Overfill Control Systems for Tank Barges

API RECOMMENDED PRACTICE 1125
FIRST EDITION, FEBRUARY 1991

American Petroleum Institute
1220 L Street, Northwest
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Transportation Department

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FOREWORD

This recommended practice has been prepared under the auspices of the API Marine Transportation Committee. The purpose of this publication is to provide guidance to users and manufacturers on the design and operation of barge loading systems and overfill control systems.

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Suggested revisions are invited and should be submitted to the director of the Transportation Department, American Petroleum Institute, 1220 L Street, **N.W.,** Washington, D.C. 20005.

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SECTION 1—INTRODUCTION

1.1 Background

The first level of protection against cargo tank overfills is careful monitoring and control of the cargo transfer by the barge tankerman. In a closed loading operation, the tankerman monitors cargo level by using a closed gauging system; he controls cargo level by manipulating onboard valves and by signaling the terminal to slow down or stop the cargo transfer.

Operator error or equipment malfunctions may lead to tank barge overfills. At the user's discretion, overfill control systems can be employed to provide additional protection. Overfill control systems constitute second-order protection against overfills and should not be activated during normal operations,

This recommended practice provides guidelines for an overfill control system designed to prevent overfilling of cargo tanks during barge loading with a vapor control system in use. Using these guidelines, terminals would provide an overfill protection control panel with an intrinsically safe electrical barge/terminal connection including a flexible cable and an industry standard female connector. This panel would be interfaced with the terminal's emergency shutdown system. The terminal's cargo loading system would be modified as necessary to allow emergency closure of the terminal's cargo loading manifold valve(s) without creating unacceptable surge pressures. Barges would provide an intrinsically safe electrical barge/terminal connection consisting of a fixed industry standard male connector at each cargo loading manifold. This connector would be interfaced with a passive system consisting of level sensors or sensor relays on each of the cargo tanks. The sensors would be set to activate the terminal's emergency shutdown system as necessary to prevent overfill of the vessel's cargo tanks.

1.2 Purpose

The purpose of this recommended practice is to provide guidance to users and manufacturers on the design and operation of barge loading systems and overfill control systems.

1.3 Scope

This recommended practice is intended to supplement Coast Guard regulations on marine vapor control systems; its scope is limited to terminals and barges fitted with overfill control systems in accordance with Title 33 of the ***Code of Federal Regulations*** (CFR) Section 154.812 and Title 46 CFR Section 39.20-9(b), respectively. This recommended practice may be used to ensure the compatibility of overfill control system equipment used in non-dedicated tank barge and terminal operations.

1.4 Referenced Publications

The following publications are cited in this recommended practice:

U.S. Coast Guard

Regulations on Marine Vapor Control Systems (46 CFR Part 39.20-9(b), 39.20-7, and 33 CFR Part 154.812)

Regulations on Oil Pollution Prevention for Marine Oil Transfer Facilities [33 CFR Part 154.550(c)]

Regulations on Electrical Engineering (46 CFR Parts 110-113)

International Electrotechnical Commission (IEC)

International Standard IEC 309-1 (Part 1) and 309-2 (Part 2); ***plugs, socket-outlets and couplers for industrial purposes***

National Fire Protection Association

National Electrical Code, Article 504

SECTION 2—GUIDELINES FOR OVERFILL CONTROL SYSTEMS

2.1 General

Overfill control systems should be designed, installed, maintained, and operated in accordance with U.S. Coast Guard regulations.

2.2 Tank Barges

2.2.1 Each cargo tank should be outfitted with a high level sensor. The setpoint of sensors used for overfill control should ensure that cargo flow is automatically

terminated before tank overfill occurs. Determination of the proper setpoint(s) must take into account the anticipated maximum loading rate, the maximum shutdown time for the terminal's cargo loading valve [see 33 CFR 154.550(c)], and the size of the compartment (that is, the available outage).

2.2.2 Tank barge level sensor circuits (or sensor relay circuits, for systems which also meet the requirements of 46 CFR 39.20-7) should have normally closed contacts and be grounded by connecting the barge cable shield to the ground pin of the connector.

2.2.3 The total connected inductance and capacitance of switches and cabling aboard the barge should not exceed 0.6 mH (inductance) or 0.18 μF (capacitance) at 20.66 volts DC/155 mA. The length of connected cable on the barge should not exceed 3000 feet.

2.3 Terminals

2.3.1 Terminals should determine the best option for interfacing the bargelterminal connection system with their emergency shutdown system (intrinsically safe electrical, fiber optic, radio, or pneumatic means may be technically feasible). Whatever interface system is used by the terminal, the bargelterminal connection system must be intrinsically safe electrical and the integrated barge/terminal system should permit an overfill protection signal on the barge to activate the terminal emergency shutdown system without delay.

2.3.2 The ground pin on the terminal's plug should be connected to the terminal cable shield which should be grounded at the overfill protection control panel.

2.3.3 The intrinsically safe associated apparatus of the terminal's overfill protection control panel should be designed within the following constraints:

1. Maximum length of terminal cable (panel to connector): 1000 feet.
2. Maximum output voltage (panel): 20.66 volts DC.
3. Maximum output current (panel): 155 mA.
4. Maximum allowable connected inductance (barge circuit): 0.6 mH.
5. Maximum allowable connected capacitance (barge circuit): 0.18 μF.

