T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Maintenance, Installation and Repair for Engineering and Manufacturing (8730-12)

8730-033 Employer-Set Project Exemplar – A Grade

Summer 2023

City & Guilds | eal

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Introduction

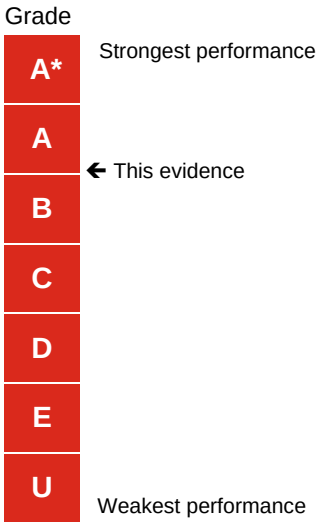
Summer 2023 Results

This document is aimed at providers and learners to help understand the standard that was required in the summer 2023 assessment series to achieve an A grade for the 8730-033 Maintenance, Installation and Repair for Engineering and Manufacturing Employer-Set Project (ESP).

Providers and learners may wish to use it to benchmark the performance in formative assessment against this to help understand a potential grade that may be achieved if a learner was to attempt the next summative assessment series.

The Employer-Set Project is graded A* to E and Unclassified.

The exemplar evidence provided for the A grade displays the holistic standard required across the tasks to achieve the A grade boundary for the summer 2023 series.



The Employer-Set Project brief and tasks can be downloaded from here.

Important things to note:

- We discussed the approach to standard setting/maintaining with Ofqual and the other awarding organisations before awarding this year. We have agreed to take account of the newness of qualifications in how we award this year to recognise that students and teachers are less familiar with the assessments (Vocational and technical qualifications grading in 2023 – Ofqual blog), whilst also recognising the standards required for these qualifications.

- The exemplar evidence presented, as a whole, was sufficient to achieve the A grade. However, performance across the tasks may vary (i.e. some tasks completed to a higher/lower standard than an A grade).

Marking of this Employer-Set Project is by task and Assessment Objective, below is a summary of these along with the mark achieved by the evidence presented and the maximum mark available for each aspect.

Task	Assessment Objectives	Mark achieved	Max mark available
Task 1 Research	- AO1 Plan their approach to meeting the project brief - AO2a Apply core knowledge - AO3 Select relevant techniques and resources to meet the brief	6	9
	- AO2b Application of core skills	5	6
Task 2 Report	- AO1 Plan their approach to meeting the project brief - AO3 Select relevant techniques and resources to meet the brief	4	6
	- AO2a Apply core knowledge	4	6
	- AO2b Application of core skills	4	6
	- AO5a Realise a project outcome – was the right outcome achieved - AO5b Review how well the outcome meets the brief, how well the brief was met, the quality of the outcome in relation to the brief	4	6
Task 3 Plan	- AO1 Plan their approach to meeting the project brief - AO3 Select relevant techniques and resources to meet the brief	5	6
	- AO2a Apply core knowledge	4	6
	- AO2b Application of core skills	4	6
Task 4 Present	- AO1 Plan their approach to meeting the project brief - AO3 Select relevant techniques and resources to meet the brief	4	6

	- AO2a Apply core knowledge	4	6
	- AO2b Application of core skills	4	6
	- AO5a Realise a project outcome – was the right outcome achieved - AO5b Review how well the outcome meets the brief, how well the brief was met, the quality of the outcome in relation to the brief	4	6
Maths	- AO4a Use of Maths skills	2	3
English	- AO4b Use of English skills	2	3
Digital skills	- AO4c Use of digital skills	2	3

What evidence was being assessed for the maths, English and digital skills:

Maths:

- Technical Brief - calculations relating to costings (and consideration of estimations), flowrates, set points, operating parameters, and calibration requirements (Task 1)
- Calculations related to installation requirements within the Report (Task 2)
- Scaling and dimensions on diagrams (Task 2)
- Calculation of timescales and critical path within the planning chart (Task 3)
- Any calculations within the supporting statement (Task 3)

English:

- Technical brief and supporting notes (Task 1)
- Report (Task 2)
- Supporting statement for the plan of work (Task 3)
- Presentation delivery (orally) and materials to support presentation (e.g. slides etc) (Task 4)

Digital:

- Types of sources used for Research (Task 1)
- Presentation of the planning chart (Task 3)
- Presentation materials (slides, handouts, notes etc) (Task 4)

Task 1 Research

Assessment number (eg 1234-033)	8730-033
Assessment title	Employer-Set Project

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	1
Evidence title / description	**Evidence expected for marking:** Technical brief (typically 1500 words) Research notes List of sources/references **Evidence submitted for marking:** Technical brief (typically 1500 words) Research notes List of sources/references
Date submitted by candidate	DD/MM/YY

Technical Brief

Introduction

A2B Water require services relating to maintenance and repair of a chlorine dosing system they provide to a small farm. The requirement is to identify the potential causes of the reported issue. This will be reported and explained to A2B Water, along with a review of the appropriateness of existing parts. This will be followed by valid solutions and suggestions for the system modifications.

Regulations, Health and Safety Concerns.

COSHH is the law that requires employers to control substances that are hazardous to health includes nanomaterials. You can prevent or reduce workers exposure to hazardous substances by finding out what health hazards are.

PPE when handling chlorine, Eye/Face protection: wear chemical safety goggles. A face shield (with safety goggles) may also be necessary. Skin protection: wear chemical protective clothing e.g., gloves, aprons, boots. Coveralls or long sleeve shirts and pants in some operations.

Safety precautions for chlorine. Store respiratory protection away from chlorine prepare an escape plan never store chlorine near flammable materials. Never apply heat directly to a chlorine container. Purge pipelines before welding. Install safety wash stations nearby. Use at least two people when handling chlorine.

If chlorine is spilt. Confine the spill to a small area. Use a commercial kit or absorbent material from your spill kit to absorb spilled materials. Place the saturated absorbent in a plastic bag. Label the bag with a hazardous waste tag and include it in the next hazardous waste collection.

