

# U. S. Coast Guard Port State Control Procedures Regarding Gas Carrier Examinations

## Introduction

The purpose of this training is to provide surveyors with an overview of the procedures and policies that U.S. Coast Guard (USCG) port state control officers will use during the examinations of non-U.S. flagged liquefied gas carriers.

The USCG describes liquefied gas carriers as two general types, liquefied petroleum gas (LPG) and liquefied natural gas (LNG). The USCG considers LPG gas carriers as vessels designed to carry cargoes like Butane, Propane, Butadiene, Propylene, Vinyl chloride monomer, and anhydrous ammonia (NH<sup>3</sup>).

LNG gas carriers are vessel specifically designed to carry liquefied natural gas which is comprised mostly of methane (CH<sup>4</sup>).

In general, it is not the USCG's intention to examine every item highlighted in this training. The port state control officers' primary goal is to verify that vessels and crews are in substantial compliance with international conventions and applicable U.S. laws.

The USCG determines the depth and scope of each examination based on observations of the condition of the ship, the operation of ship system(s), and the competency of the crew. Therefore the appearance of the vessel and the behavior of the crew can significantly affect the scope of the examination.

It is also important to understand that the USCG is very serious about the safety of its port state control officers. Therefore, the USCG has some unique policies regarding spaces that the port state control officers can enter. For example, the USCG very often the USCG will require vessel's master or agent to have a professional marine chemist certify a liquefied gas carrier's cargo compressor room as safe before the USCG personnel will enter. The vessel's agent should discuss this requirement with the local USCG office before the examination.

The port state control officers may also require the vessel's master to provide a list of cargoes and with the cargo data sheets, safety data sheet (SDS), and Emergency Response Guides for cargoes that are cryogenic, extremely flammable or toxic.

### 1. Certificates and Documents Examination

In addition to the standard certificates issued to vessels, the following are some of the certificates and documents that are specific to liquefied gas carriers. The USCG will closely focus on these types of certificates at the beginning of the Port State Control (PSC) examination.

International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (IPP NLS)

Some LPG gas carriers might have the authorization to carry noxious liquid substances (NLS) cargoes. In the IGC Code and the GC Code, an asterisk (\*) identifies these NLS cargoes. The USCG will review the IPP NLS to determine which NLS cargoes are authorized. The USCG will be looking for current an NLS certificate, the Procedures and Arrangements Manual (P&A Manual), the Shipboard Marine Pollution Emergency Plan (SMPEP), and the cargo record book.

The USCG will pay close attention to the intermediate survey dates to determine if surveys were completed within three months before or three months after the second or third-anniversary dates. The USCG will also make sure that the vessel completes annual surveys within three months before or three months after the anniversary date. If the vessel does not complete the surveys within the prescribed time frame, the USCG may find a basis for detention or restriction of cargo operations.

#### IMO Certificates of Fitness (COFs)

USCG port state control officers will pay close attention to the COF and will verify the certificate references the appropriate IMO resolutions based on the vessel's keel laid date. The USCG will also closely review the certificate to identify any alternative arrangements or equivalencies.

The port state control officers will also ensure the completion of the required intermediate survey, and the status of the annual surveys. The USCG will look very closely to make sure that the vessel has completed the Annual Survey within three months before or after each anniversary date of the COF. The USCG will also make sure that the vessel has completed the Intermediate Survey within three months before or after the second-anniversary date or within three months before or after the third-anniversary date of the COF.

The USCG is very strict regarding this date, and the USCG will determine that the COF is no longer valid if the vessel has not completed the annual or intermediate surveys within the periods specified. If the vessel does not complete surveys within the prescribed time frame, the USCG may find a basis for detention or restriction of cargo operations.

It is also important to understand that if a vessel is transporting any cargoes not listed on the COF, the USCG can deny entry into port, require expulsion from the port, or detain the vessel.

