



JOB DEMANDS ANALYSIS

Company: Corporation of Delta

Location: Works Yard

Job Title: Water Mechanic

Classification: Regular Duty

Purpose of Activities

The Water Mechanic is responsible for the maintenance, repair and installation of water meters and their associated components in business properties, vaults and chambers; water consumption checks; and monthly/quarterly water meter readings.

Tools and Equipment

The Water Mechanic will use the following tools and equipment to perform his duties:

- One-ton Gruman Van
- Work bench in back of van
- Hand tools – hand saws, hammers, levels, screw drivers, bench vise, shovels (round, square, narrow), rakes, brooms, pails, torque multiplier, 1/2 to 3/4 inch sockets, rope, cheaters, 2.75 m extension ladder
- Power tools, drills, grinders, water pumps, generator
- Valves keys, manhole cover puller, gas detector, pin finder, meters, fittings, fish tape
- Rubber boots, rubber hip boots
- Concrete meter box casing (42kg)
- First aid kit
- Traffic cones, traffic signs (lane closure, men and equipment working)

Usual Methods

Maintain/Repair/Install Water Meters and Components

1. Determine work for the day.
2. Load required tools and equipment into the van if necessary.
3. Drive to location of work (buildings, business, manhole, vault, chamber, meter box).
4. Walk from truck to work site. Manhole cover/meter box lid must be lifted off chamber, vault, manhole and meter box.
5. Set gas detector into the underground chamber if required.
6. Grasp toolbox and other required material. Lower toolbox and other materials into chamber.
7. Walk into building, property or climb into chamber. Pump water out of chamber if required.
8. Perform maintenance task and/or make the repair or installation. Water meters may be lowered by hand or in some cases they are lowered by a mechanical lifting device because they are too heavy to be lifted or lowered by hand. Concrete meter box



casing weigh approximately 42-kg. They can be lifted by one man but should be lifted by two.

9. Remove tools from the work area. Return tools to proper location in van.
10. Return manhole or meter box cover to proper location.
11. Complete paperwork for maintenance, repair or installation.
12. Drive to next project.

Check Water Consumption

1. Receive complaint for high or low water consumption.
2. Drive to location.
3. Enter building, chamber, vault or meter box as above.
4. Determine if the meter is defective. Check for other reasons why consumption may be high or low (leaking toilets, watering lawns, etc.).
5. Replace the water meter, install remote on outside of building or on a post at the manhole, chamber or meter box with hand and power tools.
6. Clean up work area.
7. Complete paperwork.
8. Drive to next project.

Monthly/Quarterly Water Meter Readings

1. Drive to location to begin water meter readings.
2. Get out of van.
3. Walk to water meter or remote location.
4. Take reading.
5. Walk back to van.
6. Drive to next water meter or remote location.
7. Repeat steps 1-6 until all water meters and remotes have been read.

Administrative Issues

The Water Mechanic works from Monday to Friday 0800 to 1630 with a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. There is one Water Mechanic in the Corporation of Delta and overtime and stand-by are required elements of this position. The Water Mechanic is required to enter vaults and chambers that are a maximum of 2.8 metres deep. A gas detector is used to alert the Water Mechanic to the presence of deadly Carbon Monoxide and Hydrogen Sulfide gas in the vault or chamber. Reading water meters and remotes takes approximately four days to month.

Activity Demand Variables

These variables are tasks that must be carried out by the employee and are implicitly or explicitly required as objectives of the job.

- Shovel or dig to install post for water meter remotes
- Climb up and down a ladder to get in/out of a chamber or vault (maximum 2.75 m deep)



- Raise and lower tools and equipment by hand or rope into chambers, vaults that can be up to 2.75 m deep
- Lift and carry tools, equipment, water meters, water meter parts, etc from the van to the work area (2-10 m)
- Repair, maintain or install water meters and accessories
- Kneel, crouch, bend and stoop to perform maintenance, repair or installation
- Two ten-minute rest periods (one in the morning and one in the afternoon) and a 30-minute lunch break
- Work in all weather conditions including prolonged periods of rain or heat
- Enter confined spaces that may contain sewer gases
- Walk to from van to work location (2-50 m)
- Sit to drive van
- Stand in van, in chambers, vaults, grass, dirt, concrete

Worker Decision Variables

These variables are the sub-routines and cognitive/physical decisions made by the worker in carrying out the objectives of the job.