HSWA The health and safety at work act 1974 lays down wide ranging duties on employers must protect the health and safety and welfare at work of all their employers must protect the health and safety and welfare at work of all their employees, as well as others on their premises, including temps, casual workers, the self – employed, clients, visitors and the general public.

As a brief overview, the HASWA 1974 requires that workplaces provide: adequate training of staff to ensure health and safety procedures are understood and adhered to. Adequate welfare provisions for staff at work. A safe working environment that is properly maintained and where operations

within it are conducted.

This places a legal duty on all employers to ensure, so far as reasonably practicable, the health, safety and welfare of employees, and to ensure that employees and others are kept safe.

MHSWR The workplace health, safety and welfare regulations 1992 cover a wide range of basic health, safety and welfare issues and apply to most workplaces.

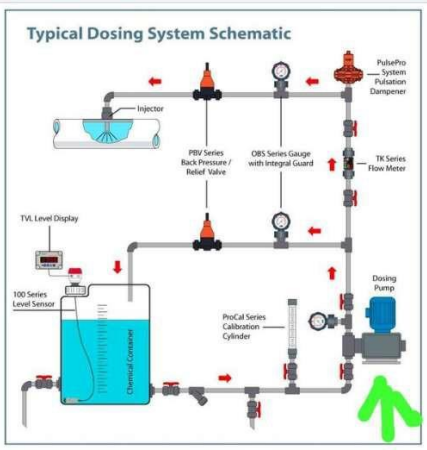
The main duty placed on employers by the Management of Health and Safety at Work Regulations is to undertake risk assessments to identify potential hazards to employee health and safety and anyone who may be affected by their work activity

MHOR Manual handling operations, the regulations define manual handling as any transporting or supporting of a load, including lifting, putting down, pushing, pulling, carrying, or moving thereof by hand or bodily force, any employer should explain how to lift and provide correct training if need be.

The five steps to performing a movement without injury is:

Plan your lift adequately, Position centre the body and feet correctly, pick lift item using good posture, proceed move toward desired location, place set object down safely.

The chlorine dosing system that has been installed is missing back pressure valves which could cause issues to due there not being a way for excess pressure to escape from the system. Therefore, a modification to be made would be to add valves.



To calculate the flowrate, you would need to divide 3m by 10m/s

Another issue I have noticed with the Chlorine dosing system is the fact that the velocity of the chlorine is 11.02 m/s where as the flowmeters maximum flowrate is 10 m/s this is an issue due to the velocity being too fast for the flowmeter to be able to handle therefore a smaller pump would be the solution.

There has been issues we are facing with the chlorine dosing pump this could be due to multiple reasons I have developed a plan of how to deal with issues that we are facing if these don't solve problems we are facing with the pump, I would recommend looking for a smaller pump that fits into the system and is in the budget of the operation.

Pump faults: Solutions

Operation via single-phase current connection: deactivate motor current monitoring.

No feedback from the corresponding contractor: Check functionality of pump.

Bimetallic strip has been tripped: check that the motor has sufficient cooling.

Motor current monitoring has been tripped: Check the set rated current and correct if necessary.

No pump connected: Connect pump or deactivate minimum current monitoring

Motor current monitoring not set: set the motor current monitoring to the pumps rated current.

No feedback from the corresponding contactor: check functionality of pump.

Motor current monitoring has been tripped: check the set rated current and correct if necessary

All Issues with the chlorine dosing system is the pump malfunctioning I have listed solutions to all causes of the pump malfunctioning if none of these issues can be solved then result into replacing the pump.

MAINTENANCE OF SYSTEM

Maintaining of chlorine dosing pumps: Remove, inspect and clean the injection quill to prevent blockages. Pump performance is measured through checking pressure gauge readings. Major maintenance tasks are also required at less frequent intervals but are just as Important for long term dosing performance. Preventative maintenance is preferable to pump tube failure and consequent wash and process down time. Ensure the pick-up tubing is down to the bottom of the chemical container in each drum. Check the dose unit is switched on. Check pump tubes for condition and crystallisation of chemical within the tubing. On average, a pump station normally needs to be services every six months to ensure long term reliability, this will reduce the chance of needing a call our or having a breakdown on the system.

Control panel in a chlorine dosing system: the panel is connected to a sample line from a dosing system, from which the PH, ORP and chlorine levels can be determined which id then used by the attached controller or pump to regulate the dosing for the whole system. How to service a control panel: Change desiccant dryers when the colour changes from blue to pink. Change corrosion inhibitors every year. Use electrical seal offs- when wiring your control panel. Keep gas, and water out of the control panel. Make sure the door is straight not bent and closed at all times. Check to assure there are no crushed, cut or damaged wires.

Servicing on a water tank should be done and professionally cleaned and serviced at least once a year.

The flowmeter does not require routine lubrication or service of any kind. Keep the interior of the flow meter housing clean and free of dust, moisture, oils or corrosive materials.

Flowmeter Calibration.

The flow meter requires calibration this is: Flow meter calibration is the process of comparing the pre-set scale or metering of a flow meter to a standard scale of measurement and adjusting its metering to conform to the standard. Some flowmeters require calibration only once every 3-4 years. In other circumstances, more frequent calibration, possibly even monthly, may be required to maintain a safe, efficient, or regulatory-complaint operation calibration intervals might also fluctuate based on usage or historical performance.

Modifications.

There needs to be improved ventilation where the chlorine dosing system is placed due to it being in a remote location.

There needs to be a gas alarm/monitor in the system to notify about any potential gas leaks in the system so we are aware of the issues.

There also is going to be pre-entry gas checks needed that must be followed before entering the location of the chlorine dosing system.

- gas alarm

- **Conntrol Panel**

- **Water tank**

- **Water pump**

Research

Chlorine dosing system.

A chlorine dosing system works by: Chlorine is dosed into a facility's water distribution system routinely it is injected continually in order to maintain a constant free chlorine residual. Chlorine is usually dosed as a concentrated solution of sodium hypochlorite which, when dissolved in water, forms hypochlorous acid.

A dosing pump draws a measured amount of liquid into its chamber and injects the chemical into a tank or pipe that contains the fluid that is being dosed. It's powered by an electric motor or an air actuator and has a controller that turns the pump on and off and manages the flow rate.