#### Subchapter O Endorsement (SOE)

Unique to U.S. ports is a document called a USCG Subchapter O Endorsement (SOE). U.S law requires that all non-U.S. flag liquefied gas carriers obtain an SOE from the USCG Marine Safety Center in Washington D.C.

The port state control officers will make sure that any certificates listed in the SOE are on board the vessel and are valid. The port state control officers will check the cargo manifest against the cargoes authorized by the IMO COF and the SOE. The SOE will refer to the list of cargoes contained in the IMO Certificate of Fitness and may restrict carriage of certain listed cargoes.

The port state control officers will ensure that the crew is observing any special operating instructions listed in the SOE or the IMO Certificate.

#### Changing/Setting Cargo Tank Pressure Relief Valves Documentation

The USCG port state control officers will review and compare the SOE to the vessel's COF for any changes or errors and pay particular attention to the maximum allowable relief valve setting (MARVS) section. The port state control officers will compare the MARVS settings that were set and sealed typically during the gas carrier's special survey (dry dock) every five years.

The USCG reviews documentation from an "administration accepted" competent Recognized Organization [RO] attesting to the proper setting of the cargo tank pressure relief valves. For LPG gas carriers the USCG may ask for Flag State Administration approval of procedures for changing cargo tank pressure relief valves or vessel log records for any changes to cargo tank pressure relief valves.

#### Crew Training Documentation

The port state control officers will ask to see the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), including 2010 Manila Amendments, STCW Convention and STCW Code, 2011 Edition, that specifies additional requirements for mariners serving on liquefied gas carriers.

The USCG will check to see that the master, chief engineer, chief mate, second engineer, and anyone responsible for cargo-related operations holds a certificate in advanced training for liquefied gas tanker cargo operations. They will also verify that all officers with specific cargo duties hold a certificate of proficiency from the Flag Administration.

#### Certificate of Inhibition

The USCG port state control officers will want to determine if the gas carrier is using the proper types and amounts of inhibitors. The USCG verifies that crews are maintaining effective temperature control of, and monitor the lifespan of any inhibitors.

## **2. Log and Manuals Examination**

#### Cargo Record Book

When an LPG gas carrier is authorized to carry Noxious Liquid Substances (NLS), it must comply with requirements outlined for the Control of Pollution of Noxious Liquid Substances in Bulk, MARPOL Annex II. These requirements include having a Cargo Record Book aboard. The USCG will want to verify that the Cargo Record Book is properly formatted, that the Office in Charge (OIC) of the operation signs each entry and that the master signs each page.

#### Procedures and Arrangements (P&A) Manual

In accordance with the Control of Pollution of Noxious Liquid Substances in Bulk, MARPOL Annex II, every ship certified to carry a category X, Y or Z NLS shall have aboard a Procedures

and Arrangements (P&A) Manual. The USCG will examine the P&A Manual to determine that the Flag Administration approves it and that the P&A Manual is in the standard format.

#### Shipboard Marine Pollution Emergency Plan (SMPEP) for Noxious Liquid Substances (NLS)

In accordance with the Control of Pollution of Noxious Liquid Substances in Bulk, MARPOL Annex II, every ship of 150 gross tons and above certified to carry NLS shall have aboard a Shipboard Marine Pollution Emergency Plan (SMPEP) for NLS. The USCG will verify that the Flag Administration approved the plan and the authorities or people to contact in the event of an incident are identified.

#### Cargo Operations Manual

The USCG will want to verify the following information in the Cargo Operations Manual. There is a description of the physical and chemical properties necessary for the safe containment of cargo. The actions to take in the event of spills or leaks. That there are countermeasures against accidental personal contact. The firefighting procedures and firefighting media to use. The procedures for cargo transfer, gas freeing, ballasting, tank cleaning and changing cargoes. Any special equipment needed for the safe handling of a particular cargo. The minimum allowable inner hull steel temperatures and emergency procedures.

