GUIDANCE FOR BITUMEN DELIVERIES INTO NEW STORAGE TANKS AND STORAGE TANKS BEING RETURNED TO SERVICE

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1. BACKGROUND AND PURPOSE

In recent years uncontrolled bitumen spills and incidents have occurred when making the first bitumen delivery into new bitumen storage tanks and when recommissioning existing storage tanks that have been out of service. Examples include:

- A bitumen spill of approximately 300 litres due to an inadequately tightened drain flange when the first delivery was made into a new storage tank.
- An incident when the first delivery was made into a tank which was being recommissioned. There was water in the tank which turned into steam when it came into contact with the hot bitumen. The inspection hatch was blown open by the steam which couldn't escape because the vent pipe was blocked.

The purpose of this document is to provide guidance when:

- Commissioning a new bitumen storage tank, i.e. guidance for the first delivery into a new tank.
- Recommissioning both static and mobile bitumen storage tanks that have been emptied and taken out of service.

2. INTRODUCTION

A bitumen storage tank may be taken out of service for a number of reasons including:

- Tank cleaning.
- Internal inspection/maintenance.
- Maintenance of contents gauges, high level alarms, heating coils, etc.
- External inspection/maintenance.
- Addition/removal of pipelines and equipment.
- Changing the grade of bitumen in the tank.
- Transferring a storage tank to another site.
- Temporary closure of the plant.

Before delivering hot bitumen into a new or existing storage tank, it is very important to determine if there is water in the tank. Condensation of water vapour in the air can result in several litres of water collecting in the bottom of the tank, particularly if the tank has been out of service for some time. When the hot bitumen comes into contact with water it rapidly turns to steam and it expands by at least 1600 times. If the resulting pressure cannot escape, e.g. due to a blocked or partially block vent, the tank will be pressurised. This is a dangerous situation as bitumen storage tanks are not pressure vessels and rupture may occur, as in the above example.

This also has the potential to result in bitumen boil-over which is an extremely dangerous situation. If hot bitumen is loaded into a tank and if there is, say, 10 litres of water in the bottom of the tank within a few seconds this will generate approximately minimum 16 m^3 of steam. This steam will rise up through the hot bitumen and form a hot bitumen foam which will rise up through the tank and escape through any opening. This is bitumen boil-over. Eurobitume has produced a document with recommendations to reduce the risk of boil-over during the loading of bitumen into a delivery vehicle (see references).

It is strongly recommended that a full risk assessment is carried out prior to the first delivery into either a new storage tank or when recommissioning a storage tank which has been out of service.

3. CHECKS AND CONSIDERATIONS

The checks and considerations for commissioning a new bitumen storage tank or for recommissioning existing static or mobile storage tanks should include the following:

Issues to be checked/considered	Type of bitumen storage tank		
		Recommissioned	
	New	Static	Mobile
Has the Work Permit and any associated isolation certificates been completed and signed off?	√	√	√
Has the storage tank been signed off by the installers of the tank as ready for the first bitumen delivery?	√	N/A	N/A
Are the storage tank and pipework free of water as far as practicable?	√	√	√
Have all probes or sleeves that have been removed been re-installed?	N/A	√	√
Have all spades/blanks been removed from pipeline flanges and flange connections secured?	N/A	√	√
Has the condition of the heating system been checked?	N/A	√	√
Are all manlids in place, secure and gaskets in place?	√	√	√
Are all pipelines free from any obstruction, connected and flange joints secure?	√	√	√
Is the vent pipe free from any obstruction?	√	√	√
Is the content gauge operational?	√	√	
Does the contents gauge require recalibrating and reprogramming if duplicated in the plant control room?	N/A	√	N/A
Are the High Level Alarm and High High Level Alarm operational and re-calibrated if required?	√	√	√
Ensure that the contents gauge has an interlock with the heating system to ensure that the heating system cannot operate when the tank is empty.	√	√	√
Are all safety devices re-instated and tested where required?	√	√	√
Is the Safe Working Capacity (SWC) of the storage tank still applicable?	N/A	√	√
Consider the effects of the addition of hot bitumen on the storage tank heating system. This may differ for hot oil or electrical heating.	√	√	√
If the storage tank is to receive a different grade of bitumen: • Have the storage tank product labels been changed? • Does the flange security system reflect the new grade? • Have any storage tank stock systems (manual or electronic) been suitably amended?	N/A	√	√
Have all tools/equipment been removed from inside the tank?	√	√	√

If in doubt your bitumen supplier will provide guidance on what to consider.

The Appendix contains a checklist for site staff to complete prior to making the first delivery into the storage tank.

For either commissioning a new storage tank or recommissioning an existing tank it is important that when the bitumen is ordered the bitumen supplier is informed that it is being delivered into a new storage tank or for a recommissioned tank and that a 'procedure discharge' will be required.

4. DELIVERY PROCEDURE

It is strongly recommended not to turn on the storage tank heaters until the heating coils are covered by hot bitumen. If the heating is turned on before being submerged in bitumen 'hot spots' on the heating units could result in a potentially explosive situation.

