



JOB DEMANDS ANALYSIS

Company: City of Burnaby

Location: Automotive Shop

Job Title: Tradesman – Mechanic –
Minor Equipment

Classification: Regular Duty

Purpose of Activities

The Minor Equipment Mechanic is responsible for the repair and maintenance of the mechanized minor equipment owned by the City of Burnaby. This minor equipment includes chain saws, weed eaters, tampers, jack hammers, cut off saws, power saws, drag machine (sewers), auger (sewers), air compressors, salter/sanders, plows, electric generators, pumps, black top roller, etc.

Tools and Equipment

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

1. Automotive shop bay with 114 kg hoist (250 lbs.)
2. Hand tools (wrenches, screw drivers, sockets, chisels, punches, hammers, task light, cheaters, hammers, sledge hammer, grease gun, hack saw, pipe wrench, chains, lifting straps, files, rasps, etc.)
3. Power tools (drill, grinder, chain sharpener, etc)
4. Air tools (1/2 and 3/4 inch impact gun, pistol and in-line grip)
5. Parts washer, solvent
6. Work bench with vise, step ladder, extension ladder
7. Forklift, cherry picker lift, floor jack, jack stand
8. Parts room

Usual Methods

1. Read work order to determine what work is required for minor equipment. During the specific seasons, work on some minor equipment takes priority over others.
2. Locate minor equipment in shop area (inside or outside).^{**}
3. Lift, carry and place minor equipment on workbench. Some pieces of minor equipment are lifted by two people or they are lifted with the hoist.^{**}
4. Dismantle minor equipment parts based on information supplied in the work order.
5. Remove defective part(s), walk to the parts room (100 m)^{**}, and retrieve part if it is stock, order the parts if it is not in stock.
6. Walk back to the Minor Equipment Shop (100 m)^{**}, clean all parts in parts washer using hand brush and spray nozzle.



7. Make repair and reassemble parts and piece of minor equipment. If the part is not in stock in the Parts Room, the piece of minor equipment is set aside and the Minor Equipment Mechanic proceeds to step 1.**
8. Test minor equipment to ensure the repair has been successful.
9. Place minor equipment in storage shelf or give back to the minor equipment operator.**
10. Repeat steps 1-9 with the next piece of minor equipment.

On occasion, the Minor equipment Mechanic will go into the field to make minor equipment repairs. A truck is loaded with tools and driven to the work site. The repair is made on site and then the Minor equipment Mechanic will return to the Minor Equipment Shop. The Minor Equipment Mechanic estimates he is called out ten times per year to perform a minor equipment repair in the field.

The presence of ** indicates non-value added tasks. These are tasks that do not contribute to the stated purpose of the work.

Administrative Issues

The Minor Equipment Mechanic works an eight-hour day, Monday to Friday from 0700 to 1530. He receives a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. The Minor Equipment Mechanic rarely works overtime. The shop bay is small and lacks work and storage space. Current parts manuals are not always purchased and the Minor Equipment Mechanic will often make the repair by trial and error. ** Some manuals and diagrams are difficult to read.

The workbenches are at fixed heights (73 and 90 cm tall). The Minor Equipment Mechanic has an unadjustable stool that he can sit while making repairs or he can choose to stand on a rubber mat. Lighting in the Minor Equipment Shop is fluorescent and task lightening only.

There are several safety issues in the Minor Equipment Shop. These issues can increase the risk of injury and/or decrease the productivity of the Minor Equipment Mechanic. These safety issues centre on the lack of adequate work and storage space. During normal daily work or in the event of an emergency, access and/or egress in, around or out of the shop can be restricted as equipment and parts may be stored on the floor

The air exchange system in the Minor Equipment Shop does not work well as diesel, gasoline and other fumes hang in the air when the shop doors are open or closed. Lighting is poor (overhead fluorescent only) and needs to be improved.

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.

- Walk, stand on concrete floor, asphalt works yard
- Bend, stoop, crouch, kneel and crawl to repair minor equipment
- Reach below, at and above shoulder height to repair minor equipment
- Insert hand(s) into confined areas to repair minor equipment
- Hand, power and air tool use is required
- Work above shoulders in cervical extension from a stand, bend, stoop, crouch, kneel



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.

- Work on minor equipment on bench, floor or ground
- Some body postures can be selected by the Minor Equipment Mechanic, but most body postures are the result of how the minor equipment has been engineered

Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the maintenance and repair of minor equipment.
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 to access parts to make repairs.
3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the repeated jarring from air tool use as well as the static grip forces required during any power or hand tool use.
4. People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use of air tools (compression and vibration).
5. Post-whiplash and other neck problems may have difficulty with this position.
6. Individuals who do not cope in open low-autonomy work environments would have difficulty with this position.
7. Must hold a Tradesman Ticket (Automotive or Heavy Duty Mechanic) valid for the province of British Columbia.