#### Loading and Stability Information Booklet

The USCG will request to review the Loading and Stability Information Booklet per the IGC Code. The USCG will want to verify that the booklet contains evidence of satisfactory review by the Administration (RO). That the booklet contains details of typical service conditions, to include loading, unloading, and ballast conditions. Verify that the booklet contains a summary of the gas carrier's survival capabilities.

### **3. Instrumentation Examination**

#### Fixed Gas Detection System

When examining the fixed gas detection system, the USCG will conduct the following test.

- Witness a satisfactory calibration of the fixed gas detection system.
- Verify gas detection alarms at 30 percent LFL.
- Verify installation of sampling points or sensors (if using electrochemical sensors) in required spaces.
- Verify the integrity of sampling pipe system (gas sampling type systems only).
- Request to see a certificate of calibration of a third party calibrated gas carrier's system.
- Verify the location within a space of the sampling points relative to the cargoes authorized for carriage (i.e., top or bottom of space) per the IGC Code and GC Code.
- Request a crewmember go to a specific sampling point and block it, stopping the flow of gas to the analyzing unit.

### Portable Gas Detection Equipment

The USCG examiners will verify the following for at least two sets of portable gas detection equipment.

- Satisfactory calibration and preparation for the use of the portable gas detection equipment.
- Logs should conform to gas carrier's Safety Management System (SMS) maintenance requirements.
- Verify that the gas carrier has appropriate tubes or sensors for each cargo aboard.
- Examine calibration logs for each piece of portable gas detection equipment.
- Witness calibration of the portable oxygen (O<sup>2</sup>) sensor to ambient O<sup>2</sup> level (20.8 percent by volume =/- 0.2 percent).
- That tubes or sensors are not expired

### Temperature Indicating Devices

The USCG will verify that at least two temperature indicating devices are installed in each cargo tank, one near the top and one at the bottom of the tank. That temperature indicating devices are marked to show the lowest Administration approved cargo tank temperature.

### Pressure Monitoring Devices

The USCG will verify the following for pressure monitoring devices in the cargo tanks, cargo pump discharge lines, liquid and vapor cargo manifold, and hold and inter-barrier spaces.

- Each cargo tank vapor space has a pressure gauge with an indicator in the control position (cargo control room [CCR]).
- The USCG may require one of the following methods for verifying the operation of the high pressure and low-pressure alarms: (1) Changing of the alarm setting through the Integrated Automation System (IAS) in the CCR. (2) Inserting a specialized handle into the middle of the pressure gauge and changing the high/low alarm settings. (3) Isolating the cargo tank pressure and adding/releasing pressure to the pressure gauge by means of a hand pump.
- The maximum and minimum allowable pressures are marked on the cargo tank pressure indicating device.
- Verify that each cargo tank vapor space is fitted with a high-pressure alarm which activates on the navigation bridge
- Witness a test of the high-pressure alarm.
- Determine if vacuum protection is fitted, then each cargo tank vapor space has a low-pressure alarm which activates on the navigation bridge
- Operation of the cargo tank vapor space low-pressure alarm, if applicable.

- Hold/inter-barrier spaces without open communication to the atmosphere are provided with operational pressure gauges.
- Verify that each manifold cargo line is fitted with at least one pressure gauge.

### Overflow Control System

The overflow control system provides a warning to shipboard personnel before the cargo tanks become full. The USCG will verify the following in the overflow control system. The high-level alarm provides both an audible and visual warning. The automatic shutoff valve is installed that prevents the tanks from being overfilled.

## **4. General Health and Safety Examination**

### Decontamination Showers and Eye Wash Stations

The USCG will verify that decontamination showers and eyewash stations are suitably marked. Capable of operating in all ambient conditions. Located on deck and in convenient locations.

### Respiratory and Eye Protection for Emergency Escape

The USCG will verify the following regarding respiratory and eye protection equipment for emergency escape purposes.

