Fires must be avoided and necessary precautions must be taken, particularly when handling dangerous goods. A tailor-made maintenance plan for fire protection systems and appliances to ensure reliability and immediate availability have to be on board every ship. This Casualty Information describes a case illustrating the severity of fire incidents on container vessels.

Course of events
On a fully loaded container vessel, a fire was detected inside one of the forward cargo holds. Direct access to the fire was impeded due to its location at mid-height in the hold with containers stacked on hatch covers.

Fire-fighting commenced using the water drenching system supplied by the port and starboard fire main lines, connected to nozzles beneath the hatch covers. But this was hampered due to leaking pipe expansion joints, rendering one side out of action.

The CO₂ system was engaged, but the line was also found to be leaking at pipe and valve flanges in the CO₂ room and in the under deck passageway, preventing total flooding of the hold with CO₂.

The crew also attempted to provide additional water via fire hoses through gaps in hatch covers from the main deck. First attempts were hindered, as the fire hose couplings had a different diameter to the hydrant couplings dedicated to the drenching system. However, the crew managed to contain the fire until it was finally extinguished at port. The vessel was detained by the port authorities, and the incident was subject to investigations by several parties, including the flag state.

Extent of damage
The cargo hold transverse bulkhead structures had locally buckled, and nearby electrical fittings were burned. There were no casualties or personal injuries reported.

Several adjacent containers in the cargo hold were damaged by heat, smoke and water. The vessel’s schedule was significantly interrupted, delaying the delivery of high-value goods.
Probable causes
The fire is thought to have started in a container carrying dangerous goods, possibly of an explosive nature. The actual goods were most likely not declared, leading to improper stowage and segregation.

The leaking fire line was probably due to a combination of deficient axial support or stoppers and misaligned pipes outside the coupling manufacturer’s recommended tolerances.

Leakages of CO₂ at the flanges of the CO₂ pipes and fittings could be the result of poor workmanship and wrong practices during installation. Gaskets of a different pressure rating and multiple gaskets to compensate excessive gaps were also found in several flange joints.

The CO₂ line’s remote control valves were dismantled after the incident and found to be contaminated with entrapped water containing foreign particles. The valve adjustment nuts were set, but apparently in a position restricting the maximum flow rate of CO₂.

Lessons learned
Rules and regulations
The vessel was approved in accordance with applicable classification society rules, and in compliance with relevant regulations under SOLAS, Chapter VII, the IMDG code and MARPOL Annex III at the time of construction.

To provide a standard approach when testing CO₂ systems, DNV GL has established its interpretations of SOLAS as presented under section 3.20 in the publication Statutory interpretations – DNVGL-SI-0364 (see Ref.1). These statutory interpretations (SI) also contain other useful guidance on SOLAS-related topics.

Recommendations
As an immediate preventive measure, we recommend to critically review on-board maintenance and inspection programmes concerning fire protection systems and appliances. Necessary amendments identified should be implemented as soon as possible.

Some specific recommendations for the following stakeholders:

Owner, manager
1) Responsible crew members must be competent and fully acquainted with the operation of all fire-fighting equipment on board each vessel. Training must be followed up on a continuous basis.

2) Unlike the active fire-wash deck piping system, fixed CO₂ piping systems remain dormant until required, but still need to be checked and maintained. It is essential that a proper maintenance and inspection regime for fixed CO₂ fire-extinguishing systems are arranged as recommended in MSC.1/Circ.1318 (see Ref.2) and supplemented by the manufacturer’s instructions. CO₂ pipes shall be blown through annually to ensure that they are free from debris and not clogged. Manifold and distribution valves are always to be operational.

3) In the statutory interpretation SI-0364 (see Ref.1), it is specified that section (or control) valves be internally inspected at least once every five years, which is in line with MSC.1/Circ.1432 for fixed-gas extinguishing systems. Planned inspections of different valves are advised to be distributed over the five-year period.

Shipyard, design office, supplier
1) Procedures for the complete installation, inspection and testing of each type of piping system must be in place, understood and monitored, i.e. coordination needs to be in place between each involved outfitting department for hull, machinery and accommodation. If hydraulic tests are carried out, it is essential that the piping system, including all valves and fittings, are completely cleaned and dried for systems such as CO₂.

2) Manufacturers’ tolerances and yards’ standards for all fittings, e.g. clamps and expansion couplings, must be readily available, strictly adhered to and properly checked. Typically, a good practice for the control valves would be to seal the spindle at the designated set point after testing.

3) The design drawings must reflect all applicable details for each piping system, i.e. capacity of pumps, remote control of valves, arrangement of supports and stoppers, etc. It is essential that signboards, marking and operating instructions are clear and unambiguous.

Other important notes
Due to an increased number of fire incidents on container vessels, DNV GL published an article in its No.1 2016 issue of Container Ship Update (see Ref.3). The article identifies several areas to ensure and improve fire safety on board container ships. A particular concern is the wrong declaration of DG cargo, which has significantly contributed to cases involving fire and explosion. Export and import legislation is outside the scope of ship classification. However, the risks associated with carrying dangerous goods pose a real threat and danger to the vessel and crew. All stakeholders should be aware of freight forwarding procedures and limitations (see Ref.4).

References
Ref.1: Statutory interpretations – DNVGL-SI-0364
Ref.2: Guidelines for the maintenance and inspection of fixed CO₂ fire-extinguishing systems
Ref.3: Fire safety on container ships – An area of concern
Ref.4: Guidance – Freight forwarding: moving goods