Guide for

Hydrocarbon Blanket Gas System

July 2014

GUIDE FOR

HYDROCARBON BLANKET GAS SYSTEM

JULY 2014

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

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Foreword

ABS has been requested by the industry and regulatory bodies to provide guidelines to address the arrangements where hydrocarbon produced gas is used as a blanketing gas to maintain a non-explosive atmosphere inside the cargo storage tanks of ABS Classed floating production units.

This Guide has been written for worldwide application and as such, compliance with individual requirements may require comprehensive data, analyses and plans to be submitted to demonstrate the adequacy of the system. ABS acknowledges that there is a wide range of documents that may be required for submittal to satisfy this type of blanketing system. It is not the intention of this Guide to impose requirements or practices in addition to those that have previously proven satisfactory in similar situations.

ABS currently has requirements for tank blanketing systems using produced gas in 3-5/5.3 of the ABS *Rules for Building and Classing Facilities on Offshore Installations*. Design and installation requirements presented in this Guide are based on existing industry practice and criteria employed by ABS in the review of such systems that are deemed to provide an adequate level of safety equivalent to traditional "Inert Gas Systems". The application of this Guide by ABS will not seek to inhibit the use of any technological approach that can be shown to produce an acceptable level of safety.

With the use of hydro carbon blanketing systems, oxygen is eliminated from cargo tanks via the use of produced gas, forming an atmosphere within the tank, saturated with hydrocarbon to a level above the UEL, at which combustion cannot be supported (too "rich" to burn).

Advantages to a HC blanketing system are (1) using a medium which is readily available in large volumes which can continuously protect a multitude of large tanks, (2) evaporation in the cargo tank is minimal and the displaced gas from the tanks can be easily recovered resulting in a safe closed system which enable substantial reduction in volatile organic compound (VOC) emissions to the atmosphere. However, one of the disadvantages of using a HC blanketing system is that an Inert Gas (IG) blanket system must be kept as backup to the HC blanketing system, should the supply of the HC blanketing medium become unavailable

Currently more than 20 offshore production platforms world-wide are using hydrocarbon gas for tank blanketing and ABS expects more to come as this system is becoming a standard in the industry.

This Guide is to be used in conjunction with other ABS Rules and Guides, as specified herein.

This Guide becomes effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of this Guide is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.

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SECTION 1
General

1 Scope and Applicability

This Guide applies to floating production installations equipped for storage of liquid hydrocarbons, where hydrocarbon gas is used for tank blanketing as permitted in 3-5/5.3 of the ABS *Rules for Building and Classing Facilities on Offshore Installations (Facilities Rules)*.

Blanketing systems employed in crude storage tanks and slop tanks are to comply with the requirements in Section 4 of this Guide.

Blanketing systems employed in a single tank containing low flash point flammable liquid [flash point of 60°C (140°F) or less], such as methanol tanks built as a hull or integral tanks are to comply with the special considerations in Section 5 of this Guide.

3 Plans and Data to be Submitted

3.1 Documents Required for Review

i) Document showing standard construction details for piping systems.

ii) Arrangement showing the location of the liquid hydrocarbon storage hull tanks.

iii) Process and instrumentation diagrams of the hydrocarbon gas blanket system clearly indicating connection to:

- ***a)*** Cargo tanks system,
- ***b)*** Inert Gas system,
- ***c)*** Venting System; and,
- ***d)*** Cargo tank vents recovery system, as applicable

iv) Cargo tank venting system, purging and gas freeing systems, including details and setting of the pressure/vacuum valves (relief valves).

v) Cause and Effect matrix and Safety Analysis Function Evaluation (S.A.F.E.) charts for the system.

vi) Since the hydrocarbon blanket gas system is a part of the topside process system, the same is to comply with safety system requirements in 3-3/13.3, “Safety System” and Chapter 3, Section 7, “Instrumentation and Control Systems” of the *Facilities Rules* and API 14C, regardless of the Class Notation of the unit. Applicable process P&IDs and S.A.F.E. charts are to be submitted for ABS review.

vii) Operating manual

3.3 Supporting Documentation

i) Hydraulic calculations for hydrocarbon blanket gas capacity, as required in 4/9.3

ii) Results of analysis for tank blanketing, inerting, purging and gas-freeing effectiveness

iii) HAZID and HAZOP studies relative to the hydrocarbon blanket gas system

iv) Electrical equipment data in hazardous areas

v) Gas dispersion analysis, as required in 4/9.1v)

5 Governmental Authority

Attention is drawn to the appropriate governmental authority in each case, as there may be additional requirements.

