Vopak Fundamentals+ on Safety Standard

Global Operations and Technology

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September 2023	3.2	Aligned with structure change to BU.
September 2022	3.1	Aligned with Static Electricity standard 5.0
May 2022	3.0	Major upgrade including additional clarification and guidance
June 2016	2.3	Clarification on steps to be completed when isolating any system (mechanical, electrical process, hydraulic etc.)
March 2016	2.2	Chapter 5 Transfer of Product – 5.1 Basics, Flash point safety margin. Change from previous guidance amended in v2.1 Endorsed by GOLT
June 2015	2.1	Added guidelines for exceptions which allows to deviate from 10 °C safety margin on flash point (not published)
Dec. 2014	0.2	Update and review of formatting (not published)
Dec. 2006	01	Endorsed by Operational Excellence Leadership Team

Date:	Version:	Endorsed by Operational Excellence Leadership Team

SUMMARY OF CHANGES

Standard revision	Major or Minor change	Paragraph number	Content of change
3.1	Minor	4.4.6	- Relaxation times aligned with Static electricity standard 5.0
3.0	Major	Overall	- MyDocs references to the relevant documents added - Set-up of document have been changed - Roles and responsibilities added
		Chapter 4	Transfer of product - Process steps regarding safety critical equipment communication and monitoring of alarms added - Details regarding measures to minimise charge generation and to enhance charge dissipation added - Replaced flashpoint picture by Flashpoint safety margin determination scheme
		Chapter 5	MOC - Implementation and closure of the change and periodically review of the MOC process added
		Chapter 6	- Aligned with Permit to Work blueprint
		Chapter 7	- Aligned with LOTO blueprint
		Chapter 8	Confined space entry - Inclusion of enclosed areas. -Stricter rules regarding confined space entry regarding the required respiratory protective equipment and / or ventilation and monitoring of the atmosphere. - Requirements for mechanical ventilation - Inclusion of rescue by fire brigade or own employees
		Chapter 9	Working at Height - Inclusion of Temporary scaffolds and working platforms above water. - Included the standard: Safe Use of Ladders and Handrails into the text of working at heights and as an Appendix 4 - *General Safety Considerations when working from a Ladder or Step Ladder*.

TABLE OF CONTENT

1 Introduction

This document is one in a series of guidelines and standards developed by Global Operations and Technology in close cooperation with Business Unit Subject Matter Experts. Implementation and compliance with these guidelines and standards is part of the process of achieving Vopak's ambitions in Operational Excellence.

This standard is intended primarily to assist terminals in the establishment of control measures in order to prevent and reduce risks associated with Vopak's highest risk activities at its sites. It shall be used in combination with the applicable national / international codes and local regulations.

Where relevant, there is also reference to other Vopak codes and standards and a list of common references is included at the end of the document.

2 Scope and applicability

This Standard applies to all existing terminals owned by Vopak and its joint venture terminals where the management is provided by Vopak.

Note that although the majority of these Fundamentals apply equally in construction sites there are some items which may be relaxed during the construction period; any waiver from this rule must be appropriate and controlled so not to increase other risks.

3 Roles and Responsibilities

The roles and responsibilities for the implementation of this standard are the following.

Global Director Operations and Technology:

- Responsible for ensuring the regular review and update of this document.

Business Unit Operations Director:

- Providing sufficient resources to be able to meet this standard.
- Ensuring governance and compliance with this Vopak Way standard on all terminal(s) under their responsibility.
- Ensuring knowledge sharing between all terminal(s) under responsibility of the Business Unit related to the content and updates of this standard.

Managing Director on the terminal or business unit:

- Ensuring compliance with this Vopak Way standard on the terminal(s) under their responsibility.
- Providing sufficient resources to be able to meet this standard.

SHE Manager on a terminal or Opco:

- Ensures there is a process in place for the compliance and periodic verification of the fundamentals on safety processes (for example in the internal audit and / or trust and verify program) and advising the company on legislative requirements.

Terminal manager

- Ensuring the compliance with the fundamentals on safety is monitoring and reporting on the terminal's compliance with this standard for the terminal(s) under their responsibility.

Anyone who carries out work on a Vopak site or carries out work on behalf of Vopak must comply with the requirements set in this standard.

4 Transfer of Product

4.1 Objective

The intent of this fundamental is to ensure that all the risks associated with transferring products between tanks, and to or from the tanks to ships, barges, road tankers, rail tankers, iso-containers, drums, industrial pipeline connections or any other type of vessel are adequately controlled so that the product is safely transferred without incident, accident or contamination.

4.2 Transfer of Product process steps

Before, during and after the transfer of product the following rules must be followed:

- The person who has to perform the task must be trained and assessed as competent;
- The safety information on the product is available, known and understood, explaining the appropriate product hazards and properties, what is referred to as a workplace safety card or safety data sheet. A process must be in place to ensure the workplace safety card and safety data sheet remains up to date, it must be reviewed in line with legislative requirements or every 5 years;
- All instructions to transfer product are issued to the operator in writing or electronic format prior to the start of the transfer. These instructions shall include as a minimum the source and destination of the product, pump (if applicable), pipelines and / or connections to be used, and the quantity to be transferred;
- All applicable safety critical equipment is verified to be in service. If safety critical equipment is defeated, the defeat of safety critical equipment standard must be applied;
- The cargo handling system is aligned and checked in compliance with the issued instructions;
- Clear and effective communication between all parties is guaranteed. The communication requirements are defined in the product management movement standard (MyDocs document number 02.001378);
- For transfer of flammable products, measures are taken to minimise charge generation and static accumulation (operational controls) and to enhance charge dissipation;
- Pressures, flow rates, quantities and operational alarms linked to the movement are monitored throughout the transfer of product;
- The appropriate personal protective equipment (PPE) is prescribed and worn.

4.3 Roles and Responsibilities

The roles and responsibilities defined as per Product Movement Management standard must be implemented into the terminal organisation, i.e. which functions are responsible for which role in the Transfer of Product process.

4.4 The principles of Transfer of Product

4.4.1 The person who has to perform the task must be trained

- The person must be trained and assessed, declared competent and authorised (a written or electronic work order) before the person may execute the task. The person is declared competent

if the person has followed the correct combination of knowledge, ability, training, experience assessment and authorization (a written or electronic work order) to execute the task;
- If an employee is not declared competent, supervision is needed, the person is not allowed to execute the task independently;
- Persons must be trained in what to do in case of an emergency. Additional training is required for persons who have a role in the emergency response plan. The training requirements are defined in the emergency planning standard (MyDocs document number 02.005126).

4.4.2 The safety information on the product is available known, and understood

- The safety information must be presented to the operator prior to the time the transfer is executed. For locations with MyService / PEPI, this is enabled via the workplace safety card and printed instructions. For other locations some other way of achieving this should be found, for example, notices at the loading position or a card which accompanies the transaction instruction;
- It is not sufficient to simply say that safety information is available in the office.

4.4.3 All safety critical equipment is in service. If safety critical equipment is defeated, the defeat of safety critical equipment standard must be applied

Safety critical equipment are those safety assets which primary purpose it is to prevent, or limit (mitigate) the effect of a major accident, but failure of which by itself does not cause a major accident. Details are defined in the Lifecycle Management of Critical Assets Standard (MyDocs document number 02.003560).

Safety critical equipment should normally be defeated after operations are suspended. However, when operations have to continue, either because the system is part of a continuous process, or because the defeat is due to equipment fault or breakdown, then the defeat of safety critical equipment standard must be applied to ensure that safe operational control is maintained. The requirements are defined in the Defeat of Safety Critical Equipment standard (MyDocs document number 02.007298)

4.4.4 The cargo handling system is aligned and checked in compliance with the issued instructions

- Instructions to align the cargo handling system and transfer product must be issued in writing or electronic format;
- Prior to use the line-up must be checked and ensured that any possible leak points or open ends are closed, blanked and fully bolted;
- A formal checklist must be used for manually executed complex line-ups;
- Satisfactory completion of the check must be recorded.

Pipelines shall be physically checked.

- Pipeline transfer systems that are normally left full and controlled with automated or remote operation shall be checked at least daily.
- Pipelines which are left empty between transfers shall be checked prior to introduction of the product. Where new connections are made at the terminal or to the modes of transport (ship-shore MLA or hose) and where any part of the pipeline system has been opened (pigging, maintenance, etc.) a leak test (2 bar) must be performed for the specific connection or section of the pipeline. For assets being built or modified, commissioning must be performed prior to commercial use. For manually controlled empty pipe lines they should be double checked by a different operator in the field (4 eye principle). For pipeline systems with a Distributed Control System (DCS) or position sensors an inspection in the field and a check by the CCR operator is sufficient.

- Immediately checked after the start of transfer for leaks (wet check), and at regular intervals but at a minimum once per shift. Priority of checking shall be given to areas where pipelines are flanged or connections are made;

4.4.5 Clear and effective communication between all parties is guaranteed

Prior to the start of a transfer of product, it is important that clear and effective communication between all parties is guaranteed. Miscommunication can cause major incidents such as contamination, overfilling, spills or even fires and explosions.

To enable effective communication:

- You MUST be able to communicate in the same language. If not, transfers do not take place;
- Use supporting documents like checklists, procedures and emergency shutdown plans;
- Never assume – always ask and verify;
- Confirm agreements in writing where appropriate (ship / shore (un)loading agreement, emergency agreement, consignment agreement (off-site pipeline transfers));
- Before starting any product transfer it is essential to positively confirm effective communications.

4.4.6 Transfer of flammable products and static accumulators

For transfer of flammable* products and static accumulators, measures are taken to minimise charge generation and accumulation (operational controls) and to enhance charge dissipation (grounding):

- All metal and other conductive material shall be bonded to earth. The road / rail tanker shall be earthed / grounded to the specific earthing / grounding point;
- For ship - shore connections (product and vapour) an insulating flange or single length of non-conducting hose must be fitted between ship and shore to ensure electrical discontinuity. Bonding cables should not be used unless it is a requirement of local legislation. In this case they should be used in addition to an insulating flange. In situations where board to board transfers take place, by direct connection of two ships berthed alongside each other, a insulation flange should be used between the two ships;
- Product shall not be splash loaded if the product is classified as flammable* or if the product is being loaded into a tank or vehicle which was last loaded with flammable product and which has not been cleaned (switch loading). Vopak does NOT allow switch loading, unless a full written risk assessment has been carried out and has shown that it is safe to (un) load;
- The liquid velocity in the initial phase during the initial loading phase until the inlet pipe is fully submerged and twice the fill pipe diameter and after roof landings and during the period to refloat the roof plus 100 mm level after refloating is restricted to 1 m/s (3.3 ft/sec). The flow rate after the initial phase varies, but should always be less than 7 m/s (23 ft/sec) at any time or at any point in the infrastructure. For exceptions, consult the static electricity standard;
- Relaxation times must always be observed (30 mins for storage tanks, ships, barges and rail cars, and 10 mins for road tankers, containers, IBC's and drums). The relaxation times are not required if a gauging well is used. Filters shall not be fitted at or close to the delivery end of any loading system. Where filters have to be installed in a loading system, these systems shall be located further from the loading point to give sufficient relaxation time in the pipeline system. (See static electricity standard).

Details regarding static electricity are defined in the Static electricity standard (MyDocs document number 02.009293).

Flammable(*) means a product that is classified as flammable within the criteria described in Global Harmonisation System or a product that is stored and handled at a temperature at, above or within the flash point safety margin as shown in the diagram below. The flash point safety margin is added to

eliminate factors that influence the accuracy and reliability in the determination of flash point, including the nature of the product itself and the changes of the flash point during storage and handling.
Gasoil, diesel and light heating oil with a flash point above 55°C do not need to be treated as a flammable liquid and can be treated as a class III product.

