# **Voisey's Bay: Overhead Crane Orientation**



Hello, welcome to the Overhead Cranes: General Safety and Operation course.

This course is a combination of knowledge-based instruction and skill-based training on the selected overhead crane. Each module has a knowledge-based component that will be covered under the supervision of an instructor. The specific equipment modules have a skill-based component where trainees will be expected to demonstrate specific skill sets as part of the evaluation process. You will be expected to complete Overhead Cranes: General Safety and Operation and at least one Equipment Specific Module.

You must obtain a minimum score of 70% on the evaluation, as well as demonstrate a minimum acceptable level of skill on the designated overhead crane to be considered a qualified operator.

Please note: Some terms or terminology contained within this module have been changed to reflect Vale's Diversity & Inclusion program and our commitment to valuing our diverse workforce and promoting an environment of respect and equal opportunities. Enjoy the module!

Revision date: August 10 2022 Module Duration: About 1 hour 30 minutes **Course Objectives** 

Bowtie

About the Equipment/Process

Controlling the Equipment

Safe Operating Procedures

**Evidence of Good Operation** 

Quiz

Conclusion





Upon completion of each section of this module, you will be given an opportunity to submit questions to obtain clarification of any content you are not sure of.

You will also be required to complete a brief survey designed to support continual improvement to your Vale learning experience.

#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 2 of 9

## **Course Objectives**

After completing this course, you will be able to:

- Describe the types and function of overhead cranes
- Describe how overhead cranes are controlled to reduce the operating risks and hazards to get HomeSafe
- Identify the known best practices for operating overhead cranes to maintain the operating risks and hazards to get HomeSafe



## Incident/Accident History

While the overall objective is to reduce or eliminate workplace hazards, it should be recognized that not all workplaces within Vale operations can be made free of all hazards.

Critical to safe operation is the ability to recognize and control hazards that may cause injuries, equipment damage, or even worse, fatalities.



Our injury and fatality index is updated monthly. It shows the numbers for Fatalities and Live Changed (N1), Recordable High-Potential Injuries (N2), Other High-Potential events (N3), Recordable Non-High Potential Injuries (N4), and Other Non-High Potential events (N5)

00:18

#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 3 of 9

**Bowtie** 



# Important: this module addresses safety and operating procedures common to all types of overhead cranes.



## Do you know what a bowtie is?

It is a very efficient risk analysis tool that identifies the event, the barriers (controls) and the consequences.

For overhead cranes, bowties assist in understanding the safe operating requirements. This module will show some bowtie diagrams about the main events related to the operation of Overhead Cranes.

It is important that you are familiar with this tool!

00:20

Watch the video below and understand bowties better!



•

Watch the video in full to continue.

# Review the bowties below relating to events that may occur while working on or around overhead cranes.



00:05

## Lifting of Load

Click on the markers below to learn more:





Lifting of Load



Fall of the load from overhead crane



#### **Preventive Control**

#### Damaged equipment:

- IV Test before first use
- I, II Pre use and periodic inspection

#### Lack of training:

- Training for operation
- Training in risk prevention

#### Moving of the equipment beyond the limit:

• Limit stop switch

#### Loose cable:

• Loose cable in the limit switch

#### Cable wear due to inclination:

• Inclinometer



#### Causes

- Damaged equipment
- Lack of training
- Moving of the equipment beyond the limit
- Loose cable
- Cable wear due to inclination



#### **Mitigating Control**

#### Hitting of person NOT involved in the activity:

- Movement sound alarm
- Area isolation
- Prohibition to access lifting area
- Emergency response plan

#### Hitting of person involved in the activity:

- Prohibition of position under suspended load
- Emergency response plan



#### Consequences

- Hitting of person NOT involved in the activity
- Hitting of person involved in the activity



Complete the content above before moving on.

## Mobile Crane Overturning

Click on the markers below to learn more:





Lifting of Load



Mobile crane overturning



#### **Preventive Control**

#### Overload:

- Visible indication of the maximum load
- Load table
- Overload sensor

#### Unevenness of equipment:

- Full extending of the outriggers
- Outriggers pressure monitoring
- Outriggers leveling control system

#### Lack of training:

• Rigging plan



#### Causes

- Overload
- Unevenness of equipment
- Lack of training
- Lack of planning for critical lifting



#### Mitigating Control

#### Hitting of person NOT involved in the activity:

- Area isolation
- Prohibition to access lifting area
- Emergency response plan

#### Fatality of the operator:

• Emergency response plan



#### Consequences

- Hitting of person NOT involved in the activity
- Fatality of the operator



Complete the content above before moving on.