SECTION 2

Definitions, References, Acronyms and Abbreviations

1 Definitions

The following definitions, references, abbreviations and acronyms are provided to clarify the use of terms in the context of this Guide. Some definitions were extracted from API.

Blanket Gas/Pad Gas. Gas added to the vapor space of a vessel or tank to prevent an explosive or ignitable vapor-air mixture from forming.

Emergency Shutdown (ESD) System. System of manual stations that, when activated, will initiate platform shutdown.

Floating Installation. An offshore facility designed to provide hydrocarbon processing and/or hydrocarbon storage, and offload hydrocarbons. The term *Floating Installation* is used to generically identify a buoyant facility that is site-specific. This installation is securely and substantially moored so that it cannot be moved without a special effort. The term includes, but not limited to Tension Leg Platforms (TLP), Spar Buoy, Permanently Moored Shipshape Hulls and Semisubmersibles.

Gas Blow-by. The discharge of gas from a process component through a liquid outlet.

Gas Sweetening. Process for removal of H_2S from sour gas.

Hazardous Areas (Classified Areas). A location in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures (see the ABS *MOU Rules*, API RP 500 or API RP 505 for additional details).

Hydrogen Sulfide (H_2S). A highly toxic, flammable, corrosive gas sometimes encountered in hydrocarbon-bearing formations.

Hydrogen Sulfide (Sour) Service. Refers to equipment designed to resist corrosion and hydrogen embrittlement caused by exposure to hydrogen sulfide..

Ignitable Mixture. A mixture that is within the flammable range (between the upper and lower limits) and is therefore capable of propagation of flame away from the source of ignition.

Inert Gas. A gaseous mixture, such as flue gas, containing insufficient oxygen to support the combustion of hydrocarbons.

Lower Explosive Limit (L.E.L.). The lowest concentration of combustible vapors or gases, by volume in mixture with air, which can be ignited at ambient conditions.

Operating Conditions. A set of conditions (i.e., flowrates, compositions, temperatures and pressures) chosen for normal operation of a production facility at a particular point in the life of an oil or gas field.

Process Shutdown. The isolation of a given process station from the process by closing appropriate SDVs to shut in flow to the process station or divert flow to another process station.

Process Station. One or more process components performing a specific process function, such as separation, heating, pumping, etc.

Produced Fluids. Fluids coming out of completed wells, which may consist of oil, water, gas, and condensable vapor.

Production Facilities. For the purpose of this Guide, *Production Facilities* are typically the processing, safety and control systems, utility and auxiliary equipment, for producing hydrocarbon liquid and gas mixtures from completed wells or other sources.

These facilities are generally inclusive from the inlet flange of the well fluid flowline above the water level to the point at which the departing pipeline enters the water. The facilities also include the safe disposal and/or collection of produced oil, gases and water.

For a floating installation with the storage and offloading capability to shuttle tanker, the production facility is terminated at the inlet flange discharge into the storage tank. The storage tank and offloading piping/electrical systems arrangement are considered marine systems.

Shutdown. A system action that will be initiated upon signal or failure and is to result in shutdown of systems, subsystems, equipment, component, or part of the facility.

Shutdown Valve (SDV). An automatically-operated, normally closed valve used for isolating a process station.

Sour Gas. Gas containing significant amounts of hydrogen sulfide (H_2S).

Sour Service. Exposure to environments that contain H_2S and can cause cracking of materials by the mechanisms addressed in NACE MR0175/ISO 15156.

Undesirable Event. An adverse occurrence or situation in a process component or process station that poses a threat to safety, such as overpressure, under pressure, liquid overflow, etc.

Upset Condition. A condition that occurs in a process component or system when an operating variable deviates substantially from its normal operating limits. If left unchecked, this condition can result in a threat to safety and may cause shutting-in of the process.

3 References

3.1 ABS Referenced Rules

- *FPI Rules* ABS *Rules for Building and Classing Floating Production Installations*
- *Facilities Rules* ABS *Rules for Building and Classing Facilities on Offshore Installations*
- *Marine Vessel Rules* ABS *Rules for Building and Classing Marine Vessels*
- *MOU Rules* ABS *Rules for Building and Classing Mobile Offshore Units*

3.3 References

In addition to the ABS Rules in 2/3.1, the additional requirements of the following ABS Guides, ABS Guidance Notes, International/National Codes or Standards and Regulations are referenced in this Guide:

- International Convention for the Safety of Life at Sea (SOLAS), as amended.
- ABS *Guidance Notes on Review and Approval of Novel Concepts (Novel Concepts Guide)*
- ABS *Guidance Notes on Risk Assessment Applications for the Marine and Offshore Industries*
- API – American Petroleum Institute
- NACE – National Association of Corrosion Engineers

ABS is prepared to consider other recognized codes, standards, alternative design methodology and Industry practice, on a case-by-case basis, with justifications as indicated in Section 3 of this Guide.

