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HUMAN RESOURCES CANADA

Electricity Human Resources Canada is a non-profit organization supporting the human resources needs of the Canadian electricity sector.

Job Demands Assessment: **Power System Electrician**

Canada
This project is funded by the Government of Canada's Sectoral Initiatives Program.

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The purpose of a Job Demands Assessment (JDA) is to document the bona fide essential duties of a task. These assessments can be used for:

- Return to work planning
- Allowing medical professionals to evaluate job offers for suitability
- Determining job and task suitability
- Determining the likelihood that a job or task contributed to an injury
- Assisting Rehabilitation Specialists set up effective treatment protocols
- Training employees
- Hiring practices and Post Offer Pre-employment hiring programs
- Identifying ergonomic hazards

Using the JDA

This JDA is purposely generic in nature to ensure applicability across various organizations. The JDA is meant to serve as a benchmark document that provides an overview of the most common physical demands associated with the occupation. Not all tasks could be observed during the assessment process; instead, the most common tasks have been assessed.

Where applicable, potential accommodations are noted to illustrate alternative means for achieving the required demand or action.

This JDA can be used by Medical Practitioners / Health Care Providers involved in return to work rehabilitation support, and workplace accommodations to identify the Major Essential Demands that can be Performed, Modified, or Avoided by an individual based on their capacity and ability.

Acknowledgements

This JDA was completed by **ERGO Inc.**, an Ergonomics, Injury Prevention & Safety Consulting & Training Firm that has been providing Canadian companies with practical ergonomic and injury prevention solutions for over 25 years.

Electricity Human Resources Canada and ERGO Inc. would like to thank **Manitoba Hydro** for allowing us onsite to complete the JDA at the Selkirk Generating Station in Selkirk, Manitoba (November 2021).

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General Information

Job Description	**Statement of Overall Job Description:** A Power System Electrician is responsible for the installation, repair and maintenance of electrical equipment at electricity generation stations, transmission and distribution stations and sub-stations. **Tasks of a Power System Electrician include:**	**Approx. % of Time Spent Performing Each Task**
	1. Installation and decommissioning of new or old equipment. Equipment consists of various voltages of breakers, transformers, relays and regulators. Duration ranges from daily to monthly assignments.	**30%**
	2. Maintenance through transformer and oil testing, breaker, switches, high voltage electrical wiring inspections and cable terminations. Duration ranges from 2 hours to 8 hours.	**10%**
	3. Testing and repairing of equipment through inspection, load testing, problem solving, fabrication, modification and reintegration. Duration ranges from hours to a full shift. Includes emergency responses to equipment failures.	**50%**
	4. Electrician duties such as wiring circuits, installing conduits and customer service repairs and upgrades in rural areas. Duration varies depending on the task.	**10%**
Work Load	Work is scheduled for consistent workload based on weekly or monthly assignments. Assignments include locations in the city or rural areas and may be called to other areas due to emergencies.	
Work Schedule	Varies by Province, Monday to Friday – 8 hour shift, 12 hour shifts, rotating shiftwork and a requirement for emergency on-call services.	
Work Environment	**Description:** Indoors and outdoors at sub-stations, generating stations, electrical equipment buildings and use of a service vehicle. Service vehicles have equipment and parts located in the back compartment.	
	Working Heights: A few feet below ground to 50-60 feet; reaches with an aerial lift. Typically, ground level to shoulder height, occasionally over shoulder height. Ladders and aerial lifts are available for use when working at heights of 10'-50'. Work below ground level when installing or decommissioning equipment.	
	Working Reaches: Full range of postures observed while performing tasks including extended reaches to manipulate and hold components, overhead positions and lateral side reaches. Work is often performed at ground level with 2 foot deep trenches below grade for installation/decommissioning work.	

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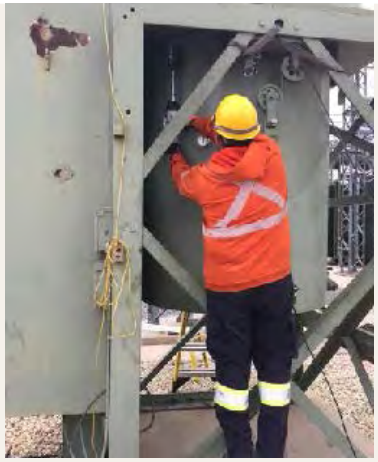
Pictures of Main Job Tasks

Grounding using a hot stick

Testing and repairing equipment

Instrumentation measurements

Service vehicle



Installation of equipment

Working below ground and at heights

Cabinet wiring

Handling of a breaker

Disclaimer: Not all tasks within the occupation were being performed at the time of data collection. The data reported in this document is based on the measurement of available equipment, observation, mockup of some tasks, and walk throughs at a hydroelectric station and sub-station, as well as a description of other tasks that were described as part of the Power System Electrician occupation. This JDA may not be 100% representative of any one job site, as demands may vary based on Company and location.

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Summary of Major Essential Demands *For further details refer to the tables on the following pages*	To be completed by Health Care Provider — Please check one:		
	Able to Perform	Modification Required (Explain)	Unable to Perform
Occasional **two-handed** and **one-handed lifting** (typical 10-25lbs) of various equipment and materials with a maximum weight of approx. 74lbs for test kit. Lifting performed mainly between ground and waist with occasional over shoulder.			
Occasional **two-handed carrying** (typical 10-25lbs) of various equipment and materials with a maximum weight of approx. 74lbs for a test kit. Distances are usually with 15' due to parking service vehicles close to the equipment.			
Occasional **two-handed horizontal pushing/pulling** of breakers and relays. Forces vary from 30lbs up to 40lbs with a typical distance of 3-4'.			
Occasional **sitting** while driving and documentation/testing, duration depends on service call locations in the city or rural area and length of tests needed, avg. 5-30 minutes.			
Occasional **standing** indoors and outdoors to inspect and perform work in cabinets, intermittent with walking.			
Occasional **walking** outdoors typically on rock and gravel terrain. Balancing on the uneven terrain and in winter conditions.			
Frequent **gripping/handling** with one/both hands involving hand tools and parts that weigh typically between 2-8lbs and up to 25 lb. Grip force measured as 25lbs usual; up to approx.100 lbs. to push on tools.			
Occasional **pinch gripping** with both hands for small fittings, tools and wires, forces typically 2-10 lbs.			
Occasional **crouching, squatting,** and/or **kneeling** when inspecting, installing and servicing equipment.			
Rare **climbing**, primarily using a step ladder, 20' extension ladder or a work platform.			
High **back repetition** (forward bending of 