Sizing of a chlorine dosing pump:

Well pump output rate in gallons per minute, multiplied by.

Required dosage in parts per million, multiplied by.

1440—the number of minutes in a day—divided

by. Solution Strength in parts per million, which

equals. Needed Metering Pump Output in gallons

per day (GPD).

Maintaining chlorine dosing pumps: Remove, inspect and clean the injection quill to prevent blockages. Pump performance is measured through checking pressure gauge readings. Major maintenance tasks are also required at less frequent intervals but are just as Important for long term dosing performance. Preventative maintenance is preferable to pump tube failure and consequent wash and process down time. Ensure the pick-up tubing is down to the bottom of the chemical container in each drum. Check the dose unit is switched on. Check pump tubes for condition and crystallisation of chemical within the tubing. On average, a pump station normally needs to be services every six months to ensure long term reliability, this will reduce the chance of needing a call our or having a breakdown on the system.

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Dosing tank's function is a compartment or basin that provides for storage of effluent from a septic tank or other treatment unit intended to be delivered to a soil treatment area at a high-rate periodic discharge. - https://cleanawater.com.au/

Servicing on a water tank should be done and professionally cleaned and serviced at least once a year.

Function of flow meter: Flow meter is a device that measures how much liquid or gas moves through a pipeline in a given period of time. By measuring flow rates, flow meters provide crucial visibility into what's flowing where, within pipes, drainage systems, and other types of infrastructure. - https://www.mccrometer.com/

Pump faults: Solutions

Operation via single-phase current connection: deactivate motor current monitoring.

No feedback from the corresponding contractor: Check functionality

of pump. Bimetallic strip has been tripped: check that the motor has

sufficient cooling.

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No feedback from the corresponding contactor: check functionality of pump.

Motor current monitoring has been tripped: check the set rated current and correct if necessary. – https://cms.media.wilo.com

The flow meter requires calibration this is: Flow meter calibration is the process of comparing the pre set scale or metering of a flow meter to a standard scale of measurement and adjusting its metering to conform to the standard. - https://ifsolutions.com/

Some flowmeters require calibration only once every 3-4 years. In other circumstances, more frequent calibration, possibly even monthly, may be required to maintain a safe, efficient, or regulatory-complaint operation calibration intervals might also fluctuate based on usage or historical performance. https://www.cpecn.com/

All Issues with the chlorine dosing system is the pump malfunctioning I have listed solutions to all causes of the pump malfunctioning if none of these issues can be solved then result into replacing the pump. – own words

COSHH

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Safety precautions for chlorine.

Store respiratory protection away from chlorine. Prepare an escape

plan. Never store chlorine near flammable materials. Never apply heat directly to a chlorine container. Purge pipelines before welding. Install safety wash stations nearby. Use at least two people when handling chlorine.

HASWA

The health and safety at work act 1974 (HASWA)lays down wide – ranging duties on employers must protect the health and safety and welfare at work of all their employees, as well as others on their premises, including temps, casual workers, the self – employed, clients, visitors and the general public.

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MHOR

Manual handling operations, the regulations define manual handling as any transporting or supporting of a load, including lifting, putting down, pushing, pulling, carrying, or moving thereof by hand or bodily force, any employer should explain how to lift and provide correct training if need be.

Specification

- Components already installed.
- Issues identified with the chlorine dosing pump.
- The flow meter is displaying an error.
- The reading error is intermittent.
- The flow of the chlorine is not consistent.

System parts

- Pump
  - Solenoid driven / controlled
  - Stainless steel
  - Flowrate up to ~50 L/min
  - IP55
  - Single phase ~ 230/110 V
- Control Panel
  - IP55 Protected
  - Fuse protected
  - controller, switchgear, solenoids already installed
  - LED indicators and visual display unit
  - on/off function
- water tank
  - dosing tank
  - capacity: 100 L
  - diameter: 500 mm
  - ~~Height~~ Height: 680 mm
- chlorine tank
  - Chlorine storage
  - capacity: 30 L
  - Length: 700 mm
  - width: 165 mm
  - height: 310 mm
- Flow meter
  - Siemens 5100 W
  - IP67 protected
  - Stainless steel
  - corrosion resistant
  - Pre-installed onto the existing pipework: diameter 3 inch
  - Pressure 16 bar
  - maximum flowrate 10 m/s
  - temperature -40°c to +70°c
  - Electromagnetic conduction
  - magnetic coil sensors. • Induction of the sensor is equal to the flowrate

Other specifications

- Velocity of Chlorine: 11.02 m/s

Access for the storage facility of the system

- Chlorine dosing system is located within a pumpstation, in a remote location
- the pumpstation can be accessed both day and night as long as prior agreement and arrangement have been made.

- To gain entry to the area, environmental regulations and procedures must be adhered to.
- Safe gas Zone entry procedures and Pre entry checks must be followed.
- Breathing apparatus need to be obtained, worn, condition checked and inspection in date.
- Calibrated gas monitor to be obtained, checked and worn.

Consideration of the arrangements and information for the chlorine substance must be acknowledge.

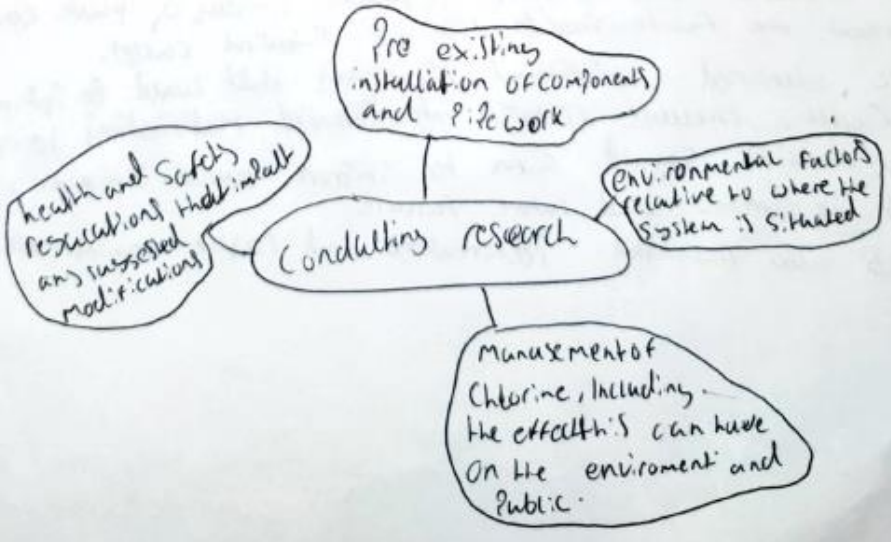
A2B water require services relating to maintenance and repair of a chlorine dosing system they provide to a small farm. requirement is to identify the potential causes of reported issues, reported and explained to A2B water. review of appropriateness of existing path. followed by valid solutions and suggestions for system modifications.