2.4 Electrical Connection

2.4.1 TANK BARGES

Tank barges should provide a mechanically protected, shielded multicable 2x18 AWG minimum (or 4x18 AWG minimum if optional high level alarm system is used) with an oil and seawater resistant jacket, terminating in a fixed, male, 5-wire, earthing-contact position 1, 16 amp inlet meeting IEC 309-1/309-2, located within 10 feet of the barge cargo loading manifolds (port and starboard). The inlet should be clearly labeled as follows:

BARGE OVERFILL CONTROL SYS. CONNECTOR
MAX. INPUT VOLTAGE: 20.66 V DC
MAX. INPUT CURRENT: 155 mA
***TOTAL* CONNECTED INDUCTANCE: ____ mH**
***TOTAL* CONNECTED CAPACITANCE: μF**

NOTE: The values to be inserted for total connected inductance and capacitance apply to switehes and cabling aboard the barge.

2.4.2 TERMINALS

Terminals should provide a mechanically protected, shielded, flexible cable 2x18 AWG minimum (or 4x18 AWG minimum if optional high level alarm system is used) with an oil and seawater resistant jacket, terminating in a female, 5-wire, earthing-contact position 1, 16 amp connector meeting IEC 309-11309-2. The terminal should provide cable to reach the fixed male connector at the barge manifold with sufficient excess to allow for changing draft, water depth and mooring conditions. The connector should be clearly labeled as follows:

BARGE OVERFILL CONTROL SYS. CONNECTOR
MAX. OUTPUT VOLTAGE V DC
MAX. OUTPUT CURRENT: ____ mA
MAX. ALLOWABLE CONNECTED INDUCTANCE: 0.6 mH
MAX. ALLOWABLE CONNECTED CAPACITANCE: 0.18 μF

NOTE: The values to be inserted for maximum output voltage and current apply to the intrinsically safe associated apparatus of the terminal's overfill control panel.

2.4.3 CONNECTOR PIN ASSIGNMENTS (see Figure 1)

Pins N and T3 (L3) are reserved for optional high level alarm connection; pins S2 (L2) and R1 (L1) are reserved for emergency shutdown system connections. Pin G (unlabeled in Figure 1) should be connected to the barge cable shield or the terminal cable shield, respectively. Designations N, T, S and R are those found in the current ***Code of Federal Regulations.*** Designations shown in parentheses and on Figure 1 are those in the 1989 revision of IEC 309-2.

2.4.4 OPERATIONS

A tank barge's overfill control system should not be used if its inductance or capacitance exceeds the terminal's design limitations or if the terminal's output voltage or current exceeds the barge's design limitations.

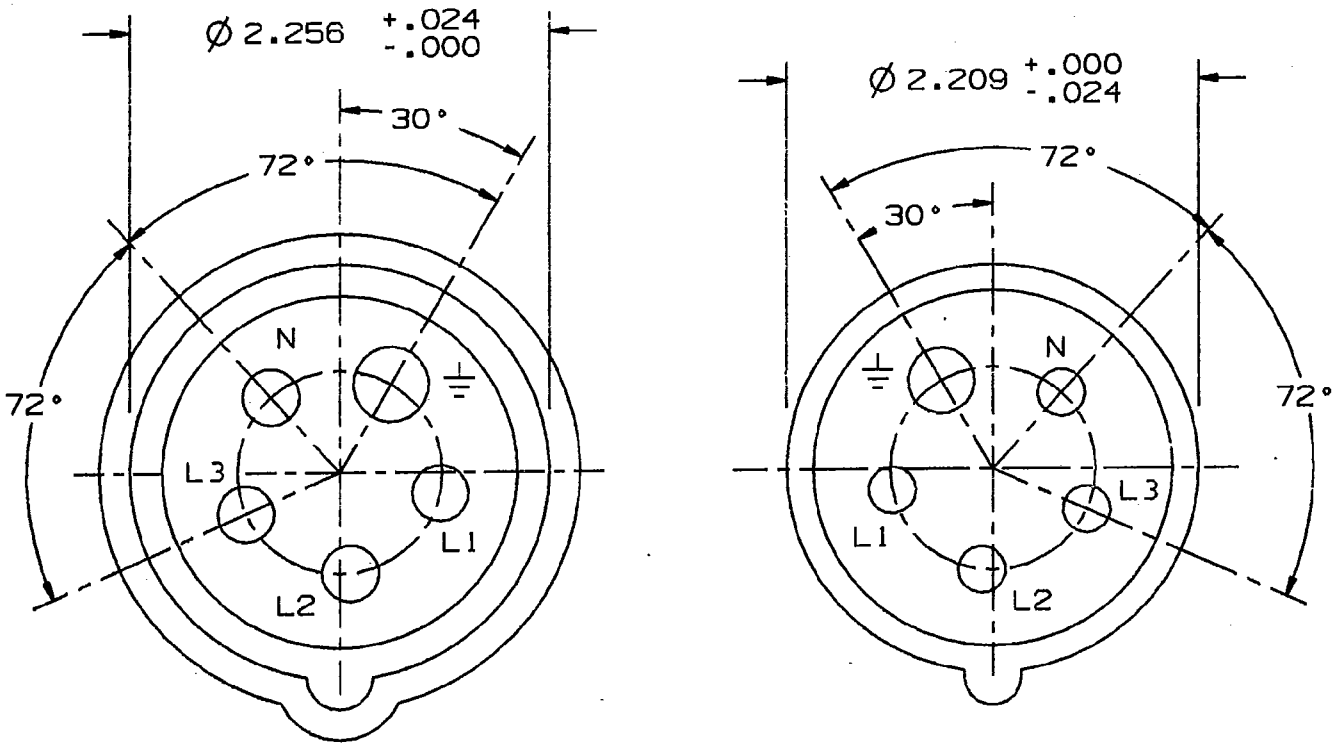

Figure 1—Construction Details for Barge Inlet and Terminal Connector (dimensions in inches)

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