5 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this Guide:

API: American Petroleum Institute

ESD: Emergency Shutdown

H_2S: Hydrogen Sulfide

HAZOP: Hazard and Operability

HAZID: Hazard Identification

IGS: Inert Gas Systems

LEL: Lower Explosive Limit

UEL: Upper Explosive Limit

NACE: National Association of Corrosion Engineers

P&ID: Piping and Instrumentation Diagram

PCV: Pressure Control Valve

PSH: Pressure Safety High

PSV: Pressure Safety Valve

S.A.F.E: Safety Analysis Function Evaluation

SIS: Safety Instrumented System

VOC: Volatile Organic Compound

SECTION 3

Recognition of Risk Based Techniques to Justify Alternatives

1 General

The requirements detailed herein provide an alternative route to obtain and maintain ABS Class. Any alternatives to the requirements of these Rules may be specially considered by ABS on the basis of a risk assessment submitted for review

i) In case of such alternatives, ABS approval will be contingent upon a demonstration of fitness for purpose and equivalent level of safety in accordance with the principles of ABS Guides and Rules, as well as recognized codes and standards.

ii) Risk acceptance criteria are to be developed in line with the principles of the ABS Rules and will be subject to ABS approval. In instances where a direct alternative recognized code or standard is used, ABS verification of compliance with the standard will be considered to demonstrate equivalent level of safety.

iii) The ABS publication, *Guidance Notes on Risk Assessment Application for the Marine and Offshore Industries*, provides an overview of risk assessment techniques and additional information.

3 Application

A risk-based approach may be applicable either to the installation as a whole or to individual systems, subsystems, equipment or components.

i) The boundaries of the components and systems of the installation to which a risk-based assessment is applied are to be logical.

ii) As appropriate, account must be given to remote hazards outside the bounds of the system under consideration. Such account is to include incidents relating to remote hazards impacting on or being influenced by the system under consideration.

iii) ABS will consider the application of risk-based techniques in the design of the installation, surveys during construction, and surveys for maintenance of class.

iv) Portions of the installation not included in the risk assessment are to comply with the applicable parts of the ABS Rules and Guides.

v) The following are the responsibilities of the owner/operator:

- ***a)*** Proposed risk acceptance criteria
- ***b)*** Hazard identification
- ***c)*** Risk assessment
- ***d)*** Risk mitigation and management

e) Compliance of the system under consideration with the applicable requirements of flag and Coastal State.

5 Submittals

As a minimum, the following documents are to be submitted to ABS for review and approval for classification purpose:

i) Proposed risk acceptance criteria

ii) Methodology for risk assessment

iii) Details of risk assessment

iv) Risk mitigation and/or management measures, wherever applicable

7 Risk Evaluation Methodology

The risk assessment is to consider the installation in all anticipated operating modes.

The designer or Owner is to apply a structured and systematic risk assessment process to identify all foreseeable incidents specific to his installation, making full consideration of the likelihood of occurrence of the incidents and their consequence.

ABS review and approval of the methodology selected by the designer or owner is required.

While various techniques/methods may be applied, the Owner is to justify the suitability and appropriateness of the particular method(s) selected. Some typical methods include:

i) Hazard and Operability Study (HAZOP)

ii) Failure Mode and Effects Analysis (FMEA)

iii) Failure Mode, Effects and Criticality Analysis (FMECA)

iv) Process Hazards Analysis (PHA)

v) Safety Reviews

vi) Checklists

vii) Experience from previous analyses

Where risk assessment techniques are used to cover only part of an installation, the designer or owner is to clearly define the boundary or extent of the item(s) being considered. The extent of the boundary is to subject to review and approval by ABS.

9 Identification of Hazards

The Owner is to identify and consider all hazards that may affect his Installation or any part thereof. Also, must apply a systematic process to identify such situations where a combination or sequence of events could lead to an Incident, with consideration given to all foreseeable causes (initiating events).