Task 1 - research

2 days ~~days~~ planning

- Methods of modifying chlorine dosing system - in line with specifications.

Reference project brief, conduct research into possible Potential causes of issues and modifications.



The Employer

- WaterFix solutions – contracting company – supplying specialist servicing and repairs of equipment, engineering processes used in the water supply and treatment industry.
- I am a newly qualified servicing engineer for WaterFix

The Project

- A2B Water – water company – who own a chlorine dosing system, providing clean drinking water. Functioning of the chlorine dosing system is high importance, chlorine dosing too high = illness or fatalities amongst drinkers.
- Concentration levels of drinking water must be less than 4 parts per million or 4 milliliters per litre – safe for human consumption.
- A2B water – supply the chlorine dosing system, located at a remote small farm, providing drinking water to several outbuildings. System located within a pumpstation building on the farm.
- A2B contact WaterFix raising a issue, flow meters used in chlorine dosing process, calling error code to display on control panel.
- A2B reported issue may be due to pulsating fluid flow, consequence of the pump within dosing system not functioning correctly.
- system installed by third party some years ago – out of warranty.
- A2B requested you explore different strategies that could be used to investigate the fault, provide list of potential causes.
- once identified, understand solutions that could be put in place to rectify the fault, include research into potential modifications to the system.
- modifications should aim to improve overall system, minimising risk of fault recurrence and future failure
- A2B also requested preventative and routine maintenance schedule.

Task 2 Report

Assessment number (eg 1234-033)	8730-033
Assessment title	Employer-Set Project

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	2
Evidence title / description	**Evidence expected for marking:** Written report (typically 2000 words) Diagram(s) (typically one side of A3) **Evidence submitted for marking:** Written report (typically 2000 words) Diagram(s) (typically one side of A3)
Date submitted by candidate	DD/MM/YY

Task 2 – Report

Introduction

A2B Water require services relating to maintenance and repair of a chlorine dosing system they provide to a small farm. The requirement is to identify the potential causes of the reported issue. This will be reported and explained to A2B Water, along with a review of the appropriateness of existing parts. This will be followed by valid solutions and suggestions for the system modifications.

Modifications

The chlorine dosing system that has been installed is missing back pressure valves, The modification I have decided to make is to add multiple valves this is because without these valves issues can occur due to there not being a way for excess pressure to escape the system. The budget of the operation is £4,000.

I have chosen to implement, WATTS 530-3/4 Adjustable Relief Valve 3/4 x 1/2 175psi these price up to £74.46 meaning that we are left with £3925.54.

Another issue I have noticed with the chlorine dosing system is the fact that the velocity of the chlorine is 11.02 m/s where as the flowmeters maximum flowrate is 10 m/s this is an issue due to the velocity being too fast for the flowmeter to be able to handle therefore a smaller pump would be the solution.

I have chosen to implement, Chemical transfer pump 20-25mm this price up to £201.60 – £358.80 depending on the different specifications this leaves us with £3723.94.

There has been issues we are facing with the chlorine dosing pump this could be due to multiple reasons, I have developed a plan of how to deal with issues that we are facing if these don't solve problems we are facing with the pump, I would recommend looking for a smaller pump that fits into the system and is in the budget of the operation.
Pump faults: Solutions

Operation via single-phase current connection: deactivate motor current monitoring.

No feedback from the corresponding contractor: Check functionality of pump. Bimetallic strip has been tripped: check that the motor has sufficient cooling. Motor current monitoring has been tripped: Check the set rated current and correct if necessary.

There needs to be improved ventilation where the chlorine dosing system is placed due to it being in a remote location.

There needs to be a gas alarm/monitor in the system to notify about any potential gas leaks in the system so we are aware of the issues. The gas monitor I have

decided to implement is Gas Alert Micro Clip multigas 4- gas detector, this will cost £345 this leaves us with £3378.94.

Another modification I would add would be adding pre-entry gas checks that need to be followed before entering the location of the chlorine dosing system to maintain the safety of all in the vicinity.

No pump connected: Connect pump or deactivate minimum current monitoring

Motor current monitoring not set: set the motor current monitoring to the pumps rated current.

No feedback from the corresponding contactor: check functionality of pump. Motor current monitoring has been tripped: check the set rated current and correct if necessary

All Issues with the chlorine dosing system is the pump malfunctioning I have listed solutions to all causes of the pump malfunctioning if none of these issues can be solved then result into replacing the pump.

After listing all modifications to the system and all issues we seem to be facing we will now move onto the Maintenance of the chlorine dosing system.

Maintenance Of System

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inhibitors every year. Use electrical seal offs- when wiring your control panel. Keep gas, and water out of the control panel. Make sure the door is straight not bent and closed at all times. Check to assure there are no crushed, cut or damaged wires.

Flowmeter Calibration. The flow meter requires calibration this is: Flow meter calibration is the process of comparing the pre-set scale or metering of a flow meter to a standard scale of measurement and adjusting its metering to conform to the standard. Some flowmeters require calibration only once every 3-4 years. In other circumstances, more frequent calibration, possibly even monthly, may be required to maintain a safe, efficient, or regulatory-complaint operation calibration intervals might also fluctuate based on usage or historical performance.

Mathematics

To calculate the flowrate, you would need to divide 3m by 10m/s. To find the volume of the cylinders is $\pi\ r2$ x h.