- Two additional sets of respiratory and eye protection are permanently located on the bridge for navigation watch personnel.
- Identified for escape purposes only and is not used for cargo handling or firefighting purposes.
- A respirator is not a filter type. Self-Contained Breathing Apparatus (SCBA) with 15 minutes of oxygen (O<sup>2</sup>) supply.

### Personnel Safety Equipment

The USCG will verify the following regarding personal safety equipment.

- Each set of personal safety equipment contains the required equipment as follows: One SCBA with at least 1,200 liters of free air, protective clothing, boots, gloves and tight-fitting goggles, steel-cored rescue line, and explosion proof lamp.
- Compressed air used for safety equipment is inspected once a year by an expert
- An adequate supply of compressed air is available as required by relevant Code. Compressed air used for safety equipment is inspected once a month by a gas carrier's officer.
- Vessels cargo capacity > 2,000 cubic meters (m<sup>3</sup>), two additional sets of safety equipment are provided with at least three spare charged air bottles for each additional set.

## First Aid Equipment

The USCG will verify the following regarding additional first aid equipment.

- A stretcher, suitable for hoisting an injured person from a space below, is available in a readily accessible location.
- That an antidote(s) is/are aboard for those cargoes specifically identified in Chapter 19 of the relevant Code
- Oxygen (O<sub>2</sub>) resuscitation equipment is aboard.

### **5. Air Lock Examination**

#### Air Locks

The USCG will inspect airlocks are required on entrances leading from a gas-dangerous zone into a gas safe space and verify the following.

- Airlock doors are self-closing.
- Operation of the audible and visual alarms on both sides of the airlock indicating that more than one door is not in the closed position.
- No hold back arrangements on airlock doors are in place.
- Presence and condition of hatch gasket, dog contact, knife edge condition and seal when closed and dogged.
- Ensure that electrical equipment that is not a certified safe type used for maneuvering and mooring, as well as the emergency fire pump(s), should not be located in spaces protected by airlocks.
- Electrical equipment that is not a certified safe type and is in a space protected by an airlock is de-energized upon loss of overpressure in the space.

### **6. Cargo Systems Examination**

#### Emergency Shutdown (ESD) System

Regarding the ESD the USCG will verify the following.

- One of the points of the shutdown is located in the cargo control room.
- The other point of shutdown located close to the manifold.
- The melting range of fusible elements is designed to melt at temperatures
- Conduct an ESD test.
- ESD shut down, and the quick closing valves should be closed within 30 seconds.
- ESDs remotely closes the actuated valves, stop the cargo pumps, and

between 98 degrees Celsius to 104 degrees Celsius.

- No paint is present on the thermal fuse.
- Proper element is used for each location (i.e., gland nut with a thermal fuse, not standard bolt).

stop the compressors (where appropriate).

- Each line, cargo, and vapor, has an indicator displaying the position of the valve.

### Cargo Tank Pressure Relief Valves

The USCG will want to verify the following regarding cargo tank pressure relief valves.

- The pilot pressure set pieces authorized by the COF are installed on the tank tops.
- The pressure alarm in use corresponds to the MARV setting in use (alarm is set less than the relief valve setting) and that the MARV settings are posted in the CCR and at the relief valves.
- Log entry indicates when MARV settings were changed under the supervision of the master.
- Each cargo tank with a capacity of more than 20 cubic meters (m<sup>3</sup>) is fitted with two relief valves.
- Each cargo tank with a capacity of 20 cubic meters (m<sup>3</sup>) or less, including deck tanks, is fitted with at least one relief valve.
- Tamper-resistant seals are in place and intact.
- Relief valves are connected to the highest part of the cargo tank above the deck (e.g., at the vapor dome).
- Relief valves are connected to a venting system which directs the vapor upwards (i.e., vent mast or riser), and exits at the height of not be less than B/3 or 6 meters, whichever is greater, where B is the maximum breadth of the gas carrier measured amidships.
- Vent mast or riser is fitted with a valve or other arrangement to drain water.
- No water has accumulated.