- Lifting techniques to some extent
- Task organization

Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during water meter and accessory maintenance, repair and installation, reading water meters and investigating high or low water consumption.
2. People with shoulder injuries such as rotator cuff tendonitis, bursitis and instability may have difficulty with dynamic and static loading and reaching activities required during water meter maintenance, repair and installation.
3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the repeated jarring and the static grip forces required to shovel, dig and hand and power tool during water meter and accessory maintenance, repair and installation.
4. People with injuries to the lower extremities may have difficulty climbing in and out of the van; up and down ladders to the chambers, vaults; bending, stooping, crouching, and kneeling required to access the water meters and accessories. Walking may also pose a challenge for some injuries.
5. People who have difficulty entering confined spaces will have difficulty with this position.

Prepared By: Jeffrey J. McGinn, Kinesiologist

May 26, 1999



Summary of Stresses

Metabolic Stresses

The aerobic energy system will supply the major source of energy while performing the duties and responsibilities of the Water Mechanic. This energy system will be utilized during the maintenance, repair and installation of water meters and accessories, water meter readings and investigation of high or low water consumption issues. The anaerobic energy systems may be required to supply energy for brief intense periods of work, which may include heavy or sustained lifting or carrying; or towards the end of the day when the aerobic energy system has been depleted. In this last instance the anaerobic energy system becomes the primary energy source

Structural Stresses

Spine –Significant loading of the spinal structures are likely in this position. Prolonged loaded and unloaded forward flexion, extension, lateral flexion and rotation of the spine are all movements required by the Water Mechanic. Forward flexed postures require no activity from the torso musculature, but increase asymmetrical disc compression and passive stretch on the posterior spinal ligaments and disc fibres. This can contribute to disc integrity problems as well as decondition the torso support musculature. Lateral flexion and/or rotation with or without forward flexion (loaded or unloaded) will significantly increase the shear forces encountered by the discs, fibres and spinal ligaments. The Water Mechanic will handle loads from less than one to 42 kilograms. Driving to and from each work location in a flexed spine position will also increase the risk for injury to the spine as described above.

Neck, Shoulders and Upper Extremity– the Water Mechanic will often perform prolonged and repeated static and dynamic movements. These static and dynamic movements through the shoulder and upper extremity require the rotator cuff muscle groups, upper trapezius and scalene muscles of the neck to maintain a significant load. Static loading of the forearm flexors, extensors, supinator, pronator teres and the pronator quadratus during tool use (shovel, hand and power tools, etc) will increase the risk of injury to these areas. Power and air tool use (drill, grinders, etc) will also increase the vibration, jarring and compressive forces from the grip to the elbow and shoulder that may lead to over use tendon or nerve injuries.

Almost all of the Water Mechanic's work is carried out in front of his body with some type of tool or implement. This position will weaken the shoulder girdle support structure and increase the risk of injury to this area. Rotator cuff and biceps tendon tendonitis injuries are likely as the muscle of the upper back and shoulder weaken through prolonged use. As this happens, thoracic spine kyphosis will increase and the cervical spine will be pulled forward out of its neutral position.

Hips and Lower Extremities – Standing and walking on concrete and asphalt will increase the compressive forces through the ankles, knee, hips and spine. The awkward positions required to access water meters and accessories do not allow the Water Mechanic to perform the required work from a stable base of support. This in turn will increase the risk of injury for all of the other structures. Climbing in and out of the van and up and down



ladder into the chamber increase the risk of a slip and fall injury. Working in a wet environment will also increase the risk of injury due to slip and fall.

INTERVENTIONS

Recommendations that could be implemented to increase productivity and lessen the risk of injury are listed below:

1. Encourage the Water Mechanic to maintain an increased level of fitness away from work that will focus on cardiovascular endurance, muscular strength, muscular endurance and flexibility.
2. Provide kneepads for the Water Mechanic for any work where kneeling is required, specifically on concrete, asphalt or other hard surfaces.
3. Provide regular education in effective use of the body and neutral joint positions for this type of work.