R = radius.

Radius = $\frac{1}{2}$ diameter.

H = height

Volume of Chlorine tank –

Volume of water tank – π (250^2) x h = 133517687.8

Volume of Chlorine tank – W x H x L = 700 x 165 x 310 = 35,805,000

Regulations, Health and Safety Concerns.

COSHH

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PPE

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Purge pipelines before welding. Install safety wash stations nearby. Use at least two people when handling chlorine.

Chlorine Spillage.

Confine the spill to a small area. Use a commercial kit or absorbent material from your spill kit to absorb spilled materials. Place the saturated absorbent in a plastic bag. Label the bag with a hazardous waste tag and include it in the next hazardous waste collection.

HSWA.

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Risk Assessment

Potential Hazards.	People at risk and how?	action Required.
Chlorine spillage.	Whoever is operating the Chlorine dosing system. Irritation, burning pain, inflammation and blisters.	Store chemicals in covered Areas, Use spill kits, bunds and spill pallets, Store containers on secure shelving, prevent overcrowding in chemical storage units, ensure chemicals are stored at or below eye level, regularly inspect chemical containers on site for leaks or decoration.
Gas Leak	Who is operating the system and is next to perform maintenance on the system, if spreads could affect the nearby employees on the farm if not contained.	Installation of a gas alarm to prevent anyone entering the building until the gas leak has been dealt with this would stop any casualties. Ensuring all gas pipework, appliances and flues are regularly maintained check all rooms with gas appliances have adequate ventilation.
Fire Hazard	Anyone with disabilities particularly with slow mobility due to not being able to escape as quick as others. Anybody with language difficulties as they can't understand instructions, anyone who is unfamiliar with the premises, anyone in the premises.	Make sure a up to date fire alarm has been put in place and is regularly maintained. Possibly install a system where the system shuts off when a fire is detected stopping the system producing excess heat, also if it fits within the budget a system could be implemented where if the building is empty all oxygen is vacuumed out to starve the fire from oxygen.

Diagrams

- Water pump

- Water tank

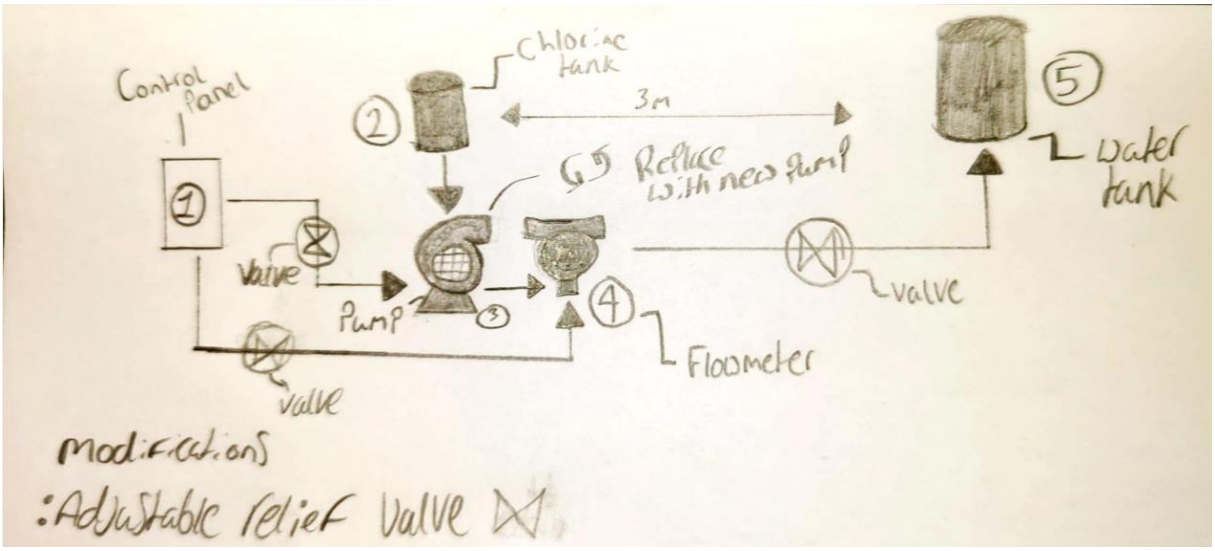
- Conntrol Panel

- gas alarm

Summary/Conclusion

I have started the report with a introduction into the project explaining the task we have been set and what needs to be done, after the introduction I have moved onto the modifications I believe are needed for the performance of the system and for it to maintain its best capability. After completing the modifications of the system, I moved onto a maintenance schedule and explaining what maintenance needs to be done to the different parts of the system. I then moved onto the mathematics needed of the system to calculate the different volume of the water tank and chlorine tank. Then I moved onto the health and safety regulations needed for the system and maintaining the safety of employees. To finish of the report, I completed a risk assessment for the different potential hazards we could face while working on maintaining this system.

Diagram



Task 3 Plan

Assessment number (eg 1234-033)	8730-033
Assessment title	Employer-Set Project

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3
Evidence title / description	**Evidence expected for marking:** Planning chart (typically one side of A3) Support statement (typically 1000 words) **Evidence submitted for marking:** Planning chart (typically one side of A3) Support statement (typically 1000 words)
Date submitted by candidate	DD/MM/YY