The risk assessments are to consider, at a minimum, the following:

i) Fire and Explosion

ii) Hydrocarbon Release

iii) Blow-out

iv) Structural Failure

v) Loss of Stability

vi) Loss of Station Keeping/Mooring

vii) Loss of Electrical Power

viii) Toxicity

ix) Extreme Weather

x) Environmental Factors

xi) Dropped Objects

xii) Ship & Helicopter Collision

xiii) Electrical Failure

xiv) Mechanical Failure

xv) Impact to Equipment

11 Other Requirements

Where it is intended that risk-based techniques are used as a basis for compliance with Flag and Coastal State requirements, the owner is directed to contact the Administration, either directly or through ABS, to obtain an understanding as to the extent to which the Administration is prepared to consider alternatives to such requirements. The Administration may require additional hazards to be considered and safety functions.

SECTION 4
System Design

1 Basic Requirements

The purpose of the hydrocarbon gas blanket system is to replace the use of the inert gas system in liquid hydrocarbon storage tanks by enriching the tank atmosphere with hydrocarbons and prevent the intrusion of oxygen into the tank. The principle is to bring the tank vapor atmosphere outside the flammable range, above the Upper Explosive Level (UEL), in a non-flammable condition at which combustion cannot be supported.

The hydrocarbon blanket gas system is to be capable of:

i) Maintaining the atmosphere in any part of any tank with oxygen content not exceeding 8% by volume and at a positive pressure at all times, except when it is necessary for such a tank to be gas free.

ii) Preventing the intrusion of air into the tank during normal operations, except when it is necessary for such a tank to be gas free.

3 Hydrocarbon Gas for Tank Blanketing

Produced gas is to be sweetened and dehydrated to acceptable levels before it can be used for tank blanketing. The use of fuel gas as blanket gas is considered acceptable. These levels are to be acceptable to the flag/ Coastal State Administration.

3.1 Oxygen Content

The hydrocarbon blanket gas is not to contain oxygen at any concentration.

5 Materials

Materials for all piping, fittings and tanks are to be suitable for the hydrocarbon blanket gas composition.

7 Inert Gas System

The inert gas system required in 5C-1-7/25 of the *Marine Vessel Rules* is to be provided as a backup system in case:

i) Hydrocarbon blanket gas sources are not available (i.e., process upset); or,

ii) Purging and gas-freeing operations

The cargo tanks are to be previously purged with inert gas when hydrocarbon gas is used for tank blanketing.

9 Tank Blanketing-Venting Capacity and Arrangement

9.1 General

The Hydrocarbon blanket gas system is to be interconnected to the tank venting system and the inert gas system. The following conditions are to be complied with:

i) The hydrocarbon blanket gas system is not to interfere with the proper operation of the tank venting system.

ii) The tank venting system is to be designed and constructed in accordance with 5C-1-7/11 of the *Marine Vessel Rules*. See also 3-5/5.5ii) of the *Facilities Rules.*

iii) The hydrocarbon blanket gas system may be considered as the primary means for tank venting. The setting of the pressure control valves (PCVs) required in 4/11.5 is to be less than the pressure setting of the venting arrangements required in 5C-1-7/11 of the *Marine Vessel Rules.*

iv) Release of the hydrocarbon blanket gas through the Pressure/vacuum relief valves fitted on the tanks is to be connected to the low-pressure flare header, or vented to a safe location as required in 5C-1-7/11.13 of the *Marine Vessel Rules*. See also 3-5/5.5i) of the *Facilities Rules*.

v) Release to the atmosphere of the hydrocarbon blanket gas through the cargo vent mast in 5C-1-7/11.17 of the *Marine Vessel Rules* may be considered acceptable provided the vent outlet is located at a height and horizontal distance that allow safe dispersion of the hydrocarbon gases. The vent outlet location is not to be less than 5C-1-7/11.17.iii of the *Marine Vessel Rules* and is to be justified in a gas dispersion analysis. Worst-case atmospheric conditions are to be used for gas dispersion calculations. Dispersion calculations are normally to assume still air and low vent velocity as worst-case condition.

vi) The hydrocarbon blanket gas system is to be isolated from the inert gas piping when the inert gas system is in operation and vice versa. Interlocked key operated valves are to be provided to ensure proper alignment and complete isolation between the two systems.

9.3 System Capacity and Calculations

9.3.1 Capacity

The hydrocarbon gas blanket system is to be capable of delivering the blanket gas to the tanks at a rate of at least 125% the maximum rate of discharge capacity of the facility expressed as a volume flow rate.