## Fall of the Load from the Crane

Click on the markers below to learn more:





Lifting of Load



Fall of the load from the crane



#### **Preventive Control**

#### Overload:

- Visible indication of the maximum load
- Load table
- Overload sensor

#### Damaged equipment:

- Test before first use
- I, II Pre use and periodic inspection
- Disposal of damaged accessories

#### Lack of training:

- Training for operation
- Training in risk prevention

#### Load without fixation:

• Hook with safety latches

#### High speed wind:

• Anemometer

#### Moving of the equipment beyond the limit:

• Limit stop switch



#### Causes

- Overload
- Damaged equipment
- Lack of training
- Load not secured
- High speed wind
- Moving of the equipment beyond the limit



#### **Mitigating Control**

#### Hitting of person NOT involved in the activity:

- Area isolation
- Prohibition to access lifting area

#### Lesion or Fatality of the operator:

- Prohibition to touch suspended load
- Safety helmet



#### Consequences

- Hitting of person NOT involved in the activity
- Injury or fatality of the operator



Complete the content above before moving on.

#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 4 of 9

# About the Equipment/Process



## What it does and its related capacities

#### Function

Overhead cranes are used to lift and transport heavy loads with the aid of different attachments within their area of operation.



00:07

## Types of

There are several types of overhead cranes used at Vale.

Click each tab below to learn more about each type of overhead crane.



#### BRIDGE CRANES/ EOT CRANES

Gantry cranes consist of a hoist on a metal frame and can be mobile.





BRIDGE CRANES/ EOT CRANES

GANTRY CRANES

**JIB CRANES** 

MONORAIL CRANES

A jib crane consists of a horizontal rail called a jib that is either mounted to the wall (left image) or free standing (right image). The hoist moves along the jib.





BRIDGE CRANES/ EOT CRANES

Monorail cranes consist of a single rail that shuttles a trolley and hoist to lift heavy objects.





## **Consists Of**

A bridge assembly, a trolley, a hoist assembly, attachments, and controls. Controls can be located in the operator's compartment (if equipped), remote, or pendant controls.



00:11
### How It Works

The bridge assembly is a girder or set of girders that travel along parallel rails mounted on beams, pillars, or columns. The trolley assembly, attached to the hoist assembly, travels across the bridge. The hoist assembly and attachments perform the tasks of lifting and transporting the loads.

- 00:17

## What it consists of; equipment and features

Overhead cranes come in different sizes, types, and models, but all possess the same four basic functional components:

- Bridge Assembly
- Trolley Assembly
- Hoist Assembly
- Controls







## **Types of Hoists**

There are three types of hoists used at Vale:

- Manual
- Pneumatic
- Electric



- 00:05



## **Assemblies Activity**

Click on the markers below to learn more:





- **Purpose:** The bridge assembly is the main travelling structure of the overhead crane. It is a girder or a set of girders that travel across parallel rails mounted on beams, pillars, or columns.
- **Consists of:** Bridge girders, rails and steel girders, end trucks, wheels, bumpers, stop blocks, drive shafts, couplings, and reversible motor gears and brakes.

• How it works: Electrical power is supplied to the motor which turns the bridge wheels in the desired direction of travel. The bridge is stopped by applying the brake, disengaging the pendant control button, or placing the control in the neutral position, depending on the type of controller being used. In some cases, the automatic brake is applied when power is removed.





- **Purpose:** The hoist assembly is attached to the trolley and performs the tasks of lifting, carrying, and dumping.
- **Consists of:** Reversible drive motor, brakes, hoist drum and gear box, upper block sheaves, roper equalizer, lower block sheaves, lifting hook, hoisting cables, and limit switches.

• How it works: The hoist drive assembly provides mechanical power to raise and lower the hook by converting electrical energy coming from a reversible drive motor via the gear reducer and hoist drum arrangement. An electromagnetic brake keeps the lifting device in position when transferring heavy suspended loads. The brake also stops the hoist and holds the load whenever power to the hoist's reversible drive motor is removed.



#### **Trolley Assembly**



- **Purpose:** The trolley assembly is attached to the hoist assembly and travels across the bridge assembly.
- **Consists of:** Trolley, wheels, brake, reversible motor, drive shafts, gearbox, pinions, and ouplings.
- How it works: The trolley drive train converts electrical power to mechanical power through the rotation of the drive shaft via a gear reducer, drive gear, and pinion arrangement.







- **Purpose:** Allows the operator to control the overhead crane and attachments.
- **Consists of:** Switches. Depending on the overhead crane, it may have an operator's compartment, or just a remote control or pendant control. Overhead cranes are operated by one or two people: the operator that controls the crane and a helper for directing crane.



Complete the content above before moving on.

# Attachments

Attachments can be added to the lifting hook to perform different tasks and different ways of lifting.

The auxiliary hoist functions in a manner similar to that of the hoist assembly but can only be used to raise lighter loads or in conjunction with the hoist assembly.