Gantt chart

1. Research and Plan	BY Who	duration	Start	end	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	3.25	3.5	3.75	4	4.25	4.5	4.75	5
The PPE required	Project engineer 1	0.5	day 1	day 1.5																	
health and safety regulations	Project engineer 2	1	day1	day 2																	
contracts and rentals required	project engineer 1	0.5	day 1.5	day 2																	
required jobs	project engineer 3	0.5	day 1	day 1.5																	
responsibilities	project engineer 3	0.5	day1.5	day 2																	
maintenance schedule	maintenance engineer	1	day 1	day 2																	
risk assessment	health and safety advisor	0.5	day 1	day 1.5																	
pre entry checks	health and safety advisor	0.5	day 1.5	day 2																	
entry and work times	project manager	1	day 1	day 2																	
tools required	project engineer 4	1	day 1	day 2																	
2.purchasing equipment																					
pump	finance engineer 1	1	day 2	day 3																	
valves	finance engineer 2	1	day 2	day 3																	
PPE	finance engineer 3	1	day 2	day 3																	
chlorine	finance engineer 4	1	day 2	day 3																	
Gas alarm																					
3.installation																					
calibrate equipment	project manager	0.25	day 3	day 3.25																	
drive to site	whole team	0.25	day 3.25	day 3.5																	
draw entire system	project engineer 1	0.25	day 3.5	day 3.75																	
install vavles in system	project engineer 2	0.25	day 3.75	day 4																	
remove the pump	project engineer 3	0.25	day 4	day 4.25																	
install new pump	project engineer 3	0.25	day 4.25	`4.5																	
fill tanks back up	project engineer 1	0.25	day 4.5	day 4.75																	
calibrate and test system	project manager	0.25	day 4.75	day 5																	

Task 3 – Supporting document

I have started my Gantt chart with the research and planning of the system, I have decided to start with finding out what the PPE required is this would be a breathing apparatus, eye and face protection, chemical protective clothing, gloves are needed and steel toe capped boots. After the PPE we moved onto the health and safety regulations the ones I have included in the project is:

COSHH – the law that requires employers to control substances that are hazardous to health.

HASWA – The health and safety at work act lays down wide ranging duties on employers must protect the health and safety and welfare at work of all their employees as well as on other premises including temporary, casual workers, self-employed, clients, visitors and the general public.

MHSWR – The workplace health, safety and welfare regulations cover a wide range of basic health, safety and welfare issues and apply to most workplaces. The main duty placed on employers by the management of health and safety at work regulations is to undertake risk assessments to identify potential hazards.

MHOR – Manual handling operations, the regulations define manual handling as any transporting of a load, including lifting, putting down, pushing, pulling, carrying or moving thereof by hand or bodily force, any employer should explain how to lift and provide correct training.

Then we move onto the contracts and rentals required this covers the wages for the engineers we employ to the tools and vehicles we wither rent or own this also includes fuel money to get our team from A – B.

After this we develop a maintenance schedule this includes how often each piece of equipment should be serviced and even cleaned to keep it performing to its maximum capabilities this also includes how often it should be repaired if our solution to the problem doesn’t work.

This is the risk assessment sheet we had come up with and planned.

Potential Hazards	People at risk and how?	Action required.
Chlorine Spillage	Whoever is operating the Chlorine dosing system. Irritation, burning pain, inflammation and blisters.	Whoever is operating the Chlorine dosing system. Irritation, burning pain, inflammation and blisters.
Gas Leak	Who is operating the system and? is next to perform maintenance on the system, if spreads could affect the nearby employees on the farm if not contained.	Installation of a gas alarm to prevent anyone entering the building until the gas leak has been dealt with this would stop any casualties. Ensuring all gas pipework, appliances and flues are regularly maintained check all rooms with gas appliances have adequate ventilation.
Fire Hazard	Anyone with disabilities particularly with slow mobility due to not being able to escape as quick as others. Anybody with language difficulties as they can't understand instructions, anyone who is unfamiliar with the premises, anyone in the premises	Make sure a up to date fire alarm has been put in place and is regularly maintained. Possibly install a system where the system shuts off when a fire is detected stopping the system producing excess heat, also if it fits within the budget a system could be implemented where if the building is empty all oxygen is vacuumed out to starve the fire from oxygen.

After this we develop a pre-entry check to the site this includes everything from PPE checks to a checklist of each item to ensure they are still working properly.

We have come up with an 8:00 AM – 16:30 PM day with a half an hour lunch break due to us feeling this is the best for our employees taking into account their social life, there day starts at 8:00 AM they work up until 12 have a half an hour lunch break then continue working up until 16:30 this means that our employees are able to be home and spend their dinner with there family and work and maintain that special bond with the family.

After this we find out what tools we need to complete the project.

The second stage of the project is purchasing the equipment which is the pump, valves, PPE and the chlorine making sure this all fits in our £4000 budget.

Stage 3 of the project starts with calibrating the equipment and preparing for installing the equipment, we start with driving to the site after that we develop a drawing of the entire system and shut off the system to prevent any leakages while working on the system, we start with installing valves into the system we do this so we can isolate any equipment if it needs working on, we then remove the faulty pump, after this we install the new pump. Last of all we fill the tanks back up and calibrate and test the system and if all is well we leave the site.

Task 4 Present

Assessment number (eg 1234-033)	8730-033
Assessment title	Employer-Set Project

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	4
Evidence title / description	**Evidence expected for marking:** Presentation materials **Evidence submitted for marking:** Presentation materials
Date submitted by candidate	DD/MM/YY

INTRODUCTION

- After completing all other tasks we have come up with a presentation on all the information we have picked up from our research.
- This presentation will contain possible causes of the intermittent fault, modifications and components selected.
- How the new components will improve the existing system, Health and safety considerations for testing and calibration including preventative maintenance and a routine maintenance schedule.
- Proposed costings, challenges presented by the brief and how they have been overcome. .

HEALTH AND SAFETY REGULATIONS

PPE

- When handling chlorine, Eye / Face protection is mandatory due to the damage it can cause if touches skin or gets into your eyes, this would mean a face shield with safety goggles is needed.
- Skin protection : is mandatory for chemical protective clothing to be worn e.g., Gloves, Aprons, Boots, coveralls and or Long sleeve shirts and pants.

- **Safety Precautions when working with chlorine**
- Store respiratory protection away from chlorine prepare a escape plan never store chlorine near flammable materials, make sure heat is never applied directly to a chlorine container.
- Make sure a safety wash station is installed nearby when working with chlorine, there has to be at least two people when handling chlorine.
- If chlorine is spilt confine the spill to a small area, use a commercial kit or absorbent material from your spill kit to absorb spilled materials, place the absorbent in a plastic bag label it with a hazardous waste tag and include it into next hazardous waste collection.