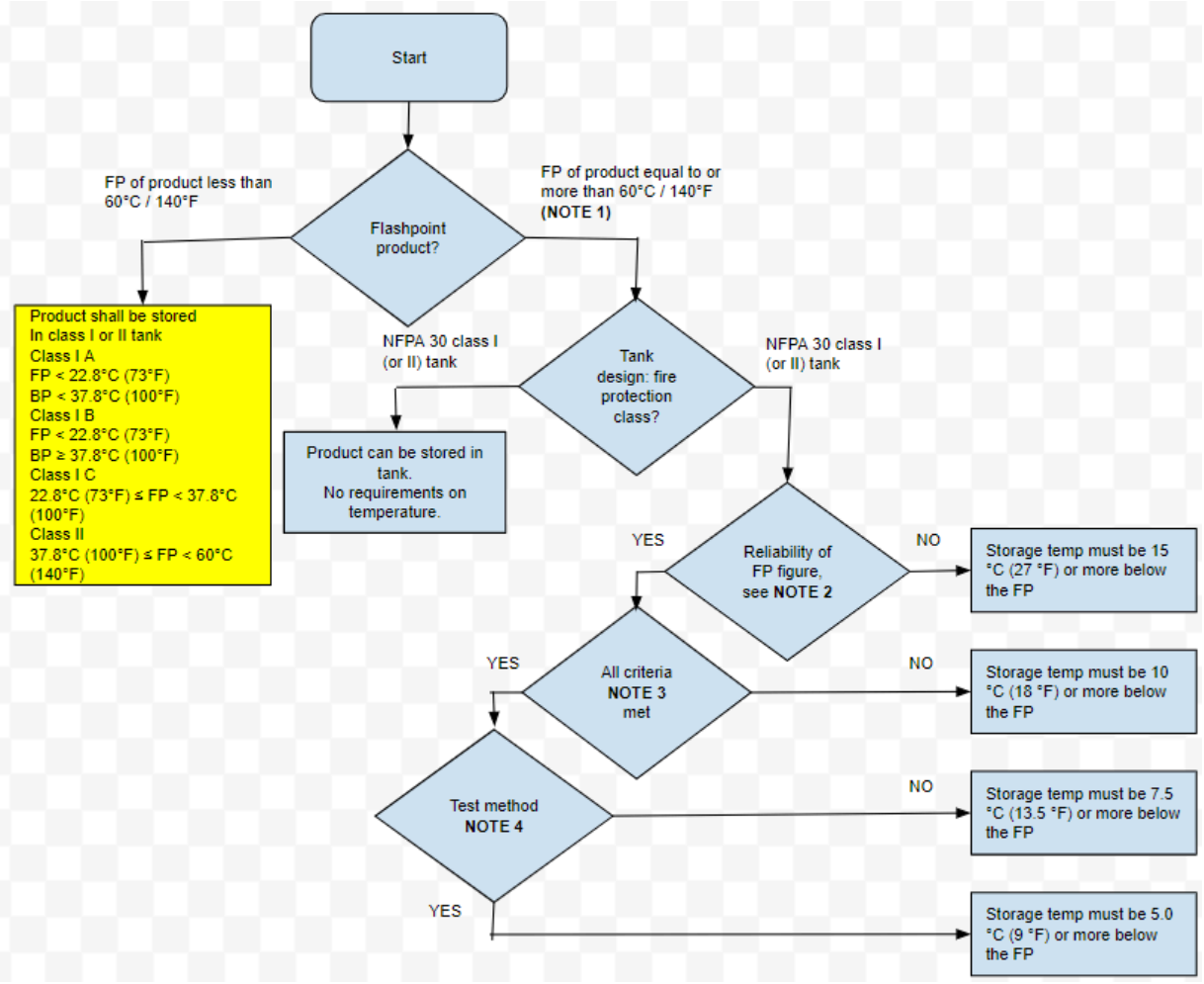
Flash point safety margin determination

The 10°C safety margin is sufficient for most products stored by Vopak. There are exceptions which allow deviation from the safety margin of 10°C:

1. It is allowed to store a product at or above its flash point when the tank meets the requirements of NFPA 30 code for storage of flammable products, i.e. class I (or class II).
2. It is allowed to reduce the safety margin between storage temperature and the flashpoint to 5°C in specific cases for a class III product in a class III storage tank based on an approved risk assessment by the TM or MD.
3. It is allowed to handle / transfer a class III product close to, at or above its flashpoint, when an engineering evaluation conducted in accordance with NFPA 11 and chapter 6 of NFPA 30 justifies following requirements other than those described for class I. Justification provided by an engineering evaluation should be risk assessed, documented with initial approval by the Terminal management team and final approval must be given by the Business Unit management team and it is allowed according to local law legislation.
4. It is allowed to import a class III product close to, at or above its flashpoint into a class III storage tank if it can be proved by engineering evaluation, risk assessment and calculation that the temperature of the product in the tank during the complete duration of the tank import / blending operation has a sufficient safety margin from the flash point. See table below for the safety margins. The Terminal Management Team should approve the calculation before commencing import activities.

Note*

Where there is doubt or uncertainty over the accuracy and reliability of the flash point, consideration should be given to increasing the safety margin (typically to 15°C).
Local / National legislative requirements for flashpoint safety margin should always be adhered to when equal to or superior to the Vopak criteria detailed in the flashpoint safety margin scheme.



NOTE 1. In those locations where GHS has not been adopted and where local legislation permits, 55°C / 130°F may be used to categorise a flammable product provided local ambient temperatures are considered and a full risk assessment is completed and approved by Business Unit management
NOTE 2. Unambiguous and consistent accurate flash point information from the customer has been received.
NOTE 3. Requirements which must be met are:

- Flashpoint, determined through independent analysis and certificate received prior to discharge of product
- Automatic temperature controllers, periodically calibrated by preventative maintenance routines
- Tank gauging systems with temperature measurement alarms in control room
- Engineering evaluation completed (detailed risk assessment) and approved by Business Unit management

NOTE 4. Tested to ASTM D93 - Standard Test Method for Flash Point determination of non residual by Pensky-Martens Closed Cup procedure A

4.4.7 Monitoring of pressures, flow rates, quantities and operational alarms

Transfer of product must be adequately controlled to ensure a safe transfer without Loss of Primary Containment and damages. The following must be monitored throughout the transfer of product:

- Pump pressure and flow rates at a minimum of once per hour;

- Ship / shore interface (if applicable);
- Filling levels and quantities loaded or transferred;
- Checks to verify if quantities delivered matches quantities received;
- Operational alarms continuously.

Monitoring of operational Alarms
As terminals become more automated, alarm systems are used to warn and alert operators or users when there are deviations from normal operating conditions. The daily alarm handling process and the alarm management improvement cycle shall be embedded as defined in the alarm management standard. The alarm system must inform the process controller about terminal conditions that require timely assessment and possibly corrective action to be taken to return to normal safe or efficient operations.
To ensure that tolerances will not be exceeded, the following is required:

- Operational alarms to be monitored continuously;
- Response actions to be carried out in time;
- Persons trained to know which actions they have to take when an alarm is activated.

4.4.8 The appropriate personal protective equipment is prescribed and worn

- There must be a list or record showing what PPE is to be used for all products handled;
- The safety information must specify what PPE is to be used or worn;
- The operators and other personnel must use PPE in the operating work location (loading racks, manifolds, jetties, etc.) as prescribed on the work order / safety information and / or local procedures;
- No person without the correct PPE can be allowed to enter the working area when the transfer is underway.

The Vopak standard Product Movement Management (MyDocs document number 02.001378) shall be applied to all product movements.

5 Management of Change (MoC)

5.1 Objective

The intent of this fundamental is to achieve safe management of all changes to the organisation and personnel, modifications to equipment, procedures, stored materials and handling conditions other than "replacement in kind" by identifying, reviewing and authorising the change and associated controls prior to implementation.

5.2 Management of Change process steps

Approval (authorization) of a MOC cannot proceed unless:

- A risk assessment is performed that covers all elements impacted by the change;
- The change is assessed by a multi disciplined team depending on the change, but as a minimum persons from SHE, OPS and TD. The checklist is a guide only, the team must assess all potential impacts of the change;
- A work plan is in place that clearly specifies the timescale for the change and any control measures to be implemented.

A change cannot start unless:

- The MOC is authorised, a formal check is performed and approval given by the responsible manager after verification that all required actions have been identified, assigned and scheduled in the work plan.

A change cannot be implemented for use unless:

- All actions which are determined in the risk assessment to be safety critical (actions which introduce unacceptable risks) are completed.

A MOC cannot be signed off / closed unless:

- **All** identified actions are completed, inspected and approved.

5.3 Roles and Responsibilities

The local procedure shall define the roles and responsibilities of the various functions who use or are responsible for the administration and management of the MOC process, including the Managing Director responsible for the overall compliance with this standard, the SHE Manager who plays a governance role, the change manager / gatekeeper responsible for the process of the change request, the authoriser / reviewer responsible for approving the changes) and the action holder(s).

5.4 The principles of Management of Change

Temporary and permanent changes to systems, processes, procedures, equipment, organisation, personnel, products, materials and work, including changes in laws and regulations cannot proceed unless a Management of Change process has been completed, where applicable, including:

- A risk assessment that covers all elements impacted by the change;
- A work plan that clearly specifies the timescale for the change and any control measures to be implemented regarding:

    - Equipment, facilities and processes
    - Operations, maintenance, inspection procedures
    - Training, personnel and communication
    - documentation
- Authorization of the work plan by the responsible person(s).

Replacement-in-kind: Maintenance activities with replacement in kind do not trigger the change management process, e.g the replacement of a pump by the same type with the same specifications, however the requirements triggered by the change (e.g. updating information in the info system) must be addressed in the maintenance procedures. Some 'routine changes' may be covered by operating procedures, for example changing the product in a multi-user dock line is covered by procedures.

The minimum requirement for management of change is a written and implemented procedure which addresses:

- The leader or owner for each individual MOC type.
- The technical basis of the change.
- Safe management by identifying and reviewing the risk and impact of the change on safety, health and environment and deciding on precautions to be taken prior to implementation.
- The necessary time period.
- Authorization by appropriate persons.
- Informing and training any employees who are affected.
- Updating process safety information and operating procedures.
- Updating system records such as drawings and data books.
- Modification and updating maintenance procedures or practices.

The procedure should clearly indicate what triggers the management of change process.

5.4.1 Examples of Reasons / Issues to Trigger and Conduct an MOC Process

These include the following but other changes may also need to be addressed:

- Introduction of new dangerous goods or other hazardous materials;
- Re-introduction of particular dangerous goods or hazardous materials after a period of absence and/or changes of the activities performed involving these materials;
- Increase in the quantity or throughput of dangerous goods or hazardous materials held on-site;
- Addition of new processes, buildings, plant and equipment;
- Changes in the design and construction of existing processes, buildings, plant and equipment;
- Introduction of temporary processes, buildings, plant or equipment;
- Temporary or permanent shutdown of the facility, or a section of it;
- Re-start of the facility, or a section of it, after an extended period shut-down;
- Changes to the codes and standards applying to the facility;
- Changes to available knowledge of technical and operational safety; such as learnings from incidents, updates from vendors, etc.;
- Changes to the content of management, operating, maintenance, engineering or emergency procedures;
- Changes to the frequency or nature of safety-critical activities (for example maintenance routine);
- Changes to organisational structure, such as de-manning, or relocation of personnel;
- Redefinition of the roles and responsibilities of safety-critical personnel;
- Changes to the persons filling safety-critical positions;
- Introduction of a new contractor group;
- Reconfiguration or reprogramming of control and monitoring systems;
- Alteration to the range of an instrument transmitter;
- The introduction or decommissioning of safety critical equipment;
- Changes to the set-points of alarm, shut-down systems, safety / relief valves, etc.;
- Redefinition of the facility's critical operating parameters;

- Bypassing or defeating safety critical equipment or control measures (i.e. shutdown valves, etc.); employing Defeat of Safety Critical Equipment processes;
- Changes to land-use around the facility;
- Changes to other facilities nearby or connected by pipeline or other means;
- Change of contractor;
- Change of customer contract which impacts safety (e.g. modes of transport).

The standard revision process of procedures in Vopak MyDocs, should not require an MOC.

5.4.2 Details of Risk Assessment

The level of risk assessment needed to be sure that the change is properly considered and controlled will vary depending on the extent of the change:

- For a simple change it may be sufficient that the consequence was taken into account by an engineer when the change was designed.
- A set of minimum factors which should be reviewed to identify those that may be affected by the proposed change can be found in Appendix 1: MOC - Basic Requirement checklist which is available in MyDocs (MyDocs document number 61.079246).
- For more complex process related changes it may be necessary to repeat all or part of a plant hazard and operability (HAZOP) study.

5.4.3 Work Plan

A work plan that clearly specifies the timescale for the change and any control measures to be implemented regarding:

- Equipment, facilities and processes. This section must address the physical changes on the terminal or location.
- The consequences of the change have been considered and evaluated using a formal checklist.
- Actions have been identified, responsible persons allocated and the deadline of actions agreed.

For example:

- If a valve can be closed off more quickly, does this bring an increased risk of pipeline pressure surge.
- If a customer advises a new temperature range for storing a product do we need to change heating control and alarm settings.
- If we are planning to store a new product for a customer then the compatibility of materials needs to be checked before a tank can be allocated to the duty.
- If regulations are changed do we need to change the control equipment used for a product, for example if there is a new emission regulation, do we need different vapour control equipment.
- Operations, maintenance, inspection procedures, ensure that procedures affected by the change are updated.
- For example, if a tank now stores a solidifying product such as phenol, the PV valve inspection frequency must be reviewed.
- If an operations process is changed, the procedures must reflect the change. For example if a product is moved from a dedicated pipeline system to a multi user pipeline system then the cleaning procedures must also be updated.
- If a new type of filter is to be used then the inspection and cleaning procedure must be updated.

Training, personnel and communication

- How will everyone be informed about the change, how do you ensure that shift workers are informed, is it necessary to re-train people, when will this be done.

Documentation

- The change has to be recorded on;
    - Procedures
    - Records
    - Drawings

Authorization, the formal check and approval by the responsible person(s) after verification that all required actions have been identified, assigned and scheduled in the work plan by the responsible person(s).

5.4.4 Implementation, verification and closure of the change

Before a change can be made operational, the MoC owner checks whether all control measures defined in the work plan have been completed. The only exception for implementation of a change are the actions which are determined in the risk assessment to be non-safety critical (actions which do not introduce unacceptable risks). They can be completed after the change is finished if they are assessed and recorded as non-critical in the work plan and approved by the authorizer.

New process areas and modifications to existing process areas that are significant enough to require a field verification to ensure the impacts on safety are suitably addressed (e.g. a Pre- Start Safety Review (PSSR).

All Mocs must be registered, a list with all open MOCs must be available.