### Cargo Piping

Regarding the cargo piping, the USCG will want to verify the following.

- Low-temperature piping is thermally isolated from the adjacent hull structure.
- Hull protection is present in areas where low-temperature piping can be regularly dismantled or where leakage is anticipated.
- Gasketed pipe joints are electronically bonded.
- Ensure bonding arrangements have metal to metal contact and are intact (no breaks, loose connections, or excessive corrosion).
- Cargo piping which may be isolated in a liquid full condition is provided with relief valves.



- On LNG vessels, that the water curtain water that runs down the side of the gas carrier below the manifold.
- Cargo piping is in good condition free of cracks or excess of corrosion.

### Cargo System Shutoff Valves

The USCG will verify the following regarding cargo system shutoff valves. On cargo tanks with MARVS not exceeding 0.7 bar gauge (BARG), the presence of shut off valves on liquid lines and vapor lines that are capable of manual operation. On cargo tanks with MARVS exceeding 0.7 bar gauge (BARG), the presence of a manually operated stop valve and a remotely controlled emergency shutdown valve on liquid and vapor lines.

### Cargo Machinery Room (Cargo Compressor Room) Equipment

When inspecting cargo machinery rooms, the USCG will verify that cargo compressors are free of leaks and are in good order. Evidence of a leak includes Wet/frozen towels, hissing, ice in the bilge, leaking shaft seals.

### Cargo Vaporizers

Regarding cargo vaporizers, the USCG will verify that cargo vaporizers are free of leaks and are in good order. Evidence of a leak includes Wet/frozen towels, hissing, and cracked deck.

### Gas Tight Seals on Compressor Shafts

Where pumps or compressors are driven by shafts that pass through a bulkhead or deck, gas-tight seals the USCG will verify the following.

- Gas-tight seals on compressor shafts passing through decks and/or bulkheads are well lubricated and in good working order (no gaps, no excessive vibration or misalignment of the shaft, and no oil leaks).
- Oil head tank in good material condition.
- No excessive oil is leaking from the gas-tight seal.
- Entire gas tight bulkhead is intact (no improperly sealed penetrations).

### Reliquefaction System Equipment

For both LNG and LPG gas carriers the USCG will verify the following regarding reliquefaction systems. Verify that the reliquefaction system equipment is free of leaks and is in good material condition (minimal carbon dust, no oil or cargo leaks, no damaged wires, no damaged instrumentation).

## 7. Cargo Environmental Control (CE) Examination

### Inert Gas Systems (IGS)

When conducting an examination of the IGS, the USCG will verify the following. The system has an operational O<sup>2</sup> content meter. The system has an operational alarm that indicates if the O<sup>2</sup> content of the inert gas reaches a level higher than 5 percent. A means to prevent the backflow of cargo gas is provided.

The USCG will not require the crew to turn on the IGS in order to verify that both the O<sup>2</sup> content meter and alarm function are operational. However, the USCG will expect the crew to explain how it works when in full operation.

### Nitrogen (N<sup>2</sup>) Gas Generating System

When conducting an examination of the N<sup>2</sup> plant, the USCG will verify the following. The system has an operational O<sup>2</sup> content meter. The system has an operational alarm that indicates if the O<sup>2</sup> content of the inert gas reaches a level higher than 5 percent. A means to prevent the backflow of cargo gas is provided.

### Inert Gas/Nitrogen (N<sup>2</sup>) Storage Tanks

Regarding the inert gas/nitrogen (N<sup>2</sup>) storage tanks, the USCG will verify the following.

- Inert gas stored for cargo related services is not used for firefighting.
- Storage is sufficient for the normal consumption of at least 30 days.
- USCG will compare the normal amount of consumption for a 30 day period, with the aboard capacity.
- USCG will calculate the amount used per day for normal consumption.
- USCG will review the vessel's inert gas or N<sup>2</sup> usage log that notes daily, weekly, and/or monthly usage. Then, multiply the aboard volume by 696 (expansion ratio for N<sup>2</sup> 696:1) and divide that number by the daily amount

## 8. Lifesaving Equipment (LS) Examination

### Lifeboats

For the lifeboat exam, the USCG will focus on three parts: the self-contained air support system, the air supply system pressure, and the lifeboat water spray system.