- **HASWA**
- The health and safety at work act 1974 lays down wide ranging duties on employers must protect the health and safety and welfare at work of all their employers.
- As well as others on the site facility including temporary workers, casual workers, self-employed, clients, visitors and the general public.
- HASWA requires that workplaces provides adequate training of staff to ensure health and safety procedures are understood and adhered to. Adequate welfare provisions for staff at work. A safe working environment that is properly maintained and where operations within it are conducted.
- This places a legal duty on all employers to ensure, so far as reasonably practicable, the health, safety and welfare of employees, and to ensure that employees and others are kept safe.
- **COSHH**
- the law that requires employers to control substances that are hazardous to health includes nanomaterials. You can prevent or reduce workers exposure to hazardous substances by finding out what health hazards are.

- **MHSWR**
- The workplace health, safety and welfare regulations 1992 cover a wide range of basic health, safety and welfare issues and apply to most workplaces.
- The main duty placed on employers by the Management of Health and Safety at Work Regulations is to undertake risk assessments to identify potential hazards to employee health and safety and anyone who may be affected by their work activity.
- **MHOR**
- Manual handling operations, the regulations define manual handling as any transporting or supporting of a load, including lifting, putting down, pushing, pulling, carrying, or moving thereof by hand or bodily force, any employer should explain how to lift and provide correct training if need be.
- Five steps to performing a movement without injury is: Plan your lift adequately, Position centre the body and feet correctly, pick lift item using good posture, proceed move toward desired location, place set object down safely.

MODIFICATIONS TO THE SYSTEM

- The chlorine dosing system that has been installed is missing back pressure valves, The modification I have decided to make is to add multiple valves this is because without these valves issues can occur due to there not being a way for excess pressure to escape the system. The budget of the operation is £4,000.
- Another issue I have noticed with the chlorine dosing system is the fact that the velocity of the chlorine is 11.02 m/s where as the flowmeters maximum flowrate is 10 m/s this is an issue due to the velocity being too fast for the flowmeter to be able to handle therefore a smaller pump would be the solution.
- There has been issues we are facing with the chlorine dosing pump this could be due to multiple reasons, I have developed a plan of how to deal with issues that we are facing if these don't solve problems we are facing with the pump, I would recommend looking for a smaller pump that fits into the system and is in the budget of the operation.
- There needs to be improved ventilation where the chlorine dosing system is placed due to it being in a remote location , I wouldn't install extra ventilation into the system I would just take this into account as could be a problem in the future.

REPLACEMENT PARTS

- I have chosen to implement, WATTS 530-3/4 Adjustable Relief Valve 3/4 x 1/2 175psi these price up to £74.46 meaning that we are left with £3925.5
- I have chosen to implement, Chemical transfer pump 20-25mm this price up to £201.60 – £358.80 depending on the different specifications this leaves us with £3723.94.
- The gas monitor I have decided to implement is Gas Alert Micro Clip multigas 4- gas detector, this will cost £345 this leaves us with £3378.94.
- Another modification I would add would be adding pre-entry gas checks that need to be followed before entering the location of the chlorine dosing system to maintain the safety of all in the vicinity.

PUMP FAULT : SOLUTIONS

- Operation via single-phase current connection: deactivate motor current
- monitoring.
- No feedback from the corresponding contractor: Check functionality of pump.
- Bimetallic strip has been tripped: check that the motor has sufficient cooling.
- Motor current monitoring has been tripped: Check the set rated current and
- correct if necessary.
- No pump connected: Connect pump or deactivate minimum current
- monitoring
- Motor current monitoring not set: set the motor current monitoring to the
- pumps rated current.
- No feedback from the corresponding contactor: check functionality of pump.
- Motor current monitoring has been tripped: check the set rated current and
- correct if necessary

SYSTEM MAINTENANCE

- **Maintenance of chlorine dosing pump**
- Remove, inspect and clean the injection quill to prevent blockages. Pump performance is measured through checking pressure gauge readings. Major maintenance tasks are also required at less frequent intervals but are just as Important for long term dosing performance.
- Major maintenance tasks are also required at less frequent intervals but are just as Important for long term dosing performance. Preventative maintenance is preferable to pump tube failure and consequent wash and process down time
- Ensure the pick-up tubing is down to the bottom of the chemical container in each drum. Check the dose unit is switched on. Check pump tubes for condition and crystallisation of chemical within the tubing.
- On average, a pump station normally needs to be services every six months to ensure long term reliability, this will reduce the chance of needing a call our or having a breakdown on the system.

Control panel maintenance

- The panel is connected to a sample line from a dosing system, from which the PH, ORP and chlorine levels can be determined which id then used by the attached controller or pump to regulate the dosing for the whole system.
- Change corrosion inhibitors every year. Use electrical seal offs- when wiring your control panel. Keep gas and water out of control panel at all times.
- Make sure the door is straight not bent and closed at all times. Check to assure there are no crushed, cut or damaged wires.

Water tank servicing / maintenance

- Servicing on a water tank should be done and professionally cleaned and serviced at least once a year.

Flowmeter servicing / maintenance

- The flowmeter does not require routine lubrication or service of any kind. Keep the interior of the flow meter housing clean and free of dust, moisture, oils or corrosive materials.

Flowmeter calibration

- The flow meter requires calibration this is: Flow meter calibration is the process of comparing the pre-set scale or metering of a flow meter to a standard scale of measurement and adjusting its metering to conform to the standard.
- Some flowmeters require calibration only once every 3-4 years. In other circumstances, more frequent calibration, possibly even monthly, may be required to maintain a safe, efficient, or regulatory-complaint operation calibration intervals might also fluctuate based on usage or historical performance.