The Management of Change can only be closed / signed off when all identified actions, including the non safety critical actions, are completed, inspected and approved. Furthermore, a check needs to be performed to ensure the change is functioning as intended.

5.4.5 Training

All persons involved in the MOC process must be trained prior to undertaking their role(s). Also these persons should have relevant work experience, seniority, and familiarity with the terminal for their role(s). The local training program must specify the minimum training frequency.

6 Permit to Work

6.1 Objective

The intent of the Permit to Work fundamental is to ensure that hazards related to non-routine work carried out at a location are controlled to prevent incidents.

A permit to work is a signed agreement required for all non routine work, for example all work that involves confined space entry, hot work, maintenance & repairs or non-standard operational tasks, requires a permit to work. For each permit to work a risk assessment must be conducted to ensure that the work to be carried out is properly assessed and controlled to prevent incidents. Only routine operational tasks that are covered by a procedure and JSA and / or risk assessment are exempt from a permit to work.

6.2 Permit to Work process steps

The permit to work process involves the process steps as mentioned below.

Permit request
The permit to work process starts with a permit request, the request for a permit to work requires the following. :

- The work is described in adequate detail by the permit requester; WHAT, HOW and WHERE the work will be carried out;
- The permit holder has included the task related hazards and controls as input for the permit request (e.g. method statement);
- The type of risk assessment is defined and completed. The completed JSA or RA is inextricably linked to the permit to work. The precautions to eliminate, control or mitigate the risks to an As Low As Reasonably Practicable level (ALARP) are determined;
- The permit requester verified that all information required for the work is added to the permit and all tasks to prepare the workplace (e.g. LOTO) are raised by the responsible person.

Assessment of the permit to work
The permit assessor must check:

- The quality, which includes:
    - The clarity of the scope of work;
    - The right selection and the quality of the JSA or RA;
    - Whether all precautions to ensure a safe workplace are identified;
    - The completeness of the permit to work.
- Potential conflicts against other permits
- Potential conflicts with operations schedule;

Preparation of the workplace
The JSA or RA identified workplace preparations (e.g. equipment is made pressure free / product free, LOTO, gas measurements, etc.) to ensure that work can be safely undertaken needs to be completed.

Authorization of the permit to work
The permit authorizer must perform a final check:

- Whether controls are in place and valid;
- On operational conflicts just prior to the release of the permit for issuance.

Issuance of the permit to work
Prior to issuance of the permit to work, the permit issuer must check whether:

- All hazards related to the job are controlled (eliminated or mitigated to an acceptable level);
- All controls specified in the permit are in place;
- The workplace has been declared safe. All workplace preparations must be completed before releasing the workplace for the execution of the work.

The permit must be signed by the permit issuer and permit holder.

Use of the permit to work
Starting and continuing the work by the permit holder, cannot proceed unless:

- The (original) permit to work is available at the workplace and (a copy) in the local control room at the terminal;
- A last minute risk assessment is performed with all workers involved in the work;
- All workers involved in the work are aware of the hazards, understand the permit details and comply to the permit scope and controls, also during execution of the work;
- The work is carried out as described on the permit;
- Certified tools, equipment and inspected vehicles are used which are suitable for the work as stated on the permit.

Closure of the permit to work
After completion of the work, the permit must be signed off by the permit holder and permit issuer before hand back. This must include a check of the workplace before leaving by the permit issuer.

6.3 Roles and Responsibilities

The roles and responsibilities defined as per the Permit to Work blueprint (MyDocs document number 61.072987), must be implemented into the terminal organisation, i.e. which functions are responsible for which role in the Permit to Work process.

6.4 The principles of Permit to Work

The COW standard consists of multiple elements that need to be organised for safe execution a.o. training, scheduling and planning of work, JSA, permit to work, Last Minute Risk Assessment (LMRA), communication and supervision. Permit to work is a key component of controlling work to ensure safe work practices at all times.

Each terminal must have a permit to work procedure governing the permit to work process aligned to this Fundamental and the Permit to Work Blueprint. The permit to work procedure must be known and understood to all persons involved in the process.

6.4.1 Describe the (scope of) work (activities to be undertaken)

The permit must describe the work in adequate detail by the permit requester, based on the information in the permit request provided by the permit holder, which includes:

- Description of the work to be undertaken in sufficient detail;
- Tools, equipment and vehicles to be used;
- Relevant documents (e.g. method statement, lift plan, excavation plan);
- Permit type (e.g. HOT / COLD);

- The work location and hazardous area classification;
- A risk assessment which includes the identified hazards and precautions and / or required workplace preparations (e.g. cleaning, depressurizing, LOTO, gas measurement, fire watch, manhole watch) to eliminate or mitigate the risk to an acceptable level;
- Duration the permit to work is required;
- Company name of Permit Holder.

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6.4.2 Permit to work types

Types of activities / permits to work:
Two types of permits are distinguished; hot and cold. Hot work is distinguished in 2 sub-categories depending on the tools, equipment and / or vehicles used. The power of the ignition source determines the hot work category:

- Hot Work category 1: Activities with an ignition source that introduce a high potential to ignite a flammable vapor, such as open fire, sparks, or a hot surface such as a grinder or combustion engine or,
- Hot Work category 2: Activities that introduce (or have the potential to create) a low energy ignition source, such as non-explosion-proof electrical equipment or camera.

Cold work is an activity which does not create, or have the potential to create, a possible source of ignition.

Although Vopak identifies two permit types (hot and cold work permits), some terminals may have legal requirements for other types of permits i.e. working at heights permit.

Work location characteristics such as at height, confined spaces, or work on pipeline or electrical systems introduces additional risks which require additional controls and mitigating measures to ensure a safe workplace / environment.

The local permit to work procedure must include as a minimum which activities or locations are exempt from permits, if any (e.g. deliveries, low risk office facility work, site visits);

6.4.3 Hot work in classified areas (zones)

The hazardous area classification must be used within the hazard identification and the risk assessment process of the Permit to Work. Hazardous areas are divided into zones based on the likelihood of occurrence and duration of a (potential) flammable atmosphere. Each zone has its leadings principles that need to be followed

- Zone 0: That part of a hazardous area in which a flammable atmosphere is continuously present or present for long periods. Leading principle: no hot work permit allowed in any circumstances.
- Zone 1: That part of a hazardous area in which a flammable atmosphere is likely to occur in normal operation. Leading principle: No operations may be undertaken in the zone during the hot work.
- Zone 2: That part of a hazardous area in which a flammable atmosphere is not likely to occur in normal operation and, if it occurs, will exist only for a short period. Leading principle zone 2 and higher: Normal fire precautions apply. No operations may be undertaken in the zone during the hot work.

- Non-hazardous areas: Areas that do not fall into any of the above.

The suitability of tools, equipment and vehicles and controls need to be addressed during the assessment.

Leading principles

Required precautions for hot work	**Hot work category 1**	**Hot work category 2**
Zone 0	No hot work permit allowed in any circumstances.	No hot work permit allowed in any circumstances.
Zone 1	Work location clean (no combustible material) and free of flammable vapours (seal pipes, close/remove hoses, clean gutters and vent gas, empty drip trays) Before start of work: LEL measurement (requirement: <10% LEL) Fire watch constantly present during hot work Continuous LEL monitoring with acoustic alarm during execution of work: < 10% Suitable fire extinguishing equipment directly available	Work location clean (no combustible material) and free of flammable vapours (seal pipes, close/remove hoses, clean gutters and vent gas, empty drip trays) Before start of work: LEL measurement (requirement: <10% LEL) Continuous LEL monitoring with acoustic alarm during execution of work: < 10% Suitable fire extinguishing equipment directly available
Zone 2	Work location clean (no combustible material) and free of flammable vapours (seal pipes, close/remove hoses, clean gutters and vent gas, empty drip trays) Before start of work: LEL measurement (requirement: <10% LEL) Continuous LEL monitoring with acoustic alarm during execution of work: < 10% Suitable fire extinguishing equipment directly available	Work location clean (no combustible material) and free of flammable vapours (seal pipes, close/remove hoses, clean gutters and vent gas, empty drip trays) Continuous LEL monitoring with acoustic alarm during execution of work: < 10% Suitable fire extinguishing equipment directly available
Non hazardous areas	Suitable fire extinguishing equipment directly available	General precautions* apply: Workplace clean, safe and free of product

		Pre use self check of equipment, material and all prescribed Personal Protective Equipment (PPE) PPE use Do not block emergency equipment, escape routes and/or access routes LMRA * These general precautions are as a minimum applicable for all activities.

6.4.4 Identification of the hazards and assessment of the risk

A risk assessment is the process of:

- identifying and assessing the hazards of each element of the task, the hazards depend on the:
  - activity to be executed;
  - tools, equipment and vehicles to be used;
  - work location (e.g. in tankpit, at height, in a confined space);
  - environment (zone/hazardous area).
- and defining appropriate controls and mitigating measures to minimise the risk to a level "as low as reasonably practicable".

A risk assessment is always required.

The type of risk assessment methodology depends on the risk involved:

A Job Safety Analysis (JSA) conducted by a multidisciplinary team is required when it concerns high risk, non-repetitive, complex work for which a standard risk assessment and related hazards and controls is not available. A JSA used for a work permit has a validity of three months. In case it is still needed after this period, the JSA needs to be reviewed and re-approved.

A Risk Assessment (RA) is sufficient in all other cases. A so-called hazard tree template of the most common permit activities with related hazards and controls can be used for this purpose or as input for a JSA.

Typical types of hazards to be considered	**Possible precautions**
Release of product from tanks, pipelines and systems	Isolation, draining and / or cleaning
High / Low Temperatures Steam and hot surfaces	Isolation, protective clothing
Trapped pressure	Isolation, draining
Excavations and buried services	See excavation fundamental

Overhead Services	Height restrictions, isolation of service, use of banksmen
Flammable materials, Flying sparks Welding or burning Grit and high pressure water blasting Portable electric and air driven tools Portable generators and weld sets	Removal of flammable materials, Firewatchers, Fire hoses and extinguishers Gas detectors Correct grounding of generators, weld sets.
Working inside tanks and other confined spaces	See confined space fundamental
Working at heights	See working at Heights fundamental;
Persons working alone	Lone worker alarms, routine checks
Traffic	Routing and segregation
Manual handling	Working in pairs Correct ergonomic practices Do not exceed the personnel load limits for carrying goods Personal protective equipment
Lifting	To ensure safe crane and lifting operations, the process steps as defined in the Cranes and Lifting Equipment Operations Safety Standard (MyDocs document number 02.011002) must be followed.
Access	Scaffolding Barriers, Barricades No entry warning signs
Tools and equipment	Risk assessment and checks are performed whether certified equipment, suitable for the job, is used.
Sewers, manholes or catch basins in the vicinity of hot work	Suitable covered to prevent potential gases from being released to the work area. Fire blankets or foam to prevent sparks / hot particles reaching flammable gases. Gas detectors.
Working above or near water (details are defined in the Marine Construction Projects Standard (MyDocs document number 61.073956)	Lifejackets. The use of harnesses when working over water must be reviewed carefully with consideration to the benefits and risks a harness brings. Safety nets.

The terminal is allowed to use a Low Risk Work Permit (LRWP) or simplified Permit to Work process for repetitive non-routine and/or maintenance activities that are considered low risks. In the LRWP / simplified process, prefilled LRWP / JSA templates can be used in favour of efficiency (reducing the time in the permit request and assessment process), while maintaining the same authorization and issuance process as described in the Permit to Work blueprint. This process and roles and responsibilities must be described in a local procedure. The list of activities and JSA falling under the LRWP needs to be approved by the Business Unit.

6.4.5 Prescription and examination of the precautions to eliminate, control or mitigate the risk to an acceptable level

Prescribe control measures to eliminate or mitigate risks:

- Reference is made to the Fundamentals+ such as “Lockout and Tagout, Confined Space Entry for example” which describes how certain precautions must be implemented.
- All hazards associated with the proposed job must be identified.
- All controls, actions and precautions necessary to ensure the safety of the site must be identified.
- The work site must be examined to ensure that all precautions specified, including isolations, to be taken before work commences have in fact been taken and will remain effective while the permit remains in force (records must be available);
- The need for gas measurements (flammable limits, oxygen, toxicity) must be identified including results and validity of the measurements. Only calibrated equipment is to be used and a bump tests shall be conducted in accordance with the manufacturer's instructions.
- The permit holder must ensure that the precautions identified are in place, and maintain control at the work site to ensure no deviation from the work described in the permit occurs.
- Appropriate PPE must be specified on the permit and used by the persons involved.

6.4.6 Maintaining operational control when authorising permit to work

The check on correctness and completeness of the permit should have been done in previous process steps by the Permit assessor. Permit assessment (preferably executed the day before the permit will be issued):

- The quality of the permit request and RA / JSA is checked;
- It is checked that there are no conflicts between the simultaneous execution of all the requested permits and that there are no conflicts between the operational activities and the requested permits. Work activities that may interact or affect one another must be clearly identified, cross referenced and either conflict avoided or precautions included on all the affected permits. It is also important, in case of a new (unplanned) operational activity, to check if the activity can start, needs to be postponed or if already issued permits need to be withdrawn;
- An indication of the running permits on a single site plan must be available to allow for an easy overview and review of possible linking of different permits;
- When considering linkage between permits, be aware that a spillage in an area can create a hazard in a different area if it is transported through the site drain or sewer systems.