For a new storage tank or recommissioning an existing tank, the bitumen supplier is recommended to adopt the following 'procedure discharge', as a minimum, for the first delivery of bitumen:

- Prior to the delivery receive assurance from customer that the storage tank is free of water.
- On the day of the delivery confirm with the customer that the tank has been checked again and is free of water.
- It is very difficult to be 100 % sure that the tank is free of water so the delivery should be undertaken with great care. If there are any safety concerns about the delivery stop immediately and investigate.
- Ensure a customer representative is in attendance for the whole of the delivery.
- Consider opening the manlid on top of tank to create extra venting capacity for the first part of the procedure discharge.
- Carry out a procedure discharge, which includes:
  - Initially discharge approximately 5 tonnes, or sufficient to ensure heating coils or elements are submerged by bitumen. Then stop the delivery and purge the line clear.
  - Wait 15 minutes for the storage tank shell and pipework to increase in temperature.
  - Check the tank shell and all pipework joints (e.g. pumps, valves, welding joints, bolt joints, lagging, etc.) for any bitumen leaks due to expansion.
  - Any condensation or remaining water residue will boil off. Be alert for signs of significant amount of water in the tank (e.g. steam or bitumen foam from vent, bubbling of product, tank vibration/movement, etc).
  - Again, check all tank connections for bitumen leaks.
  - If there is no evidence of water in the tank or leaks then add a further 5 tonnes (or whatever is considered appropriate), wait for 15 minutes and then inspect again for evidence of water and leaks.
  - At this point the storage tank heating system can be turned on.
  - Providing there are no problems, continue with the discharge cautiously, maintaining safety awareness throughout.
  - When the procedure discharge is complete carry out a final inspection of the storage tank, pipework and joints for bitumen leaks.

5. REFERENCES

Guide to the Safe Delivery of Bitumen, Eurobitume, July 2018

Guidance for Safe Bitumen Tank Management, Eurobitume

Model code of safe practice, Part 11, Bitumen safety code, (4th edition), Energy Institute

Dangerous Substances and Explosive Atmospheres Regulations 2002

Recommendations to reduce the risk of boil-over during loading of bitumen, Eurobitume, March 2020

Compatibility Matrix for loading of Bitumen for road, rail & shipping transport, Eurobitume, June 2018

APPENDIX

CHECKLIST FOR FIRST DELIVERY INTO A NEW BITUMEN STORAGE TANK

Issues to be checked/considered	Inspection findings
Has the Work Permit and any associated isolation certificates been completed and signed off?	
Has the storage tank been signed off by the installers of the tank as ready for the first bitumen delivery?	
Are the storage tank and pipework free of water as far as practicable?	
Are all manlids in place, secure and where necessary the gaskets in place?	
Are all pipelines free from any obstruction, connected and flange joints secure?	
Is the vent pipe free from any obstruction? This is particularly important to allow any steam to escape.	
Is the storage tank contents gauge operational and calibrated?	
Are the High Level Alarm and High High Level Alarms operational and calibrated?	
Has the contents gauge an interlock with the heating system to ensure that the heating system cannot operate when the tank is empty?	
Are all other safety devices installed and tested where required?	
Consider the effects of the addition of hot bitumen on the storage tank heating system. Thsi may differ for hot oil or electrical heating.	
Have all tools and equipment been removed from inside the tank?	
Has the tank been confirmed as free of water on the day of the delivery?	

CHECKLIST FOR FIRST DELIVERY INTO RECOMMISSIONED STATIC BITUMEN STORAGE TANK

Issues to be checked/considered	Inspection findings
Has the Work Permit and any associated isolation certificates been completed and signed off?	
Are the storage tank and pipework free of water as far as practicable?	
Have all spades/blanks been removed from pipeline flanges and flange connections secured?	
Have all probes or sleeves that have been removed been re-installed?	
Has the storage tank heating system been checked for general condition, e.g. leaks?	
Are all manlids secure and where necessary the gaskets in place?	
Are all pipelines free from any obstruction, connected and flange joints secure?	
Is the vent pipe free from any obstruction? This is particularly important to allow any steam to escape.	
Is the storage tank contents gauge: • Operational and re-calibrated if required? • Been re-programmed if duplicated in the plant control room?	
Are the High Level Alarm and High High Level Alarms operational and re-calibrated if required?	
Has the contents gauge an interlock with the heating system to ensure that the heating system cannot operate when the tank is empty?	
Consider the effects of the addition of hot bitumen on the storage tank heating system. This may differ for hot oil or electrical heating.	
Are all other safety devices re-instated and tested where required?	
Is the Safe Working Capacity (SWC) of the storage tank still applicable?	
If the storage tank is to receive a different grade of bitumen: • Have the storage tank product labels been changed? • Does the flange security system reflect the new grade? • Have any storage tank stock systems (manual or electronic) been suitably amended?	
Have all tools and equipment been removed from inside the tank?	
Has the tank been confirmed as free of water on the day of the delivery?	

CHECKLIST FOR FIRST DELIVERY INTO RECOMMISSIONED MOBILE BITUMEN STORAGE TANK

Issues to be checked/considered	Inspection findings
Has the Work Permit and any associated isolation certificates been completed and signed off?	
Are the storage tank and pipework free of water as far as practicable?	
Have all spades/blanks been removed from pipeline flanges and flange connections secured?	
Has the storage tank heating system been checked for general condition, e.g. leaks?	
Are all manlids secure and where necessary the gaskets in place?	
Are all pipelines free from any obstruction, connected and flange joints secure?	
Is the vent pipe free from any obstruction? This is particularly important to allow any steam to escape.	
Is the storage tank contents gauge operational and re-calibrated if required?	
Are the High Level Alarm and High High Level Alarms operational and re-calibrated if required?	
Has the contents gauge an interlock with the heating system to ensure that the heating system cannot operate when the tank is empty?	
Consider the effects of the addition of hot bitumen on the storage tank heating system. This may differ for hot oil or electrical heating.	
Are all other safety devices re-instated and tested where required?	
Is the Safe Working Capacity (SWC) of the storage tank still applicable?	
If the storage tank is to receive a different grade of bitumen: • Have the storage tank product labels been changed? • Does the flange security system reflect the new grade? • Have any storage tank stock systems (manual or electronic) been suitably amended?	
Have all tools and equipment been removed from inside the tank?	
Has the tank been confirmed as free of water on the day of the delivery?	

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