



JOB DEMANDS ANALYSIS

Company: City of Burnaby

Location: Welding Shop

Job Title: Tradesman –Welder

Classification: Regular Duty

Purpose of Activities

The Welder is responsible for the repair and fabrication of steel, metal and aluminum parts, components on vehicles, equipment, trailers, bus shelters, etc. Work can be performed in the Welding shop or in the field.

Tools and Equipment

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

- Welding shop bay (two bays) with one-ton jib crane
- Welders, tig welder, acetylene torches, plasma cutters
- Steel, aluminum templates
- Hand tools - wrenches, screw drivers, sockets, chisels, punches, hammers, task light, cheaters, hammers, sledge hammer, tape measures, chains, come along, pipe wrenches, pipe cutters, bolt cutters, etc.
- Air tools - 1/2 and 3/4 inch impact gun, pistol and in-line grip
- Work benches with vise
- Press, brake, drill press, cut off saw, grinders, fans, dies for press and brake
- Oxygen, acetylene bottles
- step ladder, extension ladder
- Forklift, floor jack, jack stand
- Steel storage racks in shop bay and in secondary storage site located 20 metres from Welding Shop
- One-ton mobile welding truck equipped with hand/power tools, welders, torches and cutters
- Steel plates (4X8), rounds, bars, flat iron, aluminum of various sizes and weights – some can be lifted by hand while others require the forklift or jib crane
- Carts for moving or holding parts and equipment
- Protective Clothing – welding gloves, welder's face shield, tinted goggles, steel toe boots, coveralls

Usual Methods

Field Work

1. Receive work order from Foreman
2. Walk to mobile welding truck, perform pre-trip inspection, load required tools and equipment on the truck. Drive to the work site.



3. Determine exact nature of the work. Determine what parts, equipment and tools are required and length of time the work will take. Time at the work site may range from minutes to hours to several days or even weeks depending on the nature of the work.
4. Unload tools, material and equipment from the truck as required.
5. Make the repair in the field. Use tools, equipment and materials as required.
6. Return tools, equipment and unused material to the truck.
7. Clean the work site if necessary.
8. Drive to shop or to next work site.

Shop Work

1. Receive work order from Foreman.
2. Clear work area in Welding Shop.**
3. Gather required tools, equipment and materials in work area. Hand carts, forklift or the jib crane may be required to maneuver tools, equipment and materials where they are required.**
4. Walk to secondary storage area to select required material, cut material in storage area if required. Walk back to Welding Shop. The forklift may be required to transport the piece between buildings.**
5. Use hand, air, and power tools, cutting torch, plasma cutters and welder to make repair or to fabricate the required part or component. The repair or fabrication may take a few minutes, to several hours, days or even weeks.
6. Note: If as high priority tasks come into the shop, all other work is set aside and the priority task is completed. Vehicles, equipment, parts, etc. may be moved out of the shop bay to allow work on the priority tasks to be completed. The original work is then returned to the shop and work is continued.**
7. Complete work on repair or fabrication.
8. Clean work area, as the work is performed.**
9. Complete paperwork as required.
10. Start next job.

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

Administrative Issues

The Welder 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 Welder rarely works overtime. Garbage Trucks are usually brought into the shop for repair without having been properly cleaned. Maggots, rats and other disease carrying bacteria have been reported on the surface or in these vehicles. There are two bays for four Welders.

There are several safety issues in the Welding Shop. These issues can increase the risk of injury and/or decrease the productivity of the Welder. These safety issues centre on the lack of adequate workspace for each Welder to perform the tasks and functions of this position.



Several vehicles and heavy equipment fill the entire bay. Some are even too large to enter the bay. During normal daily work or in the event of an emergency, access and/or egress in, around or out of the shop is restricted. In addition, in some instances, where it would be prudent to use a mechanical lifting device, the mechanical lifting device can not get near the vehicle/equipment. When this happens, the Welder(s) will remove or install the part by hand. Garbage trucks requiring repair are a priority for the Welder. Work is removed from a bay, the Garbage Truck is brought in, repaired and sent back out. Then the original work that was going on in the bay is brought back in. This is time consuming and non-productive for the Welder.