In case there are no operational schedule conflicts and the required precautions are in place and valid, the permit authorizer is allowed to approve the permit by signing it for issuance.

The maximum safe number of permits that may be issued daily at the terminal is based on, amongst others, the number of available authorisers / issuers / supervision resources and risks of activities.

Details regarding supervision on SHE aspects by both contractor and VOPAK personnel are defined in the Contractor SHE Supervision Capacity Standard (MyDocs number 61.073247).

The default timeframes for planned work in the permit to work process, ie. requesting, assessing, authorising and issuing the permit to work must be followed.

6.4.7 The permit to work must be known and understood

Requirements of the permit and controls are known and understood to all involved in the work:

- The permit must only be signed by authorised persons;
- Preferably all permits are issued at the workplace. Where not executable, a list of activities must be included in the procedure for which issuance at the workplace is always required. As a minimum to include are activities that concerns: hot work (in zoned areas), confined space entry, excavation, working at heights, lifting, multiple contractors working in the same work location and working on equipment requiring LOTO;
- The permit must be signed (accepted) by the person responsible for the work (permit holder);
- There must be a system in place to routinely check the permits being used on the job. Records of these checks must be documented on the permit and/or inspection system (where applicable) available for auditing purposes;
- The permit must have a suspension facility which stops the work if requested by Vopak staff, or if for example the terminal [fire] alarm is sounded;
- A shift hand-over procedure must be in place if work lasts more than one shift;
- In order to be fully effective a responsible person must have an overview of all permits in force;
- Copies of all issued permits must be clearly displayed at the work site or on the person in charge of the work at the work site;
- The contents of the permit must be communicated to all workers involved in the permit to ensure they are made aware of the hazards and precautions (it could be used to run the toolbox talk with the workers of the permit);
- The process to be followed for emergency permits (outside the default process timeframes defined in the procedure), as well as for safe execution of activities during an incident.

6.4.8 Supervision

There must be an adequate level of supervision present from Vopak (or a nominated competent person not directly involved in execution of the work) which is proportional to the risks and complexity of the tasks. This does not mean 100% supervision is required for all work but consideration must be given to what level is appropriate as per the risk. Details regarding supervision on SHE aspects by both contractor and VOPAK personnel are defined in the Contractor SHE Supervision Capacity Standard (MyDocs number 61.073247).

6.4.9 Closure of the permit to work

In case the work is completed (for the day), the Permit Holder ensures the workplace is ready for hand back by executing a Check Before Leaving (CBL);

After the permit has been handed back at the end of the activity, the permit issuer must inform the permit authoriser that the work is completed. The local procedure must prescribe the period for archiving the original permit.

The permit authoriser must have an up-to-date, directly available visualisation of all issued permits (best practice; magnetic white board or digital permit site overview) at the terminal. This visualisation should be used for conflict management between non-routine work and routine operational activities.

Where recommissioning of equipment or facilities is required, reference is made to the local terminal procedures in accordance with the Commissioning standard.

6.4.10 Training and competency

All persons involved in the Permits to Work process must be trained and assessed on competence prior to being allowed to undertake their role(s). Also these persons should have relevant work experience, seniority, and familiarity with the terminal, personal attributes for their role(s).

Permit Holders must receive site-specific Permit Holder training before they are allowed to fulfil the role as a Permit Holder at that site. An up-to-date list of approved Permit Holders should be available. Evidence of training and assessment results must be available.

7 Lockout and Tagout

7.1 Objective

The intent of the LOTO fundamental is to ensure that in case of non-routine work on (potential) energised systems, these systems are placed into a safe condition by isolating the equipment / system which is to be worked on from the rest of the system. The equipment / system must be secured with locks and tags, such that the equipment / system cannot be started and no unexpected release of energy can occur until the completion of the non routine work and the handover of the equipment / system.

7.2 Lockout and Tagout process steps

Isolation of energy systems cannot be executed unless:

- The method of isolation and discharge of stored energy is determined. An isolation plan is prepared and approved by a person other than the person who prepared the isolation plan (Segregation of Duty).
- A final check with operations is performed whether no conflict has arisen.
- The system / equipment is cleaned (if applicable) and de-energized safely (mechanical isolations).
- The system / equipment is administratively blocked (e.g in MyService) to prevent operational orders from being issued for operational use.
- The remotely controlled equipment is put “out of service” for example the Distributed Control System (DCS) (where applicable).

Work on the isolated system / equipment (by issuing of the work permit) cannot start unless:

- The LOTO is placed in the field as per approved isolation plan;
- Any stored energy is discharged safely (electrical isolations);
- The isolation points are secured using a system of lock, tags and lock boxes to prevent unauthorised use during the non-routine work. Only lockout-key management systems according to the LOTO blueprint are allowed (MyDocs document number 61.072988);
- A test is conducted as per isolation plan to ensure the isolation is (still) effective;
- The correct placement in the field as per the approved isolation plan is confirmed by a person other than the person who executed the isolation (Segregation of Duty).
- The permit issuer and permit holder checked the LOTO placement in the field and checked if the equipment / system is still de-energized and safe for the permitted work.
- The permit holder secures the lockbox with a permit holder padlock for grouped LOTO to ensure the isolation stays in place during the non-routine work.

Active isolations and de-energisation must be checked periodically and recorded to ensure isolations remain in a safe state as per approved isolation plan. The terminal procedure must indicate the frequency.

7.3 Roles and Responsibilities

The roles and responsibilities defined as per the LOTO blueprint, must be implemented into the terminal organisation, i.e. which functions are responsible for which role in the LOTO process as defined in the LOTO blueprint (MyDocs document number 61.072988). Please note, the following roles need to be part of the LOTO process: LOTO requester, LOTO plan preparer, LOTO owner and LOTO user. The following roles cannot be combined:

- LOTO Plan Preparer can not be the same person as the LOTO Owner. The LOTO Plan Preparer is not allowed to approve his own LOTO plan (4 eyes principle). This is to assure the

quality of the LOTO plan. At least two people are involved in the LOTO plan preparation and approval process.
- LOTO Owner can not be the same person as the LOTO User. This is to assure that the LOTO has been applied correctly in the field. At least two people are involved in the LOTO placement process (4 eyes principle).

Depending on the size of the terminal and the number of staff, the same process must be followed but roles can be combined. The condition is that at least:
- 2 people are involved in the preparation of the LOTO plan (4 eyes principle) and;
- 2 people are involved in the placement of the LOTO in the field (4 eyes principle).

7.4 The principles of Lockout and Tagout

For work on any energy systems that contains potential energy such as:
- mechanical:,
  - product;
  - hydraulic systems (loading arm control systems, cranes and similar systems);
  - water (steam / wastewater / fire fighting systems);
  - vapor, compressed air, nitrogen;
- electrical;

an isolation plan is required. This excludes operational activities that have a written procedure with JSA.

For mechanical LOTO the plan preparation and ownership is within Operations.

For electrical LOTO, an electrically competent person may be responsible for both the plan preparation and implementation in the field.

7.4.1 The method of isolation and discharge of stored energy is determined and approved

A LOTO request must be raised, the LOTO request must include the following information:
- The reason for Isolation;
- The systems / equipment to be isolated (on P&ID and / or other applicable drawings);
- Start date and expected period of the LOTO is needed;
- The type of LOTO (electrical or mechanical).

The LOTO request must be checked for completeness and an isolation plan must be prepared. The isolation plan must include the following information:
- The type of energy;
- An up to date P&ID or other effective drawing that visualise the isolation points;
- The list of isolation points with codes and / or identification numbers;
- The level of isolation to be achieved;
- How the system / equipment should be de-energized safely (e.g. gas free, clean, voltage free);
- The testing method and frequency of testing the effectiveness of the isolation.

LOTO also will require administrative / DCS blockages to prevent operational work orders or excessive alarms in the control room. These requirements must be included in the local procedure and isolation plan where applicable.

The isolation plan must be approved by a person other than the person that prepared the isolation plan (Segregation of Duties).

7.4.2 Electrical isolation method

This involves the separation of the equipment from the power circuit so that there is a physical break in the system which prevents power from flowing. This can be achieved by either opening and locking the appropriate circuit breaker.

Some electrical systems can store energy after the power has been removed and in this case additional work needs to done to drain this energy from the system (typical examples are: transformed power supplies, frequency drives and UPS systems where the system may have to be isolated from its supply and then left under load until the power is discharged).

High voltage systems

High voltage systems are systems operating at greater than 1000 V alternating current or 1500 V direct current.

The LOTO process shall also be in place for high voltage systems. The preparation and execution of the isolation can only be led by a certified competent person (often a 3rd party contractor) and shall be approved by Vopak. The governance of the LOTO process remains with the E-LOTO owner as stated in the LOTO blueprint. High voltage working is not a standard activity within the organisation and as such is subjected to specific risk assessments and safe systems of work.

Details regarding Electrical safety are defined in the Electrical Safety Standard (MyDocs number 02.011386).

7.4.3 Mechanical isolation method

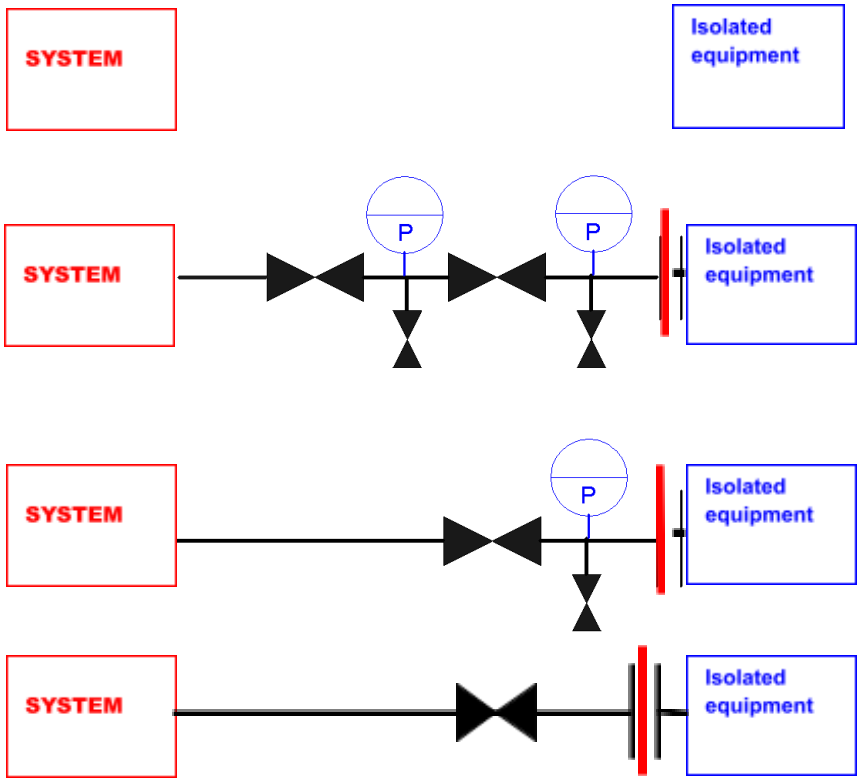
Many of the isolations performed at Vopak are to isolate the potential flow of liquids and gases; the types of isolations to be employed are shown in the diagrams below.

The level of isolation will depend on the scope of the work, time taken to execute the work etc.

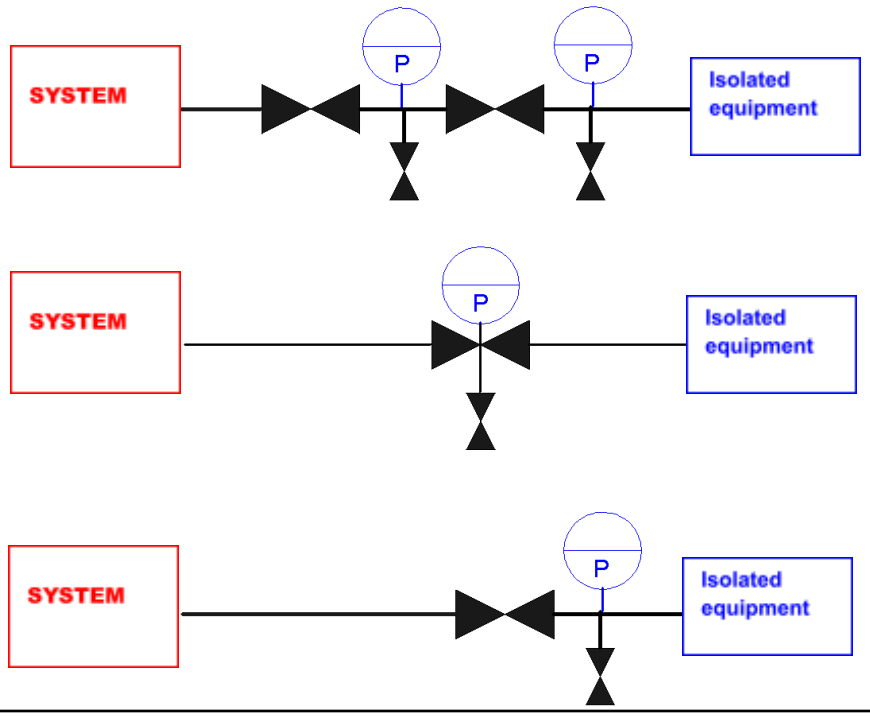
The following isolation hierarchy must be considered in order of preference in the preparation of the isolation plan, as shown below.

