T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Design and Development for Engineering and Manufacturing

Employer-Set Project (8730-035)

Project Brief Summer 2023

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The employer

Lock Restoration Limited is a small company who provides specialist products to refurbish heritage canal infrastructure. The company specialises in the provision of replacement lock gates and mooring buoys to tie up boats. You are employed by Lock Restoration Limited.

Most canals in the UK were constructed in the 18th and 19th centuries to transport goods across England. In more recent years the use of the canal system has changed and now tends to be used more for recreational boating and tourism.

A lock is a structure used for raising and lowering boats between stretches of water of different levels on a canal, such as a hill (shown in Figure 1).

Figure 1
A typical canal lock showing existing gates to be replaced
(Published anonymously-https://www.codecogs.com**)**

Heritage locks use gates which are operated manually by a lock keeper living on-site, using a gearing system (shown in Figure 2).

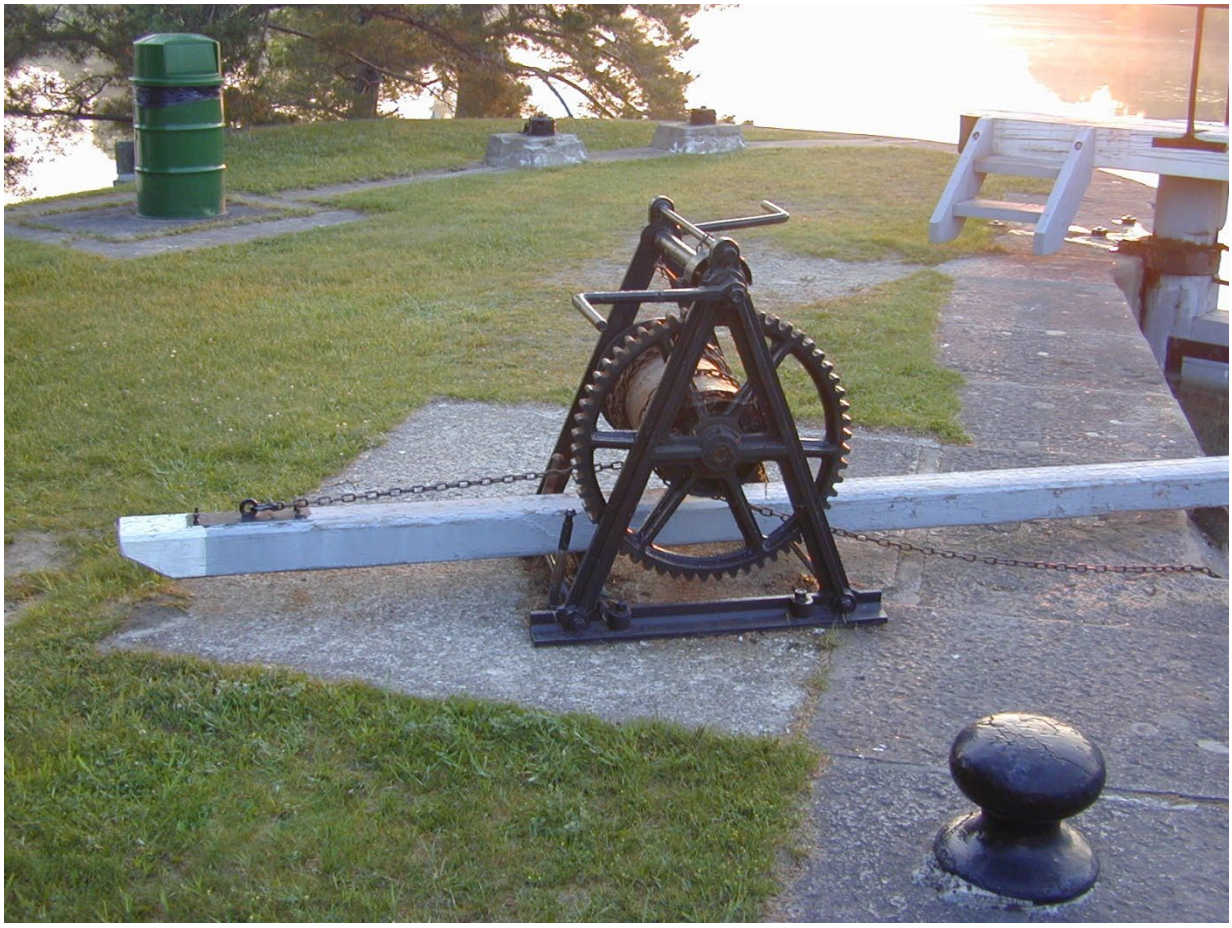

Figure 2
Typical original lock gate geared control mechanism to be replaced
(Published anonymously- https://aldunlop.com)

To manage a boat successfully going up or downstream requires five steps at each lock, as outlined in Table 1 and 2.

Table 1 – Operation of a lock for a boat going up-stream

Stages	What happens in the lock
1	The boat enters the lock.
2	The lower gates are closed.
3	The lock is filled with water from upstream.
4	The upper gates are opened.
5	The boat exits the lock

Table 2 – Operation of a lock for a boat going downstream

Stages	What happens in the lock
6	The boat enters the lock.
7	The upper gates are closed.
8	The lock is emptied by draining its water downstream.
9	The lower gates are opened.
10	The boat exits the lock

The project

Canal Heritage is a registered charity that has received a grant to restore a section of canal which contains five locks. After two hundred years the lock gates have fallen into a state of disrepair and Canal Heritage wants to replace them with a modern automated system.

Canal Heritage has approached Lock Restoration Limited to research and provide initial design solutions and a technical specification for the design of a new lock gate.

An extract of the design specification relating to your part of the project has been provided, this includes performance requirements, pictures, budget constraints and timescale requirements.

Product design specification

Canal Heritage wishes to develop a new lock gate to be used in five 200-year-old locks located on a stretch of heritage canal in the UK. Each lock is 21 m long and will require a gate system at either end. The company wishes to automate the operation of the lock gates so that they can be operated from an off-site control centre.

The specific performance requirements of the lock gates are:

- each lock gate must
    - be fitted within an opening of 4.2 m wide,
    - have an overall height of 6 m,
    - support a head of water of between 2 m and 5.5 m during the operation of the lock.
- gates should be designed to be operated automatically and independently of each other
- there will be space adjacent to the lock gates for positioning an automated opening and closing drive mechanism
- the gates opening/closing drive mechanisms are to be visually unobtrusive in a purpose-built inspection chamber next to each lock gate
- a surveillance and sensor system is required to remotely monitor operation of the gate
- a manual call point system to contact the lock keeper should be installed to enable gates to be stopped in an emergency
- preventive measures are to be provided to mitigate the risk of boats colliding with a gate
- access is to be provided for on-site visual inspection of the principal moving parts of the gate
- the overall aesthetic design of the gates to be visually appealing
- gates must be easily removable by mobile crane for reactive maintenance and designed to have limited routine operational maintenance
- hinges of the lock gates are a critical component and must be designed to be durable
- seals are required to prevent water loss from the gates during lock operation
- gates and components must use materials that are sustainable and can be easily repurposed at the end of life
- if electrical power is required, a mains electricity source is available.

Budget
Canal Heritage have budgeted for a supply price of £100,000 per gate system and wish to purchase units for five locks - i.e., a total of 5 x 2 gate systems = £1 million.

Project duration
Canal Heritage would like the overall project to be completed within a 52-week timescale.

Get in touch

City & Guilds Technicals Quality Team

We 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:

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