The one-ton overhead jib crane is stationed in the centre of the Welding Shop. The jib crane arms pivots around the centre of the shop. Material is attached to the lifting clamp, lifted by operating the jib crane controls and then pushed by hand along the roller on the jib crane arm. Often, vehicles may block the metal storage area. When this happens, the material is lifted at a 45-degree angle to the floor rather than perpendicular.

The air exchange system of the Welding Shop is weak as gases and fumes (paint fumes, cyanide gas, etc.) hang in the air when the shop doors are open or closed. The Welding Shop bay doors are often opened to assist with ventilating these gases and fumes out of the building. The Welding Shop is also dark and shadows fall over the Welders work.

The lack of adequate workspace, lighting and ventilation are factors that will negatively affect productivity. The shop bays are often out of service as the Welder waits for parts to arrive (hours, days). The lack of bays for each Welder significantly decreases productivity. Moving tools and equipment from one bay to another is time consuming and access to another bay may be blocked by vehicles or heavy equipment. Working outside in the elements is also likely to negatively affect productivity.

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 in works yard
- Bend, stoop, crouch, kneel and crawl to repair and fabricate
- Reach below, at and above shoulder height to repair and fabricate
- Insert hand(s) into confined areas to repair and fabricate
- Hand, power and air tool use is required
- Climb, stand and balance on ladders or the vehicles and equipment to perform repair or fabrication
- Work above shoulders in cervical extension from a stand, bend, stoop, crouch, kneel to perform repair or fabrication
- Work under vehicles and equipment to make repair or fabrication
- Operate hand controls on one-ton jib crane
- Weld and use cutting torches in poorly ventilated Welding Shop



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.

- Some body postures can be selected by the welder, but most body postures are the result of how the repair or fabrication presents

Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the repair and/or fabrication.
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 repair and/or fabricate.
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 welder, hand and power 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), welders, cutting torches and other hand or power tools.
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 Journeyman Tradesman Ticket (Welder) valid for the province of British Columbia.

Prepared By: Jeffrey J. McGinn, Kinesiologist

May 27, 1999



Summary of Stresses

Metabolic Stresses

The aerobic energy system will provide the major source of energy for the Welder. This position requires a moderate level of aerobic activity to perform repair and fabrication tasks. The anaerobic energy system may be used in high intensity repair tasks, such as lifting and holding parts and equipment in position, lifting heavy parts, etc. The Welder can use the forklift or jib crane to assist with heavy lifts or holds. The anaerobic energy system may be required if the Welder is fatigued at the end of the day or when required to perform a heavy lift and/or hold so that parts can be repaired or fabricated.

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 Welder. 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.

Due to the way vehicles and equipment are engineered and the space limitations found in the shop, it is almost impossible for the Welders to use proper postural control and body positioning for most of the work they perform. 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– repair and fabrication 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 Welder 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.

Burns – The welder is at risk for burns to his body and eyes from the welder, acetylene torch, plasma cutter, grinders, etc. Protective clothing is worn by the Welder to minimize these risks.



Crush and Amputation Injuries – working with heavy tools, equipment and materials as well as the press and brake increases the risk of crush and amputation injuries to the extremities of the Welder. Operating the overhead jib crane when it is supporting up to one-ton of weight will also increase this risk of injury.

Gases and Fumes – Gases and fumes are given off when cutting or welding some products. Cyanide gas is produced when welding galvanized steel and other unknown fumes are given off when cutting or welding painted steel or metal.