Physical or proven isolations: Physical isolation is the standard. When this is not feasible the reason for deviation must be documented in the isolation plan.

Physical Isolation Examples

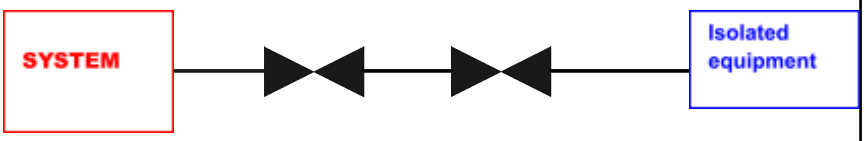
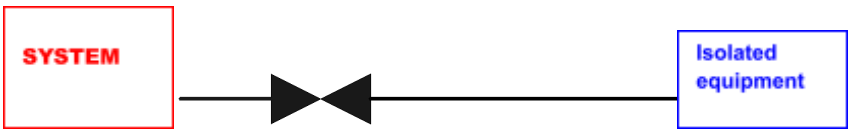
Physical isolation	
ISOLATION	Pipe work physically disconnected from all sources of contamination before any maintenance work commences.
Physical disconnection Double block, and bleed and spade or blank flange Single block and bleed with spade or blank flange Single block with a valve and no bleed with a spade or blank flange.	
TYPICAL REASON	Where equipment has to be removed from a pipeline system or where preparation is being made for confined space entry.
TESTING	No pressure at gauges, no flow of product at drain points
ADDITIONAL PRECAUTIONS	Blank flange or cap, padlock and warning tag to be fitted to any open ends of line where a hose could possibly be connected. System to be disabled in product handling software if applicable.

Proven Isolation Examples

Proved isolation	
Standard	Valved isolation
Double Block and Bleed Double seals in a single valve (Double block and bleed)) Single block and bleed	
TYPICAL REASON	Breakdown where equipment is permanently installed into fixed pipework and cannot be cleaned without potential contamination of stored product
TESTING	No pressure on gauges, no show of product at drain points
ADDITION PRECAUTIONS	Blank flange or cap, padlock and warning tag to be fitted to any open ends of line where a hose could possibly be connected. Valves to be securely closed and locked and marked with warning tags. System to be disabled in product handling software if applicable. Appropriate protective clothing for the product being handled.

Non Proved Isolation Examples

Non-Proven: the lowest standard described is only allowed to be used as a temporary isolation to achieve a higher level of isolation. This temporary isolation must be assessed and controlled to ensure a safe work location.

Non proved isolation	
Standard	Valved isolation. No provision to confirm effectiveness of valve closure prior to breaking into system. Where possible double valve isolation should be used. Extreme caution is necessary when using this standard of isolation.
Double Valve	
Single Valve	
TYPICAL REASON	Normally only to be used as a temporary step while achieving higher isolation standard
TESTING	
ADDITIONAL PRECAUTIONS	Break into the system to proceed slowly and carefully. Containment of the system to be opened in a way that it can be re-stored easily and quickly if the isolation is not effective. If the isolated equipment is to be removed from the system blank flanges with pressure indication and drain valve to be fitted to all open ends. Blank flange or cap, padlock and warning tag to be fitted to any open ends of line where a hose could possibly be connected. Valves to be securely locked, closed and marked with warning tags. System to be disabled in product handling software if applicable. Appropriate protective clothing for the product being handled.
SUPERVISION	Supervisor to witness link break and fitting of danger boards and locks.

Please note Single valve isolation against tanks or running systems is not considered sufficient except in an emergency situation.

In all situations other than emergencies, the system should be emptied of product before proceeding with work or a specific risk assessment should be performed to identify how the work can be safely undertaken. This risk assessment shall be countersigned by the MD / Terminal Manager responsible for the safe operation of the location.

No person will be allowed to enter a confined space entry without a *physical* isolation of the confined space. Details are described in section 8.4.4 of the Fundamentals Confined Space Entry.

7.4.4 Any stored energy is discharged

Any system/equipment that will be isolated requires that any stored energy is discharged (safe situation).

For mechanical systems this can be draining remaining product, steam or venting trapped pressure (steam, air, nitrogen) to a safe location and cleaning the system.

In cases where product remain in sections of pipeline and is blocked due to LOTO, precautions need to be taken so that relief routes (TRVs) are not blocked. Blockage of product can result in gasket or pipeline rupture (liquified gases have for example an expansion factor of 600 times).

For electrical systems this is specific to the equipment but consists of actions to discharge stored power in batteries, capacitors and inductive loads. It may also involve installing additional circuit bridges and earthing capability and is beyond the scope of this document.

7.4.5 For both mechanical and electrical systems, a system of locks and tags must be used to secure isolation points from use

- Install padlock and tag on each isolation point;
- The lock out key systems allowed within Vopak must comply with the key systems outlined in the LOTO blueprint, for grouped LOTO and non-grouped LOTO;
- Within grouped LOTO (more than one isolation point in the isolation plan), a lockout box system must be used;
- For short term maintenance work where start and completion of the work is on the same working day with non-grouped LOTO (where only one piece of equipment in the field is to be isolated), a lockout box system is not mandatory. A double padlock in the field on the isolation point is required by the owner / issuer of the equipment and the holder of the work permit. The keys of the 2 padlocks that are used to lock the single piece of equipment in the field, are kept by the Permit Issuer and Permit Holder themselves during the work or the padlock-key of the LoTo Owner is kept in central a key safe, other than a lockout-box;
- The lockout key system must ensure double safeguarding to prevent de-isolation or unauthorised changes to the isolation during work;
-
- Each active isolation point must have a tag. The tag must contain the following information as a minimum:
    - Equipment to be isolated (e.g. pipeline section 1);
    - Isolation point description / type (e.g. valve no. 3);
    - Isolation method / status (e.g. valve spaded or removed);
    - LOTO certificate number;
    - Lock Box number;
    - Name of the person carrying out isolation (placer);
    - Date and time the isolation is placed;

7.4.6 A test is conducted to ensure the isolation is effective

- Prior to work on the isolated system for the first time, a full verification of the placement of the isolation is required. The verification must be executed by another person than the person who placed the isolation (Segregation of Duty).
- Prior to starting work on the isolated system, a verification must be done that the (part of the) system where work is planned to take place is locked out and remains / de-energised.

7.4.7 Isolation effectiveness is periodically monitored:

- This is particularly important for pipeline and pressure systems where passing valves can allow the isolated section to slowly become contaminated or re-pressurised.
- Effectiveness can be confirmed by repeating the checks detailed above.
- Long term isolations need to be managed and checked from time to time in accordance with local procedures, considering the nature and intent of the isolation. Long term isolations are for equipment taken out of service for a period of time for reasons other than active maintenance / technical work (i.e. for operational purposes). This means no work permits can be issued on this equipment / system with this LOTO type.

7.4.8 Removing or cutting padlocks in the absence of the key/padlock owner

Removing or cutting padlocks in the absence of the key/padlock owner is only allowed in very exceptional situations and only allowed with the required approval. Removing or cutting padlocks (in the field or from the lockout-box) in the absence of the key/padlock owner is considered a defeat of a safety critical process and therefore terminals must describe this process in the local LOTO procedure. The procedure must be aligned with the requirements in the LOTO blueprint;

7.4.9 Suspect or known to be failed isolation

- Circumstances can arise as a result of equipment failure where secure isolation is not easily possible, and the first step of the maintenance and repair work is to establish proper isolation. A typical example would be equipment failure together with passing or failed isolation valves;
- Testing the degree of isolation is not always possible but an estimation of potential rate of flow and potential spillage should be made and documented;
- The containment should be broken in a controlled way so that it is always possible to re-tighten or re-close if more flow or pressure is experienced than was anticipated;
- Facilities to catch and recover any spilled product must be available and correctly positioned;
- Work can only be done if the persons working can remain out of the line of fire;
- Fire watch personnel, fire extinguishing equipment and fire hoses must be available for flammable products;
- Appropriate protective clothing for the product being handled must be used;
- Appropriate breathing protection equipment must be worn if required;
- Valves to be securely closed, locked and marked with warning tag;
- At least two persons are to be in attendance through the operation. One of these should be of supervisor level.

7.4.10 Deisolation

De-isolation cannot proceed unless:

- All work permits related to the isolation plan are handed back;
- Formal approval for de-isolation by the responsible person (e.g. LOTO Owner).

In case of temporary de-isolation for testing purposes, the sanction to test process according to the LOTO blueprint must be followed.

Handover of the equipment / system to the managing department cannot proceed unless:

- The equipment / system has been de-isolated;
- All isolated equipments are released in the administrative (e.g. MyService) and / or DCS;
- De-isolation is formally confirmed by the responsible person (e.g. LOTO Owner).

The LOTO owner is responsible for the LOTO de-isolation process.
All permits relating to the LOTO need to be handed back prior to the de-isolation.

The local procedure must outline the process for partial de-isolation for testing equipment, referred to as ‘Sanction to test’, as well as the re-approval of the changed isolation plan.

The LOTO owner is responsible for the safe partial de-isolation and testing of the equipment. The LOTO owner must inform all permit holders involved in the isolation before partial de-isolation and executing the test.

7.4.11 Training and competency

All persons involved in the LOTO process must be trained. All the persons responsible for preparation, approval and placement of the isolation plan must also be declared competent for their roles with regard to relevant work experience, seniority, and familiarity with the location / equipment.

8 Confined space entry

8.1 Objective

The intent of this fundamental is to ensure the safety of all authorised entrants by implementing controls and to prevent unauthorised entry into (potential) confined spaces.

8.2 Confined space process steps

Entry into a confined space cannot proceed unless:

- All other options have been reviewed and ruled out; This review of other options shall be recorded (documented), shall form part of the work records, and shall be kept available for inspection for a period of at least 3 months.
- All local regulatory requirements are met;
- A permit to work for confined spaces entry is authorised and issued, and for enclosed areas, the risks have been assessed in a local risk assessment of the enclosed areas and the controls have been implemented and controlled in standard operating procedures / work instructions for the location;
- The permitted confined space is physically isolated. Refer to the fundamental LOTO regarding physical isolation.
- The atmosphere has been tested / is monitored for oxygen content and where required for flammability and toxicity;
- The gas tests are verified and repeated as often as defined by the risk assessment;
- Stand-by personnel with an understanding of the agreed rescue plan are available (and covered in the risk assessment) at the permitted confined space with the proper means of communication;
- The appropriate personal protective equipment is used;
- Unauthorised entry is prevented;
- Rescue plan is in place. The emergency team is able to respond and conduct a rescue in a timely manner.

8.3 Roles and Responsibilities

The local procedure shall define the roles and responsibilities and steps to take for preparation for entry and working in confined spaces and rescue from a confined space.

8.4 The principles of Confined space entry

8.4.1 Confined space

A confined space is any area that has:

- limited openings for entry and exit that would make escape difficult in an emergency;
- has a lack of ventilation;
- contains known and potential hazards; and
- is not intended nor designated for continuous human occupancy.

(Note that local legislation may have specific definitions of a confined space)

The main areas of concern are storage tanks, spaces above and below internal and external floating roofs (EFR) (the space above the EFR is a confined space if the EFR is more than 2m lower than top of shell), interceptors, drains, deep trenches or excavations, sumps, air receivers, boilers and flues.

The confined space entry control shall start to operate from the moment the possibility to enter the space is possible. For example an instruction to open a tank manway makes the space entry “available” and must therefore initiate entry control (fitting of door barriers).

A ship's tank must not be entered by Vopak staff, road or rail tank car must not be entered by anyone, this includes areas used for road tankers visiting Vopak sites!

For inspecting ship’s tanks independent cargo surveyors may be required. This operation must be performed following the ship’s confined space entry procedure and agreement between both surveyor and Master of the vessel.

8.4.2 Enclosed areas

An enclosed area is an area which:

- Is often used for routine work;
- Is large enough to enter and work:
- Has the potential of limited ventilation;
- Does not contain atmospheric or product hazards under normal conditions.

An area needs to be classified as an enclosed area if the area has the potential of having the same risks as a confined space due to one or more of the above characteristics and/or conditions.

For example work such as entry into pump rooms, tank bunds and coupling areas which need to be accessed by operators on a regular basis as part of the operational activities and has the potential of having the same risks as a confined space, will be addressed as per enclosed areas requirements. Some excavations may also be considered as enclosed areas and these controls are covered in the permit to work for the activity.

An enclosed area is defined as pump rooms, and coupling areas whereby the depth / diagonal distance ratio is > 0,2 and have the potential of lack of oxygen and/or exposure to hazardous vapours. For depth / diagonal distance ratio ≤0,2 consideration must be given to the size of the area (length / width). The terminal can decide to take these into account as an enclosed area as well.

Tank bunds may be regarded as confined spaces if the distance from bund to tank < the bund height. This must be determined by a risk assessment.

8.4.3 Hazards of confined space entry

The main hazards when entering and working in (potential / considered) confined spaces:

Liquids may flow into the confined space drowning or asphyxiating anyone in the space, or can cause physical or chemical burns. Fine solids such as sand can have a similar effect if they become unstable and flow into a confined trench for example.