PJDC-Water Mechanic

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|--|-----------------------------|----------|--------------------------------------|------------------|------------|----------|-----------------------------|--|-------------------------|---|----------|
| Referral: Cathy Cook | | | Organization: Corporation of Delta | | | | | | Title: Water Mechanic | | |
| Dept.: Engineering | | | Division: Waterworks | | | | | | Contact: Laurie Akerman | | |
| PHYSICAL DEMANDS | | | R E Q U I R E D | S I D E | FREQUENCY* | | | | Max. Weight (kg) | Usual Weight (kg) | COMMENTS |
| | | | | | Sel 1 | Low 2 | Mod 3 | High 4 | | | |
| S T R E N G T H | Lifting - Floor to Knuckle | X | | | | X | | 42 | <1-8 | tools, equipment, materials, meters, shovel | |
| | Lifting - Knuckle to Waist | X | | | | | X | 42 | <1-8 | tools, equipment, materials, meters, shovel | |
| | Lifting - Waist to Shoulder | X | | | | X | | 42 | <1-8 | tools, equipment, materials, meters, shovel | |
| | Lifting - Over Head | X | | | X | | | 20 | <1-8 | tools, equipment, materials, meters | |
| | Carrying - With Handles | X | | | X | | | 42 | <1-8 | hand and power tools | |
| | Carrying - Without Handles | X | | | | X | | 42 | <1-8 | tools, equipment, materials, meters | |
| | Pushing - Upper Extremity | X | | | | | X | 42 | <1-8 | shovel, hand/power tool use, install meters | |
| | Pushing - Hip/Leg Assist | X | | | | X | | 42 | <1-8 | shovel, hand/power tool use, install meters | |
| | Pulling - Upper Extremity | X | | | | | X | 42 | <1-8 | shovel, hand/power tool use, install meters | |
| | Pulling - Hip/Leg Assist | X | | | | X | | 42 | <1-8 | shovel, hand/power tool use, install meters | |
| | Reach - Shoulder or Above | X | | | X | | | 30 | <1-8 | tool use, install/repair/maintain meters | |
| | Reach - Sho. or Above extnd | X | | X | | | | 20 | <1-8 | tool use, install/repair/maintain meters | |
| | Reach - Below Shoulder | X | | | | | X | 42 | <1-8 | tool use, install/repair/maintain meters | |
| | Reach - Bel. Shoulder extnd | X | | | X | | | 42 | <1-8 | lift, carry tools, equipment, materials, meters | |
| | Handling | X | | | | | X | 42 | <1-8 | tools, equipment, materials, meters | |
| | Gripping | X | | | | | X | 50 | <1-8 | tools, equipment, materials, meters | |
| | Fine Finger Movements | X | | | | | X | max. | low | install/repair/maintain meters, tool use | |
| E N R G | Aerobic (percent) | X | | | | | 95 | install/repair/maintain meters, chambers, light to moderate activity | | | |
| | Anaerobic (percent) | X | | neg. | | | | heavy lift of tools, equipment, materials, meters | | | |
| | High Energy Expenditure | | | | | | | | | | |
| | Low Energy Expenditure | X | | | | | X | install/repair/maintain meters, chambers, light to moderate activity | | | |
| P O S T U R E + M O B I L I T Y | Neck - Static Flexion | X | | | | | X | work below shoulders to repair, install, maintain meters/chambers | | | |
| | Neck - Static Neutral | X | | | | | X | sit to drive, walk, stand, work at shoulder level | | | |
| | Neck - Static Extension | X | | | | X | | work above shoulders from stand, bend, stoop, crouch, kneel | | | |
| | Neck - Rotation | X | E | | | | X | shoulder check to drive, install/repair/maintain meters/chambers | | | |
| | Throwing | X | | X | | | | dirt from shovel | | | |
| | Sitting | X | | | | X | | in Gruman one-ton van, standard seat, no suspension | | | |
| | Standing | X | | | | X | | in van, at work site, in chambers, on concrete, asphalt, grass, dirt | | | |
| | Walking | X | | | | X | | betw van and work site, chamber, meter in building, remote | | | |
| | Running/Jumping | | | | | | | | | | |
| | Climbing - Arms and Legs | X | | | X | | | in/out of van 2 steps to 0.8 m, wall ladder in/out of chambers | | | |
| | Climbing - Legs Only | X | | | X | | | in/out of van, possibly hills at work site | | | |
| | Bending/Stooping | X | | | | | X | to install, repair, maintain meters and components | | | |
| | Crouching | X | | | | X | | to install, repair, maintain meters and components | | | |
| | Kneeling | X | | | X | | | to install, repair, maintain meters and components | | | |
| | Crawling | X | | X | | | | to install, repair, maintain meters and components | | | |
| | T Y | Twisting | X | E | | | X | to install, repair, maintain meters and components, drive van | | | |
| | Balancing | X | | | X | | on steps of van, on ladders | | | | |
| | Traveling | X | | | | X | in Corporation of Delta | | | | |
| G E N | Work Alone | X | | | | | X | all of the time, except in a chamber | | | |
| | Interact with Public | X | | | | | X | drive in traffic, at buildings, work sites | | | |
| | Operate Equip/Machinery | X | | | | | X | one-ton Gruman Van, power tools, test bench for meters | | | |
| | Irregular/Extended Hours | X | | X | | | | 0800-1630, Monday - Friday, OT and Stand-by required | | | |
| * Frequency Legend 1 = Seldom; Not Daily 2 = Low Daily Activity; < 1hr 3 = Moderate Demand; Repetition 1 - 3 hrs daily 4 = High Frequency Demand; Repetition > 3 hrs daily The following shading denotes a HIGH RISK TASK: Modifications should be considered | | | | | | | | | | | |

REQD is marked with an X if the particular demand or category is relevant to the purpose of the job.