- Signs of corrosion, breaches in piping, indications of poor maintenance, and failure of the system to operate properly.
- Bottles are securely fastened within the lifeboat and in good condition (no
- Air supply system supply bottle(s) are in satisfactory condition.
- No excessive rust, pitting, leaks or other damage that could impact the integrity of the bottles.
- Seawater intake for the system is below the water line.

- deformation or excessive pitting to bottles).
- Hoses are in good condition without deformities (kinks, sharp bends, etc.) that would hinder air flow.
- The crew can properly align the system.
- The air supply system pressure indicators/gauges are in satisfactory condition. Trace the tubing from the regulator to supply bottle(s) and look for cracks in the glass, the absence of indicator “needles” or other indications that the pressure indicator/gauge may not be functioning properly.
- The stainless piping housing the water spray system is in good working condition.
- No excessive rust, pitting or clogs to piping restricting the flow of water.
- Ensure maintenance and tests are properly documented.

In accordance with USCG policy lowering, releasing, and exercising lifeboats is not required during a routine COC exam. The USCG will rely on a visual examination and ship documentation

## **9. Electrical Systems Examination**

### Electrical Installations in the Cargo Machinery (Cargo Compressor) Room Exam

The USCG examiners will visually verify the following. Lighting fixtures must be pressurized, purged, or flameproof.

- Fixtures are intact and in a good material condition
- No broken or exposed wires
- No broken bonding cables/straps
- No cracked lenses
- No loose or missing bolts
- No paint or other foreign matter on flameproof fixtures that interferes with venting arrangements or fixtures not fully enclosed/sealed, as appropriate.
- Ensure cables are enclosed in an explosion-protected device by means of an approved gland or equivalent device capable of maintaining the integrity of the enclosure.

### Electrical Installations in Gas Dangerous Zones (Open Decks and Other Spaces Other than Cargo Machinery Rooms)

In the gas dangerous zone, the USCG will verify the following. Certified safe type equipment is used. Through runs of cables are used. Lighting fixtures are pressurized/purged or flameproof.

## **10. Cargo Area Ventilation Systems Examination**

### Cargo Machinery Motor (Electric Motor) Room Ventilation System Exam

The USCG will pay attention to indications that the system is not functioning properly and an expanded exam is warranted include. It is obvious when entering the space that the pressure in the space is weak. It should take a considerable effort to close a door against positive ventilation pressure. One or more of the ventilation fans is damaged or is inoperable. The fan(s) are blocked or inhibited from properly spinning. The fan(s) cannot operate due to electrical or motor problems. There is a component of the system that is “out of service” or not operating such that the system is no longer “as designed.”

### Cargo Machinery Room Ventilation System

In the cargo machinery room, the USCG will verify the following. The ventilation can be controlled from outside the space. Negative ventilation is operational when going through the entrance of this space (you should feel a slight pulling effect). Ventilation extraction points are relative to the cargoes density. Duct openings have protective screens in place and are free from obstructions. A warning notice is posted outside of the space requiring the use of ventilation prior to entering the space.

## **11. Gas Fuel Supply System Examination**

### Master Gas Valve (MGV)

To test the MGV, the USCG will use two examiners; one located at the MGV and one located at the actuation point (i.e., vent duct, ventilation/boiler hood, gas room). Exam procedures are the same for a steam turbine (ST) and dual/tri-fuel diesel electric propulsion except as indicated. The USCG will do the following test. Verify the status of gas fuel and oil fuel burning: for ST propulsion, both main propulsion boilers must be operating in dual-fuel mode prior to MGV shutdown. For dual fuel diesel electric (DFDE) propulsion it must be operating in gas mode prior to MGV shutdown.