Oxygen Deficiency - Insufficient oxygen may lead to asphyxiation. Low oxygen levels may occur through rust formation, chemical reaction between soil and oxygen, groundwater reacting with chalk and limestone to produce carbon dioxide and displacing normal air (fermentation has a similar effect), or decomposition of organic matter.
Oxygen enrichment – An excess of oxygen in the atmosphere, even by a small amount for example from a leaking oxygen hose on an oxy-acetylene gas cutting set, creates an increased risk of fire or

explosion. Materials which normally only burn slowly, will burn very quickly in an oxygen enriched atmosphere.

Risk of fire or an explosion can arise from the presence of flammable substances / vapours.

Toxic substances may accumulate in the space from surrounding ground, may enter from connecting pipes, may build-up in connected vessels or may remain from previous use.

Physical hazards are amplified. Examples include noise, extreme temperature, burn hazards, engulfment hazards, mechanical hazards, slips, trips, falls, electrocution and moving machinery. Utilities may also introduce additional hazards.

Residues in the space can be disturbed by the work and change the condition of the atmosphere after work has commenced.

8.4.4 Confined space entry

No person may be allowed to work in a confined space unless all other possible ways of doing the work from outside the space have been considered and found to be impracticable.

Entry in a confined space is not allowed unless:

- **A permit to work is issued:**
  - All work to be performed in a confined space must be authorised using a Permit to Work, following a specific confined space entry permitting procedure;
  - Contractors and Vopak personnel are required to provide a suitable and sufficient method statement and a risk assessment of any tasks they are to perform in the confined space;
  - The work can only begin once the permit has been issued and all involved and responsible persons have implemented the conditions identified on the permit and signed the permit to show their understanding of the necessary precautions;
  - A Vopak person must be appointed to ensure the task being performed complies with the Vopak confined space / permit requirement;
  - The permit process must address:
    - Hazards of previous contents;
    - Hazards from residues;
    - Contamination of confined space from surrounding area;
    - Possibility of oxygen enrichment or depletion;
    - Inherent risks from dimensions and layout of the confined space;
    - Hazards from the work inside the confined space;
    - Hazards from any work outside the confined space;
    - Provision of adequate lighting (at appropriate voltage);
    - Hazards from any chemicals being used for cleaning;
    - Possible sources of ignition;
  - Before issuing the permit to enter the confined space, the permit issuer ensures that the confined space to be entered is withdrawn from service, empty, gas free (below 10% of LEL and below the safe health exposure limits) and clean (where required for safe entry and work) isolated as per the LOTO requirements / certificate.

- **Confined space entry is not allowed unless the confined space is isolated;**
  - The confined space MUST be isolated from all possibility of gas or liquid entering the confined space by following the **physical isolation** as per the LOTO requirements;

- As well as the main product pipelines the isolation must also include all service pipelines such as nitrogen supply to blanketing systems, bubbler systems, compressed air to sparging or blending systems and so on.

Physical Isolation standards required before entry is allowed (see also lock and tag-out fundamental)

- Physically remove a section of pipe work or remove valves as close as possible to the tank, so that the pipeline into the tank cannot be used to transfer gas or liquid into the tank.

Or if this is not possible

- Fit a spade in the line as close as possible to the tank to physically block the pipeline, so it is not possible to transfer gas or liquid into the tank. The spade must be capable of withstanding the maximum possible pressure in the pipeline. These need to be clearly identified as solid blank / spades without any confusion to them being assumed to be or mistaken as spectacle plates.

Or if this is not possible

Below method is not preferred and may only be used when above options are impossible. A written risk assessment that is formally approved by Business Unit Management is required:

- Fit a spade, blanking flange or cap to all points where gas or product can be put into the pipelines, these need to be locked and tagged in place.

Close and lock all valves and shell nozzles on the tankside and pipeline system and prevent connection of supply hoses (by padlock through flange bolt hole, locking blanking pieces into service line connections, or prevention by some other secure means).

IF NONE OF THESE ARE POSSIBLE YOU MUST NOT ENTER THE SPACE

Some confined spaces have additional hazards from mechanical and / or electrical equipment installed in the space, for example paddles in a mixing tank. Any such equipment must be effectively isolated so that it cannot be operated.

All blanking and isolation points must be locked so that they cannot be accidentally removed, re-opened or re-energised without authorisation. The isolation must follow lock and tag procedures.

- **Entry is not allowed in the confined space unless:**
  The atmosphere has been tested for oxygen content and where required for flammability / explosivity and toxicity. These tests are verified and repeated as often as defined by the risk assessment:
  - The gas test results must be checked by the authorizer prior to authorisation of the work permit and witnessed by the issuer and permit holder prior to commencement of work.
  - Gas testing by authorised personnel is required for the confined space entry work. Continuous gas monitoring with audible alarm is preferred, if this is not done the frequency must be determined in a risk assessment. As a minimum, a test must be done at the start of work, re-start after breaks and hourly, and documented on the permit. This hourly measurement can be adjusted to 4 hourly if additional effective continuous gas monitoring with audible alarm activation is in place.
  - Only calibrated equipment for testing is to be used and tested to ensure it is working correctly. Bump tests shall be conducted in accordance with the manufacturer's instructions.
  - The previous product the tank (or other confined space) contained must be noted on the gas test form, together with the name of the person making the test.

- The date and time and results of the atmosphere tests must be recorded on the tank entry permit.
- The gas test must include as a minimum,
    - Oxygen level,
    - Flammability in terms of % lower explosive limit (LEL),
    - Residual level of previous product unless that product is non hazardous to human health.
    - Other tests may also be necessary depending on the type of product stored / space to be entered such as hydrogen sulphide, carbon monoxide.
    - If the atmosphere test is satisfactory if the gas test shows that:
        - The oxygen level is between 19.5 and 22% **and**
        - Levels of previous product are below the safe health exposure limit (TOX), **and**
        - The tank is at less than 10% LEL of any previous flammable substance,

then issuing of an entry permit can proceed, taking account of the absolute gas contamination and the length of time that the work will take.

If the gas tests show the atmosphere to be:
- Above 10% LEL of the previous product (entry NEVER allowed): AND / OR
- Above 22% oxygen (entry NEVER allowed).

NB - This risk cannot be mitigated by the use of respiratory protective equipment.

YOU MUST NEVER ENTER THE CONFINED SPACE DUE TO AN INCREASED FLAMMABILITY HAZARD!

If the gas test shows the atmosphere to be:

Less than 19.5% Oxygen

And / or if the gast test shows the atmosphere to be:

- Above the Short Term Exposure Level (STEL)
- Above the Time Weighted Average (TWA)
- But below 10% LEL

ENTRY IS NOT ALLOWED, ADDITIONAL VENTILATION IS THE PREFERRED FIRST STEP. ENTRY USING SUPPLIED AIR BREATHING APPARATUS BUT ONLY AFTER A RISK ASSESSMENT HAS BEEN COMPLETED AND APPROVED.

Entry using supplied air breathing apparatus must only proceed once:

- A risk assessment of using respiratory protective equipment assessment to identify requirements for supplied air breathing apparatus and to demonstrate that supplied air breathing apparatus gives adequate protection is completed and approved. (See Appendix 2 – Selection of respiratory protective equipment which is available in MyDocs (MyDocs document number 61.079245).
- Only persons trained in the use of such RPE equipment, qualified and medically fit can be permitted entry.

Ensure that time limits for entry permit duration and personnel time constraints (particularly if respiratory, breathing equipment or temperature high / low may cause fatigue) are stated on the permit and are complied with.

- The confined space is adequately ventilated before and during the entry:
    - Roof vents and manways should be opened to promote ventilation;
    - This may be achieved by Venturi eductors or natural ventilation may suffice if there are sufficient top and bottom openings. NOTE: Venturi eductors must never be connected to the nitrogen system;
    - The removal of flammable or explosive vapours from a storage tank by means of mechanical ventilation (electrically or air-driven) is prohibited;
    - The first option must be natural ventilation e.g. open manholes and roof vents or with a venturi type blower. In the case where a venturi type blower is not suitable, i.e. where there is a need for an alternative where the total volume of air required cannot be adequately[1] and safely supplied by a venturi-type blower and or due to manway access being limited, an appropriate alternative solution should be assessed and documented;
    - The use of mechanical ventilation on tanks without flammable or explosive vapours - verified and maintained gas free, (below 10% of LEL {continuous monitoring required} and below the safe health exposure limits) is ONLY allowed under the permit to work and CSE controls. A risk assessment and ventilation plan approved by the Terminal Manager or Managing Director must be submitted to the Business Unit for approval. The approval can be valid for a period depending on the request (ie. a project, or a terminal with non-flammable products for a period). Refer to the Appendix 3 on Mechanical Ventilation requirements which is available in MyDocs (MyDocs document number 61.079247);
    - Additional ventilation may be necessary when welding is being carried out inside the tank;
    - Oxygen must not be introduced into a confined space to sweeten the air as this can lead to oxygen enrichment and its associated hazards (spontaneous combustion, increased combustibility);
    - The risks from any residues in the tank must be identified and measures taken to control them. Dangerous gases, fumes or vapours can be released when residues are disturbed or particularly when heat is applied to them.

- Stand-by personnel are stationed nearby with the proper means of communication;
    - There must be a standby person at or near the tank door or access to the confined space;
    - The function of this person is to observe, if possible, or maintain communications with, the persons working inside the confined space to assure their safety at all times;
    - The person ensures that there is a safe way in and out of the confined space, which allows quick and unobstructed access and exit. No obstructions must be caused by equipment required for performing the task.
    - Persons inside the confined space must be in contact with persons outside by radio or some other agreed means;
    - One standby person can supervise multiple tanks provided the tanks are adjacent and the standby person can respond immediately to any situation. The standby person must be able to control access to all confined spaces that they supervise. Every specific situation must be assessed and a decision made and documented in the risk assessment based on the known hazards and complexity of activities.

- Unauthorised entry must be prevented;
  Lock in place a suitable barrier across the access to prevent unauthorised entry at all times except when the permitted entry is taking place, this includes during breaks when the entry is

[1] a minimum of 4 fresh / outside / contaminant-free air changes per hour per tank during confined space working or other local regulatory requirements.

unattended. This must include a clear conspicuous safety sign prohibiting unauthorised access. Only authorised persons should be able to remove the barrier (lock, special bolts etc).

- The appropriate personal protective equipment is used;
    - Where it is possible it should be ensured that the confined space is safe to work in without the need for additional PPE and Respiratory Protective Equipment. If this is not possible then correct equipment must be provided.
    - The type of PPE provided will depend on the hazards.
        - Ensure any required P.P.E. is identified and worn during the work;.
            - Those persons entering a confined space must wear a safety harness; (this is to aid rescuers in lifting the person in the event of an incident) and where possible and practical the harness should be attached to a lifeline. This is not always possible for tanks with IFR / heating coils and must be addressed within the rescue plan;
    - If respiratory protective equipment is to be used then a full documented assessment must be made to ensure and demonstrate that it provides the required level of protection.(See Appendix 2 – Selection of respiratory protective equipment which is available in MyDocs (MyDocs document number 61.079245).

- Other tools and equipment:
    - Any equipment intended to be used in the confined space must be suitable for the conditions to be found in the confined space;
    - Internal combustion engines and gas cylinders are not allowed inside the confined space;
    - Leaking hoses on welding and oxy-acetylene gas cutting sets creates an increased risk of fire or explosion. Any flexes, hoses or pipes used for e.g welding or cutting activities in a confined space must be isolated and removed from the confined space at the end of each working period. If this is not easily possible they must be disconnected from the gas supply at the end of each work period, that is at the end of the day and during work breaks. This must be stipulated on the work permit and compliance must be ensured;
    - No flammable or combustible materials may be stored in the confined space;
    - Ensure adequate and suitable lighting is provided;
    - Exclude all sources of static electricity.

All portable electrical equipment shall preferably be powered by an internal power supply (e.g. battery power). If this is not possible, the equipment shall be powered by an extra low voltage (ELV) circuit with a nominal voltage of maximum 50VAC or 120VDC. If equipment is not available in these safe voltages, an isolation transformer or residual-current device (RCD) shall be used in the power circuit of the equipment. Terminals may have legal requirements regarding the use of portable electrical equipment

- A rescue plan and equipment are prepared and in place:
    - There must be a plan to rescue persons from a confined space in the event of an emergency.
    - This plan must be specific to the particular space to be entered.
    - Those arrangements shall not be considered suitable and sufficient unless they reduce as far as possible any risk to the health and safety of persons required to put the rescue arrangements into operation.
    - The arrangements must include at least the following points:
        - Identify the location of rescue and resuscitation equipment;
        - State how the alarm is to be raised in the event of an incident;
        - State how the rescuers safety will be ensured;

- State how any fire would be identified, alarm raised, controlled and extinguished;
- State how any associated plant and equipment would be controlled during and after the rescue.
- State how injuries would be managed and first aid assistance given;
- Describe how public or off-site emergency services would be called and involved;
- Only persons who have been trained in confined space rescue can be used in any rescue plan.

The rescue can be performed by own employees and / or centrally organised by the fire brigade. The rescue team must:

- Be able to respond and conduct a rescue in a timely manner, considering the hazard(s) identified;
- They must participate in drills once a year;
- Have adequate equipment for confined space rescue;
- Have efficient means of communication;
- Rescue equipment must be in good order and properly maintained;

Where rescue is done by Vopak, the rescue equipment must be in a location that is easily accessible in an emergency, typically at the entrance or as close to the confined space as practicable. The minimum rescue equipment must consist of:

- safety harness on the person/s working in the confined space;
- stretcher outside the CSE entrance;
- self contained breathing apparatus for the rescue team members.