9.3.2 Calculations

Hydraulic calculations are to be submitted to substantiate the adequacy of the tank blanketing-venting system. The calculations are to consider possible failure scenarios in the system and undesirable events in the hydrocarbon blanket source (process system), such as gas blow-by.

9.5 Hydrocarbon Blanket Gas Recovery/Disposal

The excess of hydrocarbon blanket gas and the gas coming from the boil off and/or loading of crude oil are to be led to:

i) The topside process system for gas recovery; and/or,

ii) The low pressure flare system (LP Flare) for gas disposal.

Gas recovery to topside process system is strongly encouraged as it provides environmental protection against the release of Volatile Organic Compound (VOC) to the atmosphere and hydrocarbon gas recycling.

11 Piping System

11.1 General

i) The hydrocarbon blanket gas piping is not to be routed through gas safe areas or enclosed spaces.

ii) The hydrocarbon blanket gas piping is to be grounded in accordance with the requirements of 4-6-2/9.15 of the *Marine Vessel Rules.*

iii) Additional requirements may be necessary as a result of the HAZOP studies at the discretion of ABS and the Governmental Authorities.

11.3 Piping Specification Breaks

The design criteria of the hydrocarbon blanket gas inlet piping starting from, and including, the SDV to the tanks is considered part of the marine system and are to meet the Part 4, Chapter 6 of the *Marine Vessel Rules* or Part 4, Chapter 2 of the *MOU Rules*, as applicable. Please also refer to 3-5/5.1 of the *Facilities Rules.* Likewise, hydrocarbon blanket gas outlet piping is considered part of the marine system up to, and including, the SDV.

11.5 Pressure Control Valves (PCVs)

The pressure of the hydrocarbon blanket gas supply and tank outlet is to be regulated by pressure control valves to maintain the design pressure of the hydrocarbon blanketing gas in the tanks.

11.7 Shutdown Valves – (SDVs)

i) A fast closing shutdown valve is to be provided at the hydrocarbon blanket gas supply piping, located upstream and next to the PCV, in order to provide isolation of the tanks from the hydrocarbon blanket gas supply source.

ii) A fast closing shutdown valve is to be provided at the hydrocarbon blanket gas release/recovery required in 4/9.5, located downstream and next to the PCV, in order to provide isolation between the tank and downstream process equipment.

11.9 Interlocked Key Operated Valves

The hydrocarbon blanket gas is to be isolated from the inert gas piping when the inert gas is in operation by means of interlocked key operated valves, as required in 4/9.1vi).

13 Instrumentation

13.1 Electrical Installations in Hazardous Areas

All instrumentation and electrical equipment are to be suitable for the hazardous areas where they are located.

13.3 Instrumentation and Control System

13.3.1 Monitoring Devices

Means are to be provided to automatically monitor and control the following parameters:

i) The pressure in each individual tank

ii) The pressure in the hydrocarbon blanket gas header

iii) The oxygen content at the hydrocarbon blanket gas header

13.3.2 Alarms and Shutdowns

i) Audible and visual alarms are to be provided to indicate failure of the PCVs required in 4/11.5.

ii) The monitoring devices in 4/13.3.1 are also to provide an audible and visual alarm in the cargo/process control rooms. The set point of the monitoring devices is to be clearly identified. The operating points are to be arranged such that the alarm is activated earlier than the safety action (shutdowns).

iii) A warning alarm is to sound when the oxygen analyser in 4/13.3.1iii) detects oxygen content exceeding 5% by volume. Cargo offloading operations (shutdown of cargo offloading or transfer pumps) are to be suspended when the oxygen analyzer detects oxygen content exceeding 8% by volume so as to avoid air being drawn into the tanks. Guidance or procedures to be followed are to be included in the operating manual. See 7/1vi).

iv) Automatic shutdown is to be provided for the SDV in the hydrocarbon blanket gas supply piping required in 4/11.7i) and for the hydrocarbon blanket gas system when predetermined high pressures limits are reached in pressure transmitters required in 4/13.3.1ii).

v) Automatic shutdown is to be provided for the SDVs required in 4/11.7 and for the hydrocarbon blanket gas system upon actuation of the Process Emergency Shutdown (ESD) system of the facility. See 3-3/13.3.4 of the *Facilities Rules*.

vi) A drop in pressure in the hydrocarbon blanket gas header sensed by the pressure monitoring device required by 4/13.3.1ii) is to shut down the cargo pumps and the hydrocarbon blanketing system, and the inert gas system is to be put in operation to supply inert gas into the tanks, per 4/13.3.2viii).

vii) Failure of the recovery system in 4/9.5i) is to automatically shut down the hydrocarbon blanket gas.

viii) The inert gas system, or any other acceptable back-up blanket gas sources (i.e., gas buy back), is to be put in operation when the hydrocarbon blanket gas is shutdown. Instructions to manually start the inert gas system and change-overs procedures (inter-locked valves, etc.) in the venting system necessary to bring inert gas into the tanks are to be included in the operating manual. Refer to 7/1vi).

ix) Additional requirements may be necessary as a result of the HAZOP studies at the discretion of ABS and/or the Governmental Authorities.