INTERVENTIONS

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

1. The present Welding Shop is inadequate for the type and volume of work that the Welder 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 (track crane) required in a diverse Welding Shop. Welding Shop bays require adequate space around them to allow for access and egress as well as crane and tool use. A stakeholder needs assessment should be conducted to determine the actual requirements of the Welding Shop. Consult industry to determine space requirements based on the number of Welders on staff and the footprint of various tools and equipment, etc.
2. Encourage the Welder to be active away from work focusing on cardiovascular endurance, muscular strength, muscular endurance and flexibility.
3. Provide regular education in effective use of the body and neutral joint positions for this type of work.
4. Encourage the Welder to ask for assistance when handling heavy and/or oversized parts or pieces of equipment
5. Provide kneepads for the Welder for the times he will spend in a kneeling position when performing a repair or fabrication task.
6. Investigate a padded handle for the pistol grip air tools. Each Welder may require his own impact gun or changeable grip 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.

Referral: Lana Ho			Organization: Burnaby						Title: Welder			
Dept.: Engineering			Division:						Contact:			
PHYSICAL DEMANDS			R E Q D E	S I D E	FREQUENCY*				Max. Weight (kg)	Usual Weight (kg)	Date: February 1999	
					Sel 1	Low 2	Mod 3	High 4				
S T R E N G T H	Lifting - Floor to Knuckle	X	B				X		50	<1-8	tools, equipment, steel	
	Lifting - Knuckle to Waist	X	D					X	50	<1-8	tools, equipment, steel	
	Lifting - Waist to Shoulder	X	B				X		35	<1-8	tools, equipment, steel	
	Lifting - Over Head	X	B			X			35	<1-8	tools, equipment, steel	
	Carrying - With Handles	X	D			X			50	<1-8	tools	
	Carrying - Without Handles	X	D					X	50	<1-8	tools, equipment, steel	
	Pushing - Upper Extremity	X	D				X		50	<1-8	tools, equipment, steel, material on jib crane	
	Pushing - Hip/Leg Assist	X	D				X		50	<1-8	tools, equipment, steel, material on jib crane	
	Pulling - Upper Extremity	X	D				X		50	<1-8	tools, equipment, steel, material on jib crane	
	Pulling - Hip/Leg Assist	X	D				X		50	<1-8	tools, equipment, steel, material on jib crane	
	Reach - Shoulder or Above	X	B				X		35	<1-8	weld, tool use, move steel on jib crane	
	Reach - Sho. or Above extnd	X	B			X			35	<1-8	weld, tool use, move steel on jib crane	
	Reach - Below Shoulder	X	D					X	50	<1-8	weld, tool use, move steel on jib crane	
	Reach - Bel. Shoulder extnd	X	B			X			50	<1-8	lift, carry, tools, equip., material, weld	
	Handling	X	D					X	50	<1-8	tools, equipment, steel, material on jib crane	
Gripping	X	D					X	50	<1-8	tools, equipment, steel, material on jib crane		
	Fine Finger Movements	X	D					X	max.	low	hold tools/material to weld, operate jib crane	
E	Aerobic (percent)	X						95	light to moderate activity to repair/fabricate steel components			
N	Anaerobic (percent)	X		neg.					possibly during a heavy lift and hold, fatigue at end of day			
R	High Energy Expenditure											
G	Low Energy Expenditure	X						X	light to moderate activity to repair/fabricate steel components			
P O S T U R E + M O B I L I T Y G E N	Neck - Static Flexion	X						X	weld, tool use below shoulders to repair & fabricate material			
	Neck - Static Neutral	X					X		stand, walk, sit, during tasks			
	Neck - Static Extension	X					X		weld, tool use from bend/stoop, crouch, kneel, above shlders			
	Neck - Rotation	X	E					X	weld, tool use to repair & fabricate material			
	Throwing	X				X			scrap to garbage or steel recycling bins			
	Sitting				X				weld/tool use at low heights, drive forklift, truck to job site			
	Standing	X						X	on concrete floor in shop, in field at job site			
	Walking	X						X	in shop betw shop bay, tools and equipment, truck to job site			
	Running/Jumping				X				down from vehicles, back of garbage trucks			
	Climbing - Arms and Legs	X			X				in/out of the back of the garbage truck/other equipment			
	Climbing - Legs Only	X				X			stairs in shop to lunch room, hills at work site			
	Bending/Stooping	X						X	weld and tool use to repair and fabricate material			
	Crouching	X					X		weld and tool use to repair and fabricate material			
	Kneeling	X				X			weld and tool use to repair and fabricate material			
	Crawling	X			X				weld and tool use to repair and fabricate material			
	Twisting	X	E					X	weld and tool use to repair and fabricate material			
	Balancing	X			X				on ladders, the back of vehicles and equipment			
	G E N	Traveling	X			X				in city of Burnaby with mobile welding truck		
		Work Alone								perform most tasks alone, in shop with others		
Interact with Public		X			X				possibly when driving mobile welding truck, at work site			
Operate Equip/Machinery		X						X	welders, torches, cutters, brakes, press, drill press, jib crane			
Irregular/Extended Hours									0700-1530, Monday to Friday, OT rare			