RISK ASSESSMENT

Potential Hazards	People at risk and how?	Action required
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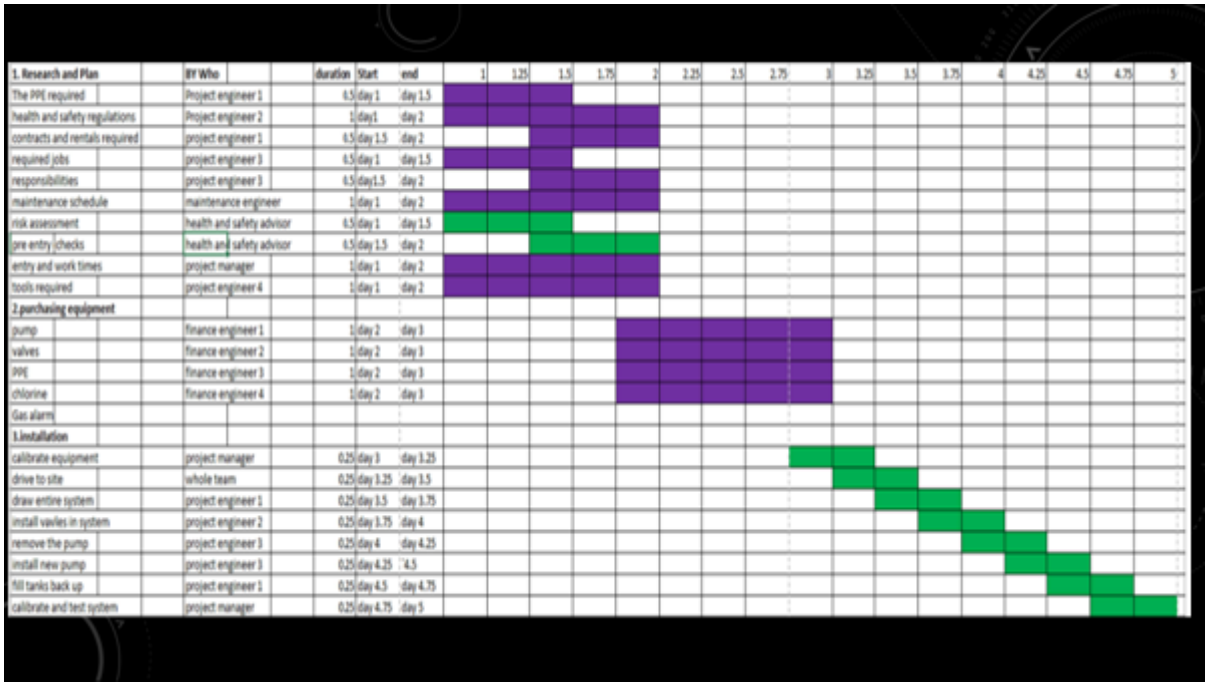

1. Research and Plan	BY Who	duration	Start	end
The PPE required	Project engineer 1	0.5	day 1	day 1.5
health and safety regulations	Project engineer 2	1	day1	day 2
contracts and rentals required	project engineer 1	0.5	day 1.5	day 2
required jobs	project engineer 3	0.5	day 1	day 1.5
responsibilities	project engineer 3	0.5	day1.5	day 2
maintenance schedule	maintenance engineer	1	day 1	day 2
risk assessment	health and safety advisor	0.5	day 1	day 1.5
pre entry checks	health and safety advisor	0.5	day 1.5	day 2
entry and work times	project manager	1	day 1	day 2
tools required	project engineer 4	1	day 1	day 2
2.purchasing equipment				
pump	finance engineer 1	1	day 2	day 3
valves	finance engineer 2	1	day 2	day 3
PPE	finance engineer 3	1	day 2	day 3
chlorine	finance engineer 4	1	day 2	day 3
Gas alarm				
3.installation				
calibrate equipment	project manager	0.25	day 3	day 3.25
drive to site	whole team	0.25	day 3.25	day 3.5
draw entire system	project engineer 1	0.25	day 3.5	day 3.75
install vavles in system	project engineer 2	0.25	day 3.75	day 4
remove the pump	project engineer 3	0.25	day 4	day 4.25
install new pump	project engineer 3	0.25	day 4.25	4.5
fill tanks back up	project engineer 1	0.25	day 4.5	day 4.75
calibrate and test system	project manager	0.25	day 4.75	day 5

Gantt Chart

Stage 1

I have started my Gantt chart with the research and planning of the system, I have decided to start with finding out what the PPE required is this would be a breathing apparatus, eye and face protection, chemical protective clothing, gloves are needed and steel toe capped boots.

After the PPE we moved onto the health and safety regulations the ones I have included in the project is COSHH, HASWA, MHSWR, MHOR.

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After this we find out what tools we need to complete the project.

Stage 2

The second stage of the project is purchasing the equipment which is the pump, valves, PPE and the chlorine making sure this all fits in our £4000 budget.

Stage 3

This part of the project starts with calibrating the equipment and preparing for installing the equipment, we start with driving to the site after that we develop a drawing of the entire system and shut off the system to prevent any leakages while working on the system.

Then we start with installing valves into the system we do this so we can isolate any equipment if it needs working on, we then remove the faulty pump, after this we install the new pump.

Last of all we fill the tanks back up and calibrate and test the system and if all is well we leave the site.

THANK YOU FOR LISTENING
ANY QUESTIONS ?

Employer-Set Project – Presentation Q & A Record (Task 4)

8730-12 T Level Technical Qualification in Maintenance, Installation and Repair for Engineering and Manufacturing

8730-033 Employer-Set Project (Summer 2023)

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234
Date	DD/MM/YY

Provider name	<provider name>
City & Guilds Provider No.	999999a

Record observation notes below to inform external marking. **Notes must be detailed, accurate and differentiating.**

Tutor questions to candidate	Candidate responses
What did you feel the most challenging aspect of the brief?	The research had to find a lot out about chloring dosing and specifications.
What do you feel are the biggest risks to ensuring the project timescales are met?	Parts coming in time if not have to push back the maintenance system/work.
Why did you go for this type of maintenance and process?	Preventative – stops issues before they happen. Keep track its cheaper as well as maintaining it so no call out fees – won't be needed.

Any other comments

Tutor signature	Date
X _____	DD/MM/YY

If completing electronically, double click next to the 'X' to add an electronic signature once the record is **finalised**.

Get in touch

The City & Guilds Quality team are here to answer any queries you may have regarding your T Level Technical Qualification delivery.

Should you require assistance, please contact us using the details below:

Monday - Friday | 08:30 - 17:00 GMT

T: 0300 303 53 52

E: **technicals.quality@cityandguilds.com**

W: **http://www.cityandguilds.com/tlevels**

Web chat available **here**.

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