Overhead cranes have upper and lower limit switches. The upper limit switches prevent over-lifting. The lower limit switches prevent the hoisting cables from unwinding too far.

Hoists also come equipped with limit switches which prevent the hoist from passing certain thresholds. In general, the first limit switch can be bypassed using the bypass controls.



#### Purpose

Special attachments are used to enable the overhead crane to perform different types of tasks.



## **Consists Of**

Attachments and accessories are suspended from the hook in the hoist or auxiliary hoist assembly. The attachments may be controlled from the operator's compartment or by using the remote control or pendant control.

There are many types of attachments available for overhead cranes. Please refer to site specifics and ensure you are familiar with the required attachments, use, and functions prior to beginning a process.









Drag and drop to match the number to the assembly. Click Submit to check your answers.



Drag and drop to match the assembly to its function. Click Submit to check your answers.

Bridge Assembly		girder(s) that travels across the parallel rails mounted on beams, pillars, or columns
Trolley Assembly		travels across the bridge assembly
		attached to the trolley and performs the task of lifting, carrying, and dumping
= Controls		can be a pendant control, remote control, or found in an operator's compartment
= Attachments		enable the overhead crane to perform different types of tasks
	SUBMIT	

#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 5 of 9

# **Controlling the Equipment**

# Objectives To identify what elements are controlled. To explain how these elements are controlled.



# What is Controlled

- Direction of travel of the bridge, trolley, and hoist.
- Speed of travel of the bridge, trolley, and hoist.
- Movement of the hoist or attachment.

Direction of travel is controlled by the direction of rotation of the motor using the control and placing it in the required position. Movement of the hoist or attachment is controlled using the control in the operator's

compartment, or using the remote or pendant control. The direction and speed of the attachments are determined by the hoist.



## How it is Controlled: Remote or Pendant





Overhead cranes can use either a remote or pendant to control the movement. A pendant control is tethered to the crane.



# **Bridge Movement**

The bridge assembly is controlled by choosing forward, neutral, or reverse directions using the bridge control.



# **Trolley Movement**

The trolley assembly is controlled by choosing forward, neutral, or reverse directions using the trolley control.



## **Hoist Movement**

The hoist assembly is controlled by choosing raise or lower directions using the hoist control.









The hoist assembly is attached to the bridge assembly and travels across the trolley assembly



Image: Second second

#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 6 of 9

# **Safe Operating Procedures**



# **Pre-Start-Up**

To prepare an overhead crane for start-up, perform the following steps:

- Refer to pre-use log books and fill out as required
- Check that no one is working on the crane or in the path of the crane operation
- Check the girders, trolleys, and catwalk for anything which may fall off
- Check the drive shafts for wear and broken or loose bolts

- Check the hoisting cables for kinks and/or damage
- Check the bridge lights or boarding lights on some of the larger cranes
- Check the siren or horn by depressing the appropriate button
- • 00:29

Complete the content above before moving on.

# Start-up and Follow-up

To put the overhead crane into operation:



P

Complete the content above before moving on.







Complete the content above before moving on.

# Run

To run an overhead crane:

- Position the hook over the load by moving the bridge and trolley, lowering the hoist and attaching the load, or have it attached to the hook by the crane follower
- Lift the load to safe travel height and move the trolley to place the load in a safe travelling position

- Move the bridge to the destination area and position the load over its destination point by moving the bridge and trolley
- Set the load down and disconnect it or have the load disconnected from the hook or attachment
- Raise the lifting device to travel height and move to the next load
- • 00:27

Image: OrganizationComplete the content above before moving on.

## Normal shutdown

To shut down the overhead chute under normal conditions:



Complete the content above before moving on.



Match so they	the steps for Shutting Down t are in the correct order. Click	ne Over Submit	head Crane under normal conditions to check your answers.
=	Raise the main and auxiliary hoists to a safe height and position		Step #1
=	Move to the designated position		Step #2
=	Put all controls for bridge, trolley, hoists, and attachments in Neutral or OFF position		Step #3

•





Complete the content above before moving on.

## **Emergency shutdown**

If the overhead crane has to be stopped in an emergency:



00:14

# **Safe Operating Practices**

Knowing how to safely operate the overhead crane is a critical responsibility of the operator.

Make sure you know and understand the loader's working capacities, performance, and limitations.







#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 7 of 9

# **Evidence of Good Operation**



# **Good Operation**

The overhead crane operator must be able to recognize the indicators of good, safe operation.

It is equally important to recognize when equipment is not in good condition so the problem can be documented and corrected. Let's look at some examples of good operational practices.

00:16

## **Crane Inspections**

The crane should be inspected at the beginning of each shift and a record of findings kept. The inspection must be documented and recorded in the daily crane log book and signed by the person who completed the inspection.