The USCG will verify that the alarm and shutdown set points are usually set at 30 percent LEL and 60 percent LEL methane ( $\text{CH}_4$ ). For DFDE propulsion systems may have multiple MGVs serving engine rooms and GCU rooms. These arrangements often also have multiple alarm and shutdown set points, as prescribed in the Cargo Operations Manual or Machinery Manual. The USCG will use one of the following methods to test systems. Introduce gas with no more than 3 percent methane ( $\text{CH}_4$ ) by volume (60 percent LFL), with a balanced air or  $\text{N}_2$ , into a continuous gas detection sensor installed in the vent duct, boiler hood/gas room (or gas valve unit (GVU) room for DFDE propulsion). Shut off the ventilation in the vent duct, boiler hood/gas room (or GVU room for DFDE propulsion). Simulate loss of pressurization in the double-wall gas fuel piping (i.e., the inert gas pressure in the annular space falls below the gas fuel pressure in the inner pipe). Simulate low gas fuel pressure in the gas fuel piping.

At the vent duct, boiler hood/gas room or GUV room the USCG will verify the following. Examine the gas detection cabinet which may be located in, or near, the CCR or engine control room (ECR). Examine the interior of the cabinet for anomalies such as jumper wires or other evidence of tampering. Verify gas detection sensor calibration and/or witness a calibration check (i.e., bump test) per manufacturer's recommended maintenance or gas carrier's SMS.

If gas detection is chosen to trigger MGCV closure, verify that alarms and shutdown will activate at gas concentrations prescribed in the Cargo Operations Manual or Machinery Manual. The concentrations are 30 percent LFL and 60 percent LFL respectively but may be lower, especially for gas carriers fitted with DFDE propulsion.

If gas detection is chosen to trigger MGCV closure, verify that ventilation remains on in the duct, boiler hood/gas room or GUV room when the MGCV closes. Verify that fail-closed and fail-open valves in the machinery space operate properly by observing the valves close/open or by observing valve status in the ECR.

For DFDE propulsion only: Verify that the shutoff valves on the gas fuel piping at the engines close when MGCV closes.

If loss of ventilation is chosen to trigger MGCV closure, verify that gas burning cannot be restarted until ventilation is operating.

At the MGCV the USCG will verify the following. Each MGCV can be closed manually (i.e., equipped with a wheel for local closing). Each MGCV fully closes. Upon closure, the valve indicator should be perpendicular to the fuel gas pipe.

#### Ventilation within the Ventilation/Boiler Hood or Casing

The USCG will verify the following regarding the Gas Utilization Unit (GUU)/Gas Utilization Valve (GUV). The extraction fan and the vent at the top of the space can sweep ventilation air across the GUUs. Ventilating air is exhausted at the top of the ventilation/boiler hood or casing. Ensure ventilation remains on during MGCV test (unless performing a ventilation shutdown).

#### Gas Detection System Used for the Protection of the Cargo Fuel System

For the continuous monitoring gas detection system in the fuel gas space (i.e., vent duct, ventilation/boiler hood, gas room) the USCG will verify the following. The alarm should activate per the Cargo Operations Manual set points, generally 30 percent LFL. Closure of MGCV at or before the gas concentration reaches 60 percent LFL. The setpoint may be much lower for DFDE propulsion systems.

#### Gas Utilization Unit(s) (GUU)

Regarding the automatic protective devices (valves) built into a system that uses LNG boil-off as fuel, the USCG will only verify that the Gas Fuel (GF) supply system shall be fitted with a Gas Utilization Unit (GUU). The USCG will determine if these protective devices (valves) are regularly inspected and maintained and include automatic shut-down in the event of system

malfunction or leak detection. The USCG will verify that each GUU has two valves, in series, located in the gas fuel pipe leading to the consuming unit.