Prepared By: Jeffrey J. McGinn, Kinesiologist

February 17, 1999



Summary of Stresses

Metabolic Stresses

The aerobic energy systems will provide the major source of energy for the Minor Equipment Mechanic. This position requires a low to moderate level of aerobic activity to perform minor equipment repair. The anaerobic energy system may be used in high intensity repair tasks, such lifting parts to and from their proper location or using cheater to loosen or tighten nuts and bolts.

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 Minor Equipment 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 contributing to deconditioning of 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.

Due to equipment engineering and the space limitations found in the shop, it is almost impossible for the Minor Equipment Mechanic to use proper postural control and body positioning for most of the work he performs. With this in mind, the goal should be to minimize the time spent in these undesirable, high-risk postures and make good postural and movement choices whenever the situation presents itself.

Neck, Shoulders and Upper Extremity– Minor equipment maintenance and repair requires prolonged and repeated static and dynamic movements. The static and dynamic movements through the shoulder and upper extremity often require the rotator cuff muscle groups, upper trapezius and scalene muscles of the neck to maintain a significant load. Hand, air and power tool use (predominately dominant hand) will increase the static and dynamic loading of the forearm flexors, extensors, supinator, pronator teres and the pronator quadratus. Power and air tool use 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.

Hips and Lower Extremities – Standing and walking on concrete and asphalt for the entire shift increase the compressive forces through the ankles, knee, hips and spine. The awkward positions required to access some parts and components do not allow the Minor Equipment 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.



INTERVENTIONS

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

1. The present Minor Equipment Shop is inadequate for the type and volume of work that the Minor Equipment Mechanic performs. A larger, space that is more modern is required. This space should be equipped with a proper ventilation system, an effective lighting system and be equipped with the proper number and type of tools and equipment required in a diverse mechanic shop. A stakeholder needs assessment should be conducted to determine the actual requirements of the Minor Equipment Shop.
2. Provide regular education in effective use of the body and neutral joint positions for this type of work.
3. Encourage the Minor Equipment Mechanic to be active away from work focusing on cardiovascular endurance, muscular strength, muscular endurance and flexibility.
4. Provide kneepads for the Minor Equipment Mechanic for the times he will spend in a kneeling position when making a repair.
5. Purchase current minor equipment manuals with easy to read fonts and diagrams.
6. Investigate a padded handle for the pistol grip air tools. Each Mechanic may require their own impact gun so that the pistol grip can be matched to the user's handgrip. Investigate the use of a variable speed impact gun to reduce the jarring force at the end of the cycle.
7. Install a mercury vapor light to improve the lightening in the Minor Equipment Shop.
8. Purchase an adjustable perching stool so that the Minor Equipment Mechanic can maintain a neutral spine when he chooses to sit/perch at the workbench.
9. Install adjustable benches so that the Minor Equipment Mechanic can adjust the height of the work surface based on the size of the piece of minor equipment. This will decrease the time spent in forward flexion and increase the opportunity of maintaining a neutral spine posture.