SIDE refers to the side or limb required to execute a task. If it is marked **E**, it indicates either side, the most common choice is listed first. **D** refers to dominant and **B** to both sides.

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|---|----------------------------|------------------|------------------|------------|----------|-----------|-----------|---|--|
| Referral: | | Organization: | | | | | | Title: see 1st page header | |
| Dept.: | | Division: | | | | | | Contact: | |
| PHYSICAL DEMANDS | | R E Q D | S I D E | FREQUENCY* | | | | COMMENTS | |
| | | | | Sel. 1 | Low 2 | Mod. 3 | High 4 | | |
| P E R C E P T I O N | Hearing - Conversations | X | | | | X | | property owners, co-workers on radio, cell phone | |
| | Hearing - Other Sounds | X | | | | | X | 2 way radio, cell phone, van, gas detector | |
| | Vision - Far | X | | | | | X | install, repair, maintain meters, check consumption's, test bench | |
| | Vision - Near | | | | | | | | |
| | Vision - Colour | | | | | | | | |
| | Vision - Depth | X | | | | | X | install, repair, maintain meters, check consumption's, test bench | |
| | Perception - Spatial | X | | | | | X | install, repair, maintain meters, check consumption's, test bench | |
| | Perception - Form | X | | | X | | | tool use, parts/material selection | |
| | Feeling (Tactile) | X | | | | X | | hand and power tool use | |
| | Reading | X | | | | X | | paperwork, meters, remote readers | |
| W O R K E N V I R O N M E N T | Writing | X | | | | X | | paper work | |
| | Speech | X | | | | X | | property owners, coworkers on 2 way radio, cell phone | |
| | Inside Work | X | | | | X | | in cab of van, buildings, chambers, shop, test shop | |
| | Outside Work | X | | | | X | | installing remotes, outside of chambers | |
| | Hot Conditions >25 deg. C | X | | X | | | | spring, summer, fall | |
| | Cold Conditions <10 deg.C | X | | X | | | | fall, winter, spring | |
| | Humid | X | | X | | | | in chambers, wet weather | |
| | Dust | X | | X | | | | at work site, in chambers | |
| | Vapor Fumes | X | | X | | | | CO, H2S gas in chambers, glue, paint | |
| | Hazardous Machines | X | | | | | X | one-ton Gruman van, power tools | |
| | Proximity to Moving Object | X | | | | X | | drive in traffic, hands near power tools | |
| | Noise | X | | | | | X | traffic noise, hand/power tool use, pumps, motors | |
| | Electrical Hazard | | | | | | | | |
| | Sharp Tools | X | | | | X | | hand and power tools | |
| | Radiant/Thermal Energy | X | | X | | | | sun burn | |
| | Slippery Conditions | X | | X | | | | in wet weather, water in chambers | |
| | Vibration and Related | X | | | | | X | spinal compression driving van, hand/power tool use | |
| | Chemical Irritants | X | | X | | | | paint, glue, CO, H2S gas | |
| | Organic Substances | X | | X | | | | Hanta Virus | |
| | Medical Waste | | | | | | | | |
| | Blood Products | | | | | | | | |
| | Congested Worksite | X | | X | | | | possibly to access some meters, chambers | |
| | Lighting - Direct | X | | | | | X | sun light, day light, overhead lights in shops, buildings | |
| | Lighting - Indirect | X | | | | | X | sun light, day light | |
| | Lighting - Adjustable | X | | | X | | | tasks lighting in chambers, meter rooms | |
| | Lighting - Fluorescent | X | | | X | | | overhead lights in buildings, shops | |
| | Lighting - Incandescent | X | | | X | | | overhead lights in buildings, shops | |
| | Lighting - Shadows etc. | X | | | X | | | depends on time of day, location | |

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For detailed descriptions of each of the different categories, please refer to the reference guide or inquire with Human Effort at 1-888-4EFFORT