* 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.

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		other welders, vehicle/equipment operators, foreman	
	Hearing - Other Sounds	X					X	tools, equipment, trucks, vehicles, forklift	
	Vision - Far	X					X	weld, tool use to repair and fabricate material	
	Vision - Near								
V I S I O N	Vision - Colour	X			X			flame on torch	
	Vision - Depth	X					X	weld, tool use/walk in shop, jib crane to move material	
	Perception - Spatial	X					X	weld, tool use/walk in shop, jib crane to move material	
	Perception - Form	X				X		tools, equipment, steel, aluminum	
F E E L I N G	Feeling (Tactile)	X					X	weld, tool use, gloves are worn most of the time	
	Reading	X			X			blue prints, drawings, paperwork	
	Writing	X			X			paperwork	
	Speech	X				X		other welders, vehicle/equipment operators, foreman	
W O R K	Inside Work	X					X	in welding shop, drive in cab of mobile welding truck	
	Outside Work	X				X		shop door open for ventilation, filed work driveway of shop	
	Hot Conditions >25 deg. C	X		X				spring summer, fall, shop bay doors open for ventilation	
	Cold Conditions <10 deg.C	X		X				fall, winter, spring, shop bay doors open for ventilation	
E N V I R O N M E N T	Humid	X		X				wet weather conditions	
	Dust	X					X	grinding steel, iron, etc., shop is coated with fine black dust	
	Vapor Fumes	X					X	gases/fumes released when welding, cyanide gas, paint fumes	
	Hazardous Machines	X					X	welders, torches, power/hand tools, overhead crane, forklift	
T A S K	Proximity to Moving Object	X					X	vehicles in shop, overhead crane, tools and equipment	
	Noise	X					X	welders, torches, power/hand tools, ear protection required	
	Electrical Hazard								
	Sharp Tools	X					X	cutters, grinders, knives, cutting torches, saws	
V I B R A T I O N	Radiant/Thermal Energy	X					X	welding, cutting torches, protective gloves/clothing required	
	Slippery Conditions	X					X	dust, oil, water on the floor	
	Vibration and Related	X					X	hand, power and air tool use, welder, torches	
	Chemical Irritants	X					X	gases/fumes released when welding, cutting material	
O R G A N I C	Organic Substances	X		X				decaying garbage in back of garbage trucks, rats, bugs, etc.	
	Medical Waste								
	Blood Products								
	Congested Worksite	X					X	in shop bays, performing tasks in confined areas	
L I G H T I N G	Lighting - Direct	X					X	overhead lights, daylight, sun light	
	Lighting - Indirect	X					X	day light, sun light, task lighting, welding face shield	
	Lighting - Adjustable	X				X		task lighting	
	Lighting - Fluorescent	X					X	overhead lights	
	Lighting - Incandescent	X					X	overhead lights	
	Lighting - Shadows etc.	X				X		depends on location of work in shop, time of day	

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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