PJDC-Minor Equip Mechanic

Referral: Lana Ho		Organization: City of Burnaby							Title: Mechanic - Minor Equipment	
Dept.: Engineering		Division:							Contact:	
		FREQUENCY*							Date: February 17, 1999	
PHYSICAL DEMANDS		R E Q D	S I D E	Sel 1	Low 2	Mod 3	High 4	Max. Weight (kg)	Usual Weight (kg)	COMMENTS
S T R E N G T H	Lifting - Floor to Knuckle	X	D			X		45	<1-7	equipment, tools, parts
	Lifting - Knuckle to Waist	X	D				X	45	<1-7	equipment, tools, parts
	Lifting - Waist to Shoulder	X	D			X		20	<1-7	equipment, tools, parts
	Lifting - Over Head	X	D		X			10	<1-7	equipment, tools, parts
	Carrying - With Handles	X	D			X		45	<1-7	equipment, tools, parts
	Carrying - Without Handles	X	D				X	45	<1-7	equipment, tools, parts
	Pushing - Upper Extremity	X	D				X	40	<1-7	wrenches, equip., tools, parts on bench
	Pushing - Hip/Leg Assist	X	D			X		40	<1-7	equip. on floor, parts, tools
	Pulling - Upper Extremity	X	D				X	40	<1-7	wrenches, equip., tools, parts on bench
	Pulling - Hip/Leg Assist	X	D			X		40	<1-7	equip. On floor, parts, tools
	Reach - Shoulder or Above	X	D	X				10	<1-7	chain to hoist, repair above shoulders
	Reach - Sho. or Above extnd	X	D	X				10	<1-7	chain to hoist, repair above shoulder
	Reach - Below Shoulder	X	D				X	45	<1-7	repair minor equip., tool use, lift, carry
	Reach - Bel. Shoulder extnd	X	D		X			45	<1-7	lift, carry equip., tools, parts
	Handling	X	D				X	45	<1-7	equip., tools, parts
Gripping	X	D				X	45	<1-7	equip., tools, parts	
Fine Finger Movements	X	D				X	max.	low	tool use, handle small parts for repair	
E N R G	Aerobic (percent)	X					100			repair minor equip., lift, carry, shop and some field work
	Anaerobic (percent)	X		X						heavy lift and carry
	High Energy Expenditure									
	Low Energy Expenditure	X					X			repair minor equip., lift, carry, shop and some field work
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 minor equipment
	Neck - Static Neutral	X					X			stand, walk, sit in minor equipment shop
	Neck - Static Extension	X				X				work from bend, stoop, crouch, kneel to repair equip.
	Neck - Rotation	X	L/R				X			view minor equip. for repair on bench, floor, ground
	Throwing									
	Sitting				X					on stool at work benches for repair
	Standing	X					X			on concrete floor, asphalt in works yard
	Walking	X					X			in shop and works yard on concrete and asphalt
	Running/Jumping									
	Climbing - Arms and Legs									
	Climbing - Legs Only	X			X					stairs to storage in minor equipment t shop
	Bending/Stooping	X					X			to repair minor equipment at bench, on floor, ground
	Crouching	X				X				to repair minor equipment at bench, on floor, ground
	Kneeling	X			X					to repair minor equipment at bench, on floor, ground
	Crawling									
Twisting	X	L/R				X			to repair minor equipment at bench, on floor, ground	
Y	Balancing									
G E N	Traveling	X		X						repair minor equipment in the field
	Work Alone	X					X			work independently, in building with others
	Interact with Public	X		X						only when driving to field work
	Operate Equip/Machinery	X					X			power and air tools, chain saw, weed eaters, etc.
	Irregular/Extended Hours									8 hour day, Monday-Friday, 7:00am-3:30pm, no OT

* 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.

PJDC-Minor Equip Mechanic

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			co-workers, Foreman, minor equipment user	
	Hearing - Other Sounds	X				X		minor equipment motors	
	Vision - Far	X					X	repair minor equipment	
	Vision - Near								
	Vision - Colour	X				X		oil, fluid quality	
	Vision - Depth	X					X	repair minor equip., move about in shop/shop area	
	Perception - Spatial	X					X	repair minor equip., move about in shop/shop area	
	Perception - Form	X					X	minor equipment parts, tools, equipment	
	Feeling (Tactile)	X					X	force application to loosen/tighten parts, repair equip.	
	Reading	X			X			service/repair reports	
W O R K E N V I R O N M E N T	Writing	X			X			service repair reports	
	Speech	X			X			co-workers, Foreman, minor equipment user	
	Inside Work	X					X	in shop	
	Outside Work	X		X				door way of shop bay, field work	
	Hot Conditions >25 deg. C	X		X				spring, summer, fall, shop doors open	
	Cold Conditions <10 deg.C	X		X				fall, winter spring, shop doors open	
	Humid	X		X				wet weather conditions	
	Dust	X			X			possibly when repairing minor equipment	
	Vapor Fumes	X					X	oil/gas mix, gasoline, solvent in parts washer	
	Hazardous Machines	X					X	minor equipment, tools, equipment	
	Proximity to Moving Object	X				X		moving parts on minor equipment	
	Noise	X					X	power/air tools, running minor equipment	
	Electrical Hazard								
	Sharp Tools	X				X		hand/power/air tools to repair equipment	
	Radiant/Thermal Energy	X			X			hot motor or parts on minor equipment, hot oil, fluid	
	Slippery Conditions	X					X	oil, fluid, water on shop floor	
	Vibration and Related	X				X		power and air tool use	
	Chemical Irritants	X				X		oil/gas mix, gas, oil, chain saw oil, etc.	
	Organic Substances	X		X				decaying grass, weeds on minor equipment	
	Medical Waste								
	Blood Products								
	Congested Worksite	X					X	in minor equipment shop	
	Lighting - Direct	X					X	overhead fluorescent	
	Lighting - Indirect	X					X	daylight from open shop doors	
	Lighting - Adjustable	X					X	trouble lights	
	Lighting - Fluorescent	X					X	overhead fluorescent lights	
	Lighting - Incandescent								
	Lighting - Shadows etc.	X					X	in shop and field work	

* 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.

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