Rescue teams must be trained, details regarding arrangements for training, testing and exercising plans are defined in the emergency planning standard (MyDocs document number 02.005126).

NO PERSON SHALL ATTEMPT A RESCUE FROM A CONFINED SPACE EXCEPT IN ACCORDANCE WITH THE AGREED PLAN.

NO PERSONS SHALL ENTER THE CONFINED SPACE IN THE EVENT OF AN INCIDENT UNTIL ALL NECESSARY STEPS HAVE BEEN TAKEN TO ENSURE THEIR SAFETY DURING THE RESCUE.

8.4.5 Enclosed area entry

Entry into an enclosed area without a permit to work is not allowed unless:

- The terminal has set up an inventory of enclosed areas, which operators (or other Vopak personnel) can enter for daily operational activities;
- For each enclosed area i.e. pump rooms, coupling areas and tank bunds, a risk analysis has been carried out;
- Based on risks (flammable products, toxic products, nitrogen availability) measures have to be taken as per the risk assessment;
- A standard measure for all enclosed areas is barricading it off (e.g. by chain with warning sign) and placing information signs (e.g. Enclosed area; entry only allowed, if entrance is in compliance with terminal procedure *X*) on all entrances of the pump room / coupling area / tank bunds;
- Other measures could include:

- Stationary oxygen analyser in the enclosed areas, equipped with visible and acoustic alarm and linked to an alarm in the CCR. This is a requirement when nitrogen systems and thus nitrogen leak scenarios are present in the area;
- Personal monitors (LEL / Oxygen and possible detection of toxic products). Caution: These will NOT work for nitrogen and for acute toxic products (as it detects too late for the person to be able to evacuate or avoid exposure to the toxic product above the limit value;
- When dangerous atmospheres in an enclosed area can only occur when a person performs a certain task in this area, personal detection is considered acceptable if a nitrogen leakage is not possible and the product is not acutely toxic;
- Clear procedures / work instructions / work permits;
- Ventilation.

8.4.6 Special cases

Tanks under construction
A tank under construction is normally not considered a confined space but may become confined as it approaches completion.

The standard definition of a confined space is any area that has limited openings for entry and exit that would make escape difficult in an emergency, has a lack of ventilation, contains known and potential hazards, and is not intended nor designated for continuous human occupancy.

Limited openings for entry and exit that would make escape difficult in an emergency:
- normally once the tank can only be accessed via the man way doors
- Tank shells on jacks with a minimum of 0.5 metres clearance between shell and floor are not considered to have restricted access.

Ventilation:
- Until the tank roof has been fitted and sealed to the shell and the tank doors are open it is not normally considered as having poor ventilation

Contains known and potential hazards, the two main hazards to be considered are:
- presence and accumulation of gases and fumes from welding or hot cutting etc,
- oxygen depletion when a tank is emptied of water after a hydro test (and the oxygen is consumed during shell rusting).

An assessment of the combination of these circumstances will show if a confined space condition applies, for efficiency of construction, methods which avoid the tank becoming a confined space should be selected.

8.4.7 Tanks under repair

A tank under repair shall normally be considered as a confined space, unless a door sheet has been cut out of the tank shell so that access in and out of the tank is no longer restricted. However other hazards may still remain and a risk assessment must be completed to control the remaining risks.

9 Working at Heights

9.1 Objective

Falls from height is a leading cause of fatal injury or major injury to persons in the workplace. This fundamental is intended to help recognise the situations where falls from height are possible and to provide requirements / controls for providing a safe work environment and prevention of accidents.

9.2 Working at Heights process steps

Working at heights cannot proceed unless:

- All other options for eliminating the need for working at a height have been reviewed and ruled out;
- A fixed platform is used with guard or hand rails, verified and approved by a competent person;
- or if this is not achievable, a fall arrest system is used. Preference is given to the fall arrest block / inertia reel / retractable type fall arrester with auto controlled descent. The use of a fall arrest system must comply with the following;
    - It is appropriate for the specific situation and approved by a competent person;
    - It is visually inspected and if damaged or activated is taken out of service;
    - All who use a fall arrest system are instructed and trained in its use;
    - In the event of a fall, the arrest system must be capable of stopping the person before they hit the floor or other equipment below where they are working;
    - Fall arrest systems must be clipped to structures which are strong enough to stop and support the falling person,
    - Worn by persons constructing / dismantling and working on scaffolds.
    - Worn by persons working on cable suspended platforms:
        - For all temporary suspended platforms or permanent platforms which do not have two independent supporting wires the person's harness and fall protection equipment must be hooked to an independent static point and not to the working platform so that if the platform should fall they are separately supported.
        - For permanent suspended platforms that have two independent supporting wires (where one alone is capable of supporting the platform and people etc. should the other fail) the person's harness and fall protection equipment must be hooked to a manufacturer designed anchor point on the working platform
    - For persons working at height above water, priority must be given to fixed / temporary platforms with guards or handrails. Persons should not be clipped to structures which could itself fall into the water (for example a mobile scaffold mounted on a floating pontoon) or in the case where the person could fall into the water, where the harness could hinder their safe rescue. They should be clipped while entering and exiting these structures.
    - The person that falls may not be able to contact a rescue team. In the risk assessment / work permit it must be made very clear who will raise an alarm if a person falls and is suspended at heights. A rescue team must be able to respond and be able to hoist them to a safe area as quickly as possible within 15 minutes of falling.
- Or if no other alternative is available, a ladder or step ladder can be used once a formal and documented risk assessment shows that no practical alternatives exist.

9.3 Roles and Responsibilities

The local procedure shall define the roles and responsibilities for persons who are responsible for and involved in working at heights.

9.4 The principles of Working at Heights

Work at Height should be avoided where possible. Where this is not possible a suitable and sufficient risk assessment must be undertaken and a safe system of work developed. Any work at height needs to be properly planned in advance of the work activity, appropriately supervised and carried out in a safe manner. Careful consideration should be given to the selection and use of work equipment.

Hierarchy of preference must be followed when planning and assessing working at heights:

1. Avoid working at height;
2. Prevent falls when working at height;
3. Mitigate the consequence of someone falling.

A specific minimum height when this standard is applicable cannot be given as local laws must be complied with as a minimum. In some areas any work which is not at ground level is considered to be at height.

Consideration should be given to the risk of the work taking into account the frequency, duration, height, task involved, weather (particularly wind speeds above force 6 / 44km/hr) and so on. For guidance purposes any work above 1.5 metres is definitely considered to be at height.

9.4.1 Avoiding working at heights

Consideration must always be given to avoiding working at heights. This can be achieved in many different ways but in many cases it is just not possible or practicable. Have the following been considered:

- Automating the activities / redesign so that working at height is no longer required / reduced;
- Redesigning tools?
- Changing working practices?
- Performing preparation work at ground level and lifting it into place once completed?

9.4.2 Prevent falls when working at heights

Where it is not possible to eliminate the need for working at a height you must prevent a person from falling. Fixed platforms with handrails must be considered as a first option. They can be permanently or temporarily installed.

A fixed platform is used with guard or hand rails, verified and approved by a competent person.

Permanently installed platforms with guard and handrails are installed on tanks, loading racks or similar facilities.

- Any gap between the platform and protective handrails should be sufficiently small to prevent someone falling through the gap;
- Permanently installed platforms must be inspected and maintained as part of the site's maintenance system. Inspection shall be formalised and recorded.
- The handrails shall be free from any sharp, protruding pieces to prevent injuries to any part of the body.

- Do not walk on a platform where defects are seen / suspected, gratings are corroded, damaged, not positioned correctly or fully secured on the platform or handrails of the platform.
- If any part of the stairs, ramp, walkway or handrail is damaged or loose, tag out and barricade to prevent use. DO NOT USE UNTIL REPAIRS ARE COMPLETED;

Temporary platforms can be a scaffold or a mobile elevated working platform.

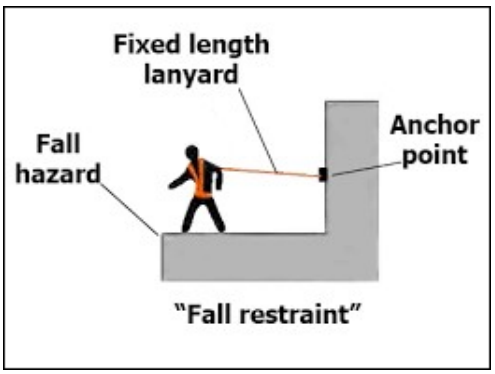
Scaffold and temporary work platforms must comply with (local) regulations for design, fabrication, erection, and use, regardless if the scaffold / temporary platform is erected on land or over water. These regulations are specific to, and exist in, almost every country but in the absence of regulations an internationally accepted standard must be selected and adopted e.g. for scaffold standards: OSHA 3150, BS EN 12811-1 and NZ/AS 4576. For Temporary Work Design standards EN 12810 & 12813, BS 5975 and SS 598 & 580.

General safety rules for scaffolding:
- The scaffold is designed and engineered for its purpose;
- Safe access (in line with legislative requirements, in the absence of regulations, international standards must be applied) of the platform is considered in the design. Access between the different levels should preferably be provided by inclined stairs within the platform within a widening of the work platform at one bay or in a tower immediately adjacent;
- Can be installed and dismantled in a safe manner;
- Only certified workers can build or rebuild scaffolds;
- Temporary scaffolds and particularly mobile towers must be of a sufficient base area to prevent them from tipping;
- The scaffold is surrounded by handrails, mid rails and toe board;
- Never leave materials or tools lying around to prevent the risk of tripping or falling;
- The scaffold must be high enough for the work to be carried out. A ladder that does not form part of the scaffold structure must never be used to complete a task on the scaffold;
- Never use scaffolds above a windforce 6 Beaufort (24.1 MPH, 35.3 fps, 22 kts, 39 km/h 10,8 m/s);
- Make sure traffic is aware of the scaffold by placing signals or barricades off the area;
- People using scaffolds should be made aware of the risks and the rules for working on scaffolds;
- Temporary platforms must be inspected by a qualified person such as a scaffold inspector, and must be certified to show that they have been properly designed and erected. For prolonged temporary scaffolding there should be a system to check the scaffold regularly. A scaff-tag should always be present, filled out and valid.

The use of new methods and equipment for working at height must be tested and approved by the MD prior to introduction.

Mobile elevated platforms are also used as temporary platforms. These sorts of motorised vehicles are only to be used by trained, competent and certified persons.

If fixed or temporary platforms are not a practical option other systems which prevent falls, such as a restraint system which prevents a person approaching within say 2 metres of a position where they can fall can be considered.



Temporary scaffolds and working platforms above / near water
It is mandatory to provide safe access and safe work platforms for all persons at all times. Installation, erection and dismantling of platforms and scaffolds may be exempted from this requirement under the strict condition that safety and wellbeing of the 'erectors' is guaranteed. Method Statements, JSA's and LMRA's for scaffold erection / dismantling are mandatory and must be authorised by Vopaks technical / project manager or a competent and approved person higher in the organisational hierarchy.

Proper platforms, handrails and safe access prevent incidents whereas PPE mitigates the consequences of an incident and prevents accidents. According to the hierarchy of safety control measures:

1. Eliminating and substituting work over water, when possible, are the most effective measures.
2. Providing a safe work platform is a higher control (i.e. more effective) than PPE (lifejackets, harnesses) when working over water.

When scaffold boards are at risk to be exposed to, or submerged in, water (by waves, swell, surge, wake, high tide) they must have an open structure i.e grating or mesh type, and must be secured to the supporting structure to prevent uplift or displacement.

Detailed information is defined in the Marine Construction Projects Standard (MyDocs document number 61.073956).

Accessing and Working on heights:

To carry out the work in a safe manner and to avoid others being injured by falling objects, the following rules must be followed:

- Avoid two-handed job demands when walking on stairs / a walkway. Use one hand to hold tools keeping free the hand closer to the handrail;
- The use of one hand to carry tools and materials up stairs / at heights should be discouraged where possible. Light tools can be carried in pockets, in a shoulder bag or attached to a suitable belt;
- Heavier tools and materials can be hoisted on a hand line provided a platform is available for them at working level;
- Never leave materials or tools lying around to prevent the risk of tripping or falling;
- Do not walk on stairs / walkways where there is no fall protection or handrails.
- Do not walk on stairs or a walkway if the floor is slippery or wet and there is no anti slip material.
- Always be aware of objects on the stairs / walkway and avoid tripping hazards.

9.4.3 Mitigate the consequence of someone falling

If preventing a fall whilst working at heights is not possible or practicable then the consequences of falling must be mitigated.

Systems which minimise the consequences of a fall must be used, such as:

- an air bag system (collective system);
- a safety net (collective system);
- fall arrest / retractable type system and harness (individual system);
- Lifejackets (individual system).

These types of systems are separated into collective and individual systems; collective systems protect many people at the same time whereas individual systems only protect one person. The preference is always for collective systems over individual systems. In typical Vopak locations for day-to-day operations the use of collective systems is not possible or practicable, then fall arrest systems and harnesses must be used.

Lifejackets must be used when working above or near water.