13.3.3 Cargo/Process Control Room Displays

The monitoring devices in 4/13.3.1 and alarms and shutdowns in 4/13.3.2 are to be placed in the cargo/process control room. However, where no cargo/process control room is provided, they are to be placed in a position easily accessible to the responsible members of the crew.

The position of the PCVs and SDVs required in Subsection 4/11 is to be indicated on the display panel of the control room.

13.3.4 Testing Requirements

For testing requirements, refer to Chapter 5, Section 1 of the *Facilities Rules.* Testing requirements are to be witnessed by the Surveyor.

SECTION 5

Special Considerations for Single Tanks Fitted in the Hull and Containing Low Flash Point Flammable Liquids [Flash Point of 60°C (140°F) or less]

1 Application

The special consideration in this section applies to single tanks for the storage of low flash point flammable liquid [flash point of 60°C (140°F) or less], such as methanol storage tanks that are built as a hull or integral tanks.

3 Tank Arrangement Considerations

These types of tanks are to comply with the requirements in 3-3/5.9 and 3-5/5.9 of the *Facilities Rules.*

5 Tank Blanketing System Considerations

The hydrocarbon gas blanket system for these types of tanks is to meet the requirements of Section 4 of this Guide, except the following:

i) The inert gas system required in 4/7 is not mandatory for these tanks, provided the system is fitted with capability for gas buy back from pipelines.

ii) The operating manual in Section 7 of this Guide is to include instructions for bringing onboard nitrogen cylinders in cases where gas buy back from the pipelines is not possible or when tank purging and gas freeing operations are necessary.

iii) The blanketing system is considered the primary means for tank venting, per 4/9.1iii) and is to comply with the requirements in 4/9.9, 4/9.5, 4/11.1, 4/11.3, 4/11.5, 4/11.7, 4/13.1, 4/13.3.1, 4/13.3.2, 4/13.3.3 and 4/13.3.4 of this Guide.

iv) The tank is to be equipped with a pressure-vacuum relief valve of suitable setting and capacity as per 5C-1-7/11.1 of the *Marine Vessel Rules* as a secondary means for tank venting. The pressure-vacuum relief valve is to be fitted with flame arresting devices as per 5C-1-7/11.9 and the openings for pressure release are to comply with 5C-1-7/11.13 of the *Marine Vessel Rules.*

SECTION 6
Fire Protection

1 Fire Suppression System

The arrangements for providing foam are to be capable of delivering foam to the entire tank deck area as well as into any tank, the tank deck of which has been ruptured as required in 3-8/5.1.5 of the *Facilities Rules* and 5C-1-7/27 of the *Marine Vessel Rules.*

3 Fire and Gas Detection

The fire and gas detection specified in 3-8/7 of the *Facilities Rules* is to shut down the hydrocarbon blanket gas system and the SDVs required in 4/11.7.

SECTION 7
Manuals

1 Operating Manuals

Detailed instruction manuals are to be provided onboard, covering operations, safety and maintenance requirements relevant to the hydrocarbon blanket gas system and its application to the tank system and interconnection with the inert gas system and gas recovery/disposal system.

The Operating manual is to include the following:

i) Narrative description of the system and concepts

ii) Detailed description of how the tanks can go from lean to hydrocarbon rich atmosphere when blanketed and vice versa and time to reach lean and reach conditions.

iii) Detailed requirements and procedures for purging and gas freeing operation. This is to include instruction on the operation of the interlocked key operated valves.

iv) Instructions for bringing onboard nitrogen cylinders as required in Subsection 5/5 for single tanks fitted in the hull.

v) Detailed requirements and procedures for blanketing the tank with hydrocarbon gas.

vi) Guidance or procedures to be followed in the event of a fault or failure in the hydrocarbon blanket gas system or any associated process upset condition, or oxygen detection per 4/13.3.2iv).

vii) Guidance or procedures to be followed in the event of planned facility shutdown, hurricane evacuation, facility start-up after shutdown, etc.