- **Submerged pumps divided into:**
  - Low-head (ship & shore)
  - Multi-stage (peak-shaving)
- **Bottom suction prevents vapor lock**
- **Emphasis on reliability, safety & performance**



# Regasification equipment

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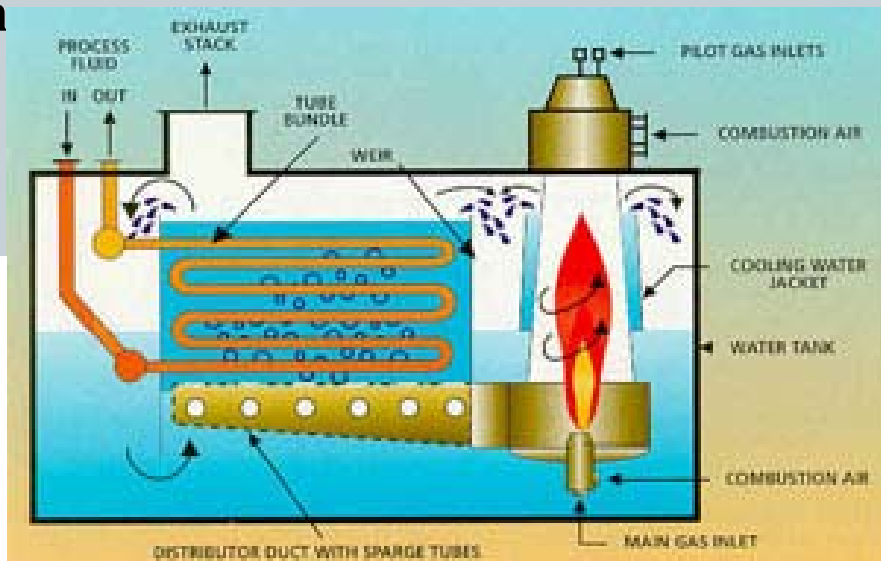
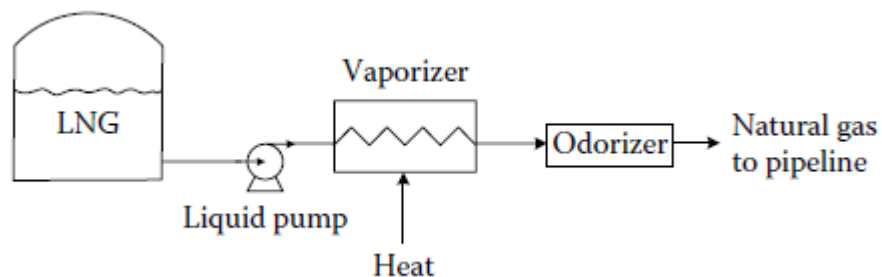
- For near-shore **base load**: sea-water evaporator
- Extruded Al pipes facilitate heat transfer
- Water flow rate:  $\sim 3.5\text{t/h}$
- Gas exit temperature:  $0^\circ\text{C}$



## Regas equipment (2)

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- For peak shaving facilities gas fired vaporizers are preferred
- Pros:
  - a) Short notice
  - b) flexibility
- Energy intensive process
- System reliability of paramount importance
- Cost of regas facilities: \$100m- \$2bn
- **Regas costs:** \$0.5/MMBtu



**Thanks for your attention!**