Fall arrest systems, harnesses and lifejackets must be appropriate for the specific situation, maintained, inspected in accordance with the manufacturer's guidelines and approved by a competent person; records of the inspection must be maintained.

- Selection of the type of fall arrest system to be used must be in accordance with a documented risk assessment. Fall arrest block/inertia reel/retractable type fall arrester with auto controlled descent is preferred over the standard suspension harness.
- The risk assessment must be carried out by someone trained and competent to make such a selection (often guided by local legislation).
- Fall arrest systems, harnesses and life jackets must be visually inspected routinely and before every occasion of use by the wearer.
- On inspection if the life jacket, harness or fall arrest system is damaged or activated it must be taken out of service. Some types of harnesses can only be activated once, particularly those which have a velocity reducer.
- Passive arrest systems such as nets and air bags must be inspected each day and each shift where appropriate.
- Maintenance and inspection of these systems must be completed by a competent person and recorded.

The consideration and decision to enforce, or refrain from, using a fall arrest system and harness when working over water must be reviewed carefully with consideration to the benefits and risks a fall arrest system and harness brings. This review must be recorded and approved in a risk assessment.

All who use a fall arrest system and / or lifejacket must be instructed and trained in its use:

- Persons using harness arrest systems must be trained in wearing the equipment and must understand its use and limitations.
- Persons working above passive arrest systems must be taught how to react if they fall so that they are not injured by the passive system, and so that they know how to recover themselves if they fall.

All persons working with a fall arrest system must have someone with them in the work area able to contact a rescue team to recover the person to a safe area.

IMPORTANT TO REMEMBER

People left suspended in harness type systems even for very short periods (5-30 minutes) can suffer serious injury or fatality if not rescued in a short period after the fall.

- If a fall occurs someone must be able to contact a rescue team immediately;
- A plan must be available upfront for the rescue;
- The rescue team must know how to react to rescue the person;
- It must be possible to rescue the person within 15 minutes of the fall and this must be verified with emergency exercises. Please note this rescue time is significantly less if a person is falling into the water.

9.4.4 Ladders and Stepladders

A ladder is:

A stepladder is

Only if no better alternative is available may ladders or step ladders be used:

- The use of ladders and step ladders for activities should be limited as much as reasonably possible;
- Before ladders and step ladders are used a formal and documented risk assessment must show that no practical alternatives exist.

Details for the safe use of ladders and stepladders in the workplace are defined in the appendix 4 General Safety Considerations when working from a ladder or /a stepladder which is available in MyDocs (MyDocs document number 61.080140).

10 Excavation

10.1 Objective

The intent of this fundamental is to prevent persons being injured when working in or near excavations. This is achieved by making sure the excavation is properly planned, managed and supervised and undertaken in a manner that prevents accidents.

10.2 Excavation process steps

Work that involves a man-made cut, cavity, trench or depression in the soil cannot proceed unless:

- A risk assessment of the work location is completed and documented by the competent person(s);
- All underground hazards, i.e. pipelines, electrical cables, etc., have been identified, located and if necessary, isolated;
- A valid permit to work is obtained.

Where persons are to enter an excavation:

- A confined space entry permit must be issued where applicable;
- Ground movement must be controlled and collapse prevented by systematically shoring, sloping, benching etc., as appropriate;
- Ground and environmental conditions must be continuously monitored for change.

10.3 Roles and Responsibilities

The local procedure shall define the roles and responsibilities for persons who are responsible for and involved in preparation and execution of work within excavations.

10.4 The principles of Excavation

Work that involves a man-made cut, cavity, trench or depression in the soil cannot proceed unless:

- A risk assessment of the work location is completed by the competent person(s);
  - The assessment must identify the risks which may be present during the excavation;
  - The necessary precautions are identified and put in place;
  - The main hazards are collapse of the sides, materials falling onto persons working in the excavation, people and vehicles falling into the excavation, undermining of nearby structures, contact with underground services, access to the excavation and fumes filling the excavation.
- All underground hazards, i.e. pipelines, electrical cables, etc., have been identified, located and if necessary, isolated;
  - Where possible up to date, reliable drawings are used for reference;
  - In addition to drawings use can be made of detection equipment such as electrical and magnetic field detectors, and ground penetrating radar;
  - Look for obvious signs of underground services, for example valve covers or patch repairs to road surfaces;
  - If there is any doubt about the location of an underground hazard, digging by hand will be necessary until the hazard is sufficiently located to allow the use of machines;

    - When digging to locate hazards, and when digging near known underground hazards, sources of energy such as pumped liquids and electricity must be isolated;
    - Underground pipelines in excavations must be provided with adequate temporary supporting.
- A valid permit to work is obtained;
    - A permit to work must always be used during the excavation;
    - The permit must detail exactly the type and location of underground hazards and specifies the precautions to be taken while excavating near those hazards;
    - It details the precautions necessary to stop unauthorised persons from entering or falling into the excavation, and to protect persons working in the excavation;
- Clear barriers must be in place to prevent persons falling into an excavation
    - If the excavation is more than 1.5 metres deep then substantial barriers (physical guardrails and toe boards) must be provided to prevent a person falling into the excavation;
- Proper means of access must be provided at suitable opposite ends where required as indicated by the risk assessment.

Where persons are to enter an excavation:

- A confined space entry permit must be issued where applicable. This is determined when an excavation meets the definition of a confined space. See the basic requirement on confined space entry.

Ground movement must be controlled and collapse prevented by systematically shoring, sloping, benching etc., as appropriate;

- Ends and / or sides must be prevented from collapsing by grading them at a safe angle or supporting them with timbers, sheeting or proprietary support systems;
- People must work in supported excavations and not work ahead of the supports. Even shallow trenches can be dangerous if the work involves bending, or kneeling in the trench;
- Excavated materials cannot be stored near the sides of the excavation, this can fall back into the trench and the additional loading can cause the ground to collapse;
- The excavation and its vicinity must be checked after rainfall;
- Ground and environmental conditions must be continuously monitored for change.

Vehicles must be kept away from the excavation.
Where vehicles are being used to backfill, stop blocks or similar must be used to prevent them from falling into the trench.

11 Motorised vehicles

11.1 Objective

The intention of the Fundamental is to prevent serious and fatal accidents during workplace transport. Common forms of accidents are being struck or run over by a vehicle; vehicle overturns due to incorrect loading or unsuitable road surfaces, falling from vehicles, or being struck by objects falling from vehicles, damage to infrastructure / equipment by vehicles moving in operational areas.

11.2 Motorised vehicles process steps

All categories of onsite motorised vehicles, including forklifts, must not be operated unless:

- The vehicle is appropriate for the purpose, inspected, maintained and confirmed to be in safe working order;
- Seat belts are installed and worn by all occupants and other relevant safety devices are used as intended;
- Loads are secured and do not exceed design specifications;
- The local road safety regulations are fully complied with;
- Drivers must not be allowed to operate the vehicle unless they are:
    - Fully trained;
    - Qualified;
    - Authorised;
    - Declared medically fit (self-declaration is sufficient where not legally required) to drive and operate the vehicle.

11.3 Roles and Responsibilities

The local procedure shall define the roles and responsibilities for the use, maintenance and inspections of the vehicles.

11.4 The principles of Motorised vehicles

All categories of onsite motorised vehicles, including forklifts, must not be operated unless:

- The vehicle is appropriate for the purpose, inspected and confirmed to be in safe working order;
- Appropriate for the purpose includes at least considerations such as
    - the road or other surface which is to be driven on;
        - the load lifting and carrying capacity of the vehicle;
        - the size and security of the load;
- All motorised vehicles at the site must be inspected and certified in accordance with applicable local regulation.
- In addition, repetitive checks prior to use need to be executed by the terminal owned or rented motorised vehicles.
    - Vehicle inspection must be formalised and use standard checklists and record sheets.
    - The frequency and complexity of checks must reflect the type of vehicle and duty, for example;
    - Forklift trucks must be inspected every shift or before each use;
    - A site van / car must be inspected weekly
    - Inspection must include lights and warning devices, lifting equipment, security for forks, brakes, tyres;

    - If there is any doubt about the safe working order of a vehicle it must be withdrawn from service until it can be checked by a competent mechanic or engineer;
- Seat belts are installed and worn by all occupants and other relevant safety devices are used as intended.

Seat belts carry out 2 main functions, they restrain the driver in the event of a collision, either into a fixed object or striking or being struck by another vehicle, and secondly they hold the driver in position in the event of an overturn. This second function is particularly important as it prevents serious injuries where the driver is thrown from the vehicle as it overturns and is then crushed. This is a most common cause of serious injury or fatality when using forklift trucks.

- Seat belts must be worn whenever driving even when the distance to be moved is very short.
    - If safety devices other than seat belts are provided (e.g. fully enclosed roll over cage), they must be used at all times as intended;
    - For vehicles driving or operating close to water, it is recommended to provide the vehicle with a seat belt cutter and a window breaker (if applicable);
- Other safety devices include for example load limit alarms on cranes and lift trucks;
- Loads are secured and do not exceed design specifications;
- Design specification will always include a safe working load for lifting and / or carrying and this must not be exceeded;
- Where the load is within the weight limit but is too big or bulky to be carried safely, or where the load needs to be properly stowed before carriage, the load must be secured properly;
- Carriage of cargo hoses hanging from the forks of a lift truck is extremely unsafe and is not allowed;
    - Hoses may be carried by a forklift truck if they are properly enclosed within a pallet box which is secured to the forklift truck;
- Loads being carried must always be secured so that they cannot fall off as the vehicle brakes or corners;
- In case securing is not achieved by the design of the vehicle such as a fork lift truck, it is necessary to secure the load with ropes or straps (e.g. flatbed truck);
- For drums on pallets it may be necessary to secure the drums to each other and / or to the pallet to prevent them falling.

The local road safety regulations are fully complied with:

- In addition, site speed limits and traffic controls must be established to minimise the risk of any collision or other accidents (typically between 10km / h and 30km / h) at the location;
- These rules must be clearly indicated and complied with.

Drivers must not be allowed to operate the vehicle unless they are:

- Fully trained, qualified and declared medically fit to drive and operate the vehicle (self declaration is sufficient where not legally required).
    - The extent of driver training will vary for different vehicles, for simple site vans and cars a normal driving licence may be sufficient, for more complex vehicles such as road tankers, cranes, and forklift specialist training is necessary to understand the different characteristics of the vehicle during loading and lifting, and generally guided by local legislation.
    - For simple site vans, drivers must have the appropriate driving licence.
    - In addition drivers must be declared medically fit when driving road tankers, forklift trucks and cranes.
    - The frequency of medicals is age related and often guided by local legislation. For example, forklift truck drivers' medicals must begin at a predefined age of 40 and to be repeated every 5 years.

This fundamental applies equally to Vopak owned, rented and road tankers, ISO-tainers and rail tank cars used to collect from, and deliver to, the terminal storage tanks.

Motorised vehicles have been involved in major accidents on many occasions when the vehicle was parked with a running engine / has been driven into a large cloud of flammable vapour following a large spillage. This risk must be managed during emergency events. Motorised vehicles are a potential ignition source in case of a flammable vapour cloud. Extreme caution must be taken during emergency events.

Lifting equipment on motorised vehicles:
Mobile and installed lifting equipment on vehicles must be designed, manufactured, inspected, tested and certified in accordance with applicable local regulations and industry accepted codes of practice.

All lifting equipment including devices shall be marked to show:

- Safe Working Load (SWL);
- Unique identification number;
- Date of last certification and / or date of next certification;
- Included in the preventative maintenance schedule (if owned by Vopak).

Detailed information is defined in the Cranes and Lifting Equipment Operations Safety Standard (MyDocs document number 02.011002).

12 Appendixes

Appendix 1 MOC - Basic requirement checklist

As mentioned in section 5.4.2 Details of Risk Assessment, a set of minimum factors should be reviewed to identify those that may be affected by the proposed change.

In this appendix are the minimum factors listed.

- When using a list of this type, all identified items must be initialed to indicate the factor has been considered and does not present a hazard or has been taken into account in the design/review;
- Recommended actions to minimise any problems which may affect personnel or plant safety must be recorded.

The MOC Basic Requirement checklist can be found in MyDocs (document number 61.079246).

Appendix 2 Selection of Respiratory Protective Equipment

As mentioned in section 8.4.4 Confined space entry, appropriate personal protective equipment must be used. If respiratory protective equipment is to be used then a full documented assessment must be made to ensure and demonstrate that it provides the required level of protection.

This appendix is a guidance document for the selection of Respiratory Protective Equipment.

The Selection of Respiratory Protective Equipment Guidance can be found in MyDocs (document number 61.079245).

Appendix 3 Mechanical ventilation requirements

As mentioned in section 8.4.4 Confined space entry, the removal of flammable or explosive vapours from a storage tank by means of mechanical ventilation is prohibited.

This appendix describes the use of mechanical ventilation on tanks without flammable or explosive vapours (below 10% of LEL (continuous monitoring required) and below the safe health exposure limits) in more detail.

The mechanical ventilation requirements can be found in MyDocs (document number 61.079247).

Appendix 4 General considerations when working from a ladder or stepladder

As mentioned in 9.4.4 Ladders and stepladders, details for the safe use of ladders and stepladders are described in this appendix.

General Safety Considerations when working from a ladder or /a stepladder can be found in MyDocs (document number 61.080140).