It is equally important to recognize when equipment is not in good condition so the problem can be documented and corrected. Let's look at some examples of good operation.

Click each tab below to learn more.



VISUAL/OPERATIONAL INSPECTION	DIRECTIONAL LABELING						
The following items should be inspected on the pendant or remote:							
Casing is damage free (no exposure to wires)							
Buttons are free from sticking							
Corresponding direction symbols							
e)							
	VISUAL/OPERATIONAL INSPECTION ected on the pendant or remote: posure to wires) g abols						





#### CONTROLLER INSPECTION

#### VISUAL/OPERATIONAL INSPECTION

#### DIRECTIONAL LABELING

Locate and inspect the following:

- There is no visual damage.
- The overhead crane responds to the remote control.
- The bridge moves quietly and freely. It also brakes properly.
- The trolley moves quietly and freely. It also brakes properly.
- The hoist assembly stops once it reaches the limit switch.
- The hoist assembly works freely and brakes properly.
- The special attachments are functioning properly.
- The load hangs straight without excess swing while travelling.
- All procedures specific to the operation are performed satisfactorily.
- Communications between craneman and signalman are performed properly (if applicable).

CONTROLLER INSPECTION

VISUAL/OPERATIONAL INSPECTION

DIRECTIONAL LABELING

Verify the movement of the crane functions compared to the labeling of the controller.



P

Complete the content above before moving on.

# **Limit Switches**

The Upper Limit Switch is an **EMERGENCY STOP** only. Its primary purpose is to prevent over winding the hoist block into the drum. It must be present and operational on all cranes. It should **not** be used as a stop while travelling.



	00.14
	00:14

# **Hand Signals**

To safely operate the overhead crane, hand signals are used to communicate with the operator.

Here are some examples of hand signals we use at Vale.





**EMERGENCY STOP**. Arm extended, palm down, move hand right and left.



**TRAVEL.** (Rail Mount or Bridge) arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.



**MULTIPLE TROLLEYS**. Hold up one finger for block marked "1" and two fingers for block marked "2".



P

Complete the content above before moving on.



Which of the following is **NOT** evidence of good operation?

There is no visual damage.




#### Got a Question?

Submit your question here using Valeforms, be sure to include your first name last name and contact information.



Lesson 8 of 9



You will now take an evaluative test regarding the content of this training.

In order to receive credit for this training, you need to pass the following quiz with a score of 70% or better.

Good luck.

## 01/10

On a bridge crane, which of the following travels directly across the rails?

$\bigcirc$	Bridge Assembly
$\bigcirc$	Trolley Assembly
$\bigcirc$	Hoist Assembly
$\bigcirc$	Attachments

02/10

## Identify the assembly marked with a 1.



O Bridge Assembly

Trolley Assembly

Hoist Assembly

Controls

03/10



Identify the assembly marked with a 2.



Trolley Assembly

Hoist Assembly

Controls

04/10



Identify the assembly marked with a 3.



Trolley Assembly

O Hoist Assembly

Controls

## 05/10

Attachments are suspended from which section of the hoist assembly?

$\bigcirc$	The hoist drum
$\bigcirc$	The lifting hook
$\bigcirc$	The hoisting cables
$\bigcirc$	The limit switch

## 06/10

What has its own motor to control the speed and direction of travel?

$\bigcirc$	Magnet
$\bigcirc$	Pendant
$\bigcirc$	Trolley
$\bigcirc$	Cable

## 07/10

What are suspended from the hook in the hoist or auxiliary hoist assembly?



## 08/10

Which of the following are part of the start-up procedure? Select all that apply.

Turn the master key to the "ON" position.
Check the hoist brakes.
Turn on the power to the auxiliary equipment.
Check the limit switches for main and auxiliary hoists.

## 09/10

Which of the following are part of the normal shutdown procedure? Select all that apply.

Raise the main and auxiliary hoists to a safe height and position
Put all controls for the bridge, trolley, hoists, and attachments in the "Neutral" or "OFF" position
Press the emergency button to make sure all controls are disengaged
Press the emergency stop button

## 10/10

Which of the following are evidence of good operation? Select all that apply.

There is no visual damage.
The brakes are functioning properly for the hoist, trolley, and bridge assemblies.
Loads swing excessively while travelling.
The hoist assembly stops at limit switches.

## Conclusion

In this course, you have learned about:

- The types and function of overhead cranes
- Controls used with overhead cranes
- General safety and operations of overhead cranes

If needed, you can review any part of this course again to gain a better understanding of these tasks.



#### **Online Training Survey**

Submit your evaluation here using Valeforms, all submissions are anonymous. Thankyou.



Click on the button beside to exit.



# Thank you for completing the Vale Online Module Training.

Complete Your Module Validation

PLEASE CLICK HERE