#### Gas Fuel Piping (Double Wall Piping System)

Regarding the gas fuel Boil-Off Gas (BOG) provided to the engine room from the cargo machinery (compressor) room through either a double wall piping system or a ventilated pipe or duct system, the USCG will verify the following in the engine control room. Inert gas is at a pressure in the annular space that is greater than the gas fuel pressure in the inner pipe. Double wall piping system is fitted with an alarm that activates when inert gas pressure falls below the fuel gas pressure in the inner pipe.

#### Gas Fuel Piping (Ventilated Pipe or Duct System)

The USCG will verify the following regarding the ventilated pipe or duct systems that employ a duct or concentric pipe around the fuel gas pipe. When fuel gas is flowing, negative ventilation is maintained in the annular space by an extraction fan at a rate of at least 30 air changes per hour. The fan is fitted near the upper end of the duct and exhausts to a safe location (outside the engine room). If a gas leak is detected, or if ventilation is cut off, the MGV closes automatically. The mechanical exhaust ventilation system is running while the vessel is operating in dual/tri-fuel mode. When in the ECR, there is continuous gas detection at the gas detection panel.

#### Gas Combustion Unit (GCU)

Regarding the gas combustion unit (GCU) or thermal oxidizer, the USCG will verify the GCU is in operational condition. Verify alarms are operational. Per the GCU operations manual, select two or three alarms to test. The following are some of the alarms the USCG may choose to test: Flame failure, flame scanner failure, Combustion air fan failure, dilution air fan failure, main power supply failure, control power supply failure, high flue gas outlet temperature. The USCG will not normally test all these alarms but pick two or three.

## **12. Firefighting Systems (FF) Examination**

### Fire Water Main Equipment

The USCG will test fire prevention and firefighting equipment and verify the following.

- The main piping, fittings, and nozzles are in good condition, free of excessive corrosion, pitting, and holes (unauthorized temporary repairs).
- Per the IGC Code, there are at least two jets of water that can reach any part of the deck in the cargo area as well as those portions of the cargo
- Two pumps are present.
- There are no excessive leaks from mechanical seal, valves, and flanges.
- If the gas carrier's engine room is unattended, one of the vessel's fire pumps can remotely start and connect to the fire main from the navigating bridge or other control station outside the cargo area

containment system and tank covers above the deck.

- Stop valves are fitted at intervals of not more than 40 meters and in any crossovers

### Deck Water Spray System

For deck water spray system for cooling, fire prevention, and crew protection the USCG will verify the following. If the deck water spray system is supplied by the fire pump, both systems operate simultaneously with the fire main and are capable of producing 5 bar gauge (BARG) (73.5 pounds per square inch [psi]). Consistent spray from all nozzles and coverage of required areas per the IGC Code.

### Dry Chemical Powder Fire-Extinguishing System

The USCG will verify the following for dry chemical powder fire-extinguishing systems.

- Documentation of periodic system servicing either on the system itself or by a service technician report.
- Independent, self-contained dry chemical powder unit is free of corrosion, pitting, and canister deformation.
- All hoses and piping, including the inert gas storage pressure vessel(s), are connected and in good material condition (e.g., dry rot).
- Deck monitors can protect the cargo loading and discharge manifold areas.
- Monitors and hoses can reach the transfer areas.
- An additional dry chemical powder unit is installed for gas carriers fitted with a bow or stern loading and discharge arrangements.
- On a fixed dry powder system, the propellant bottles (inert gas pilot bottles) are in good material condition (i.e., no corrosion, wastage, or scaling)

### Fire-fighter Outfits

Liquefied gas carriers are required to have fire-fighter outfits aboard in addition to those required to be carried on other ship types per and the USCG will verify the following. The required number of fire-fighter outfits is aboard. For vessels 5,000 cubic meters (m<sup>3</sup>) and below 4 additional outfits. For vessels above 5,000 cubic meters (m<sup>3</sup>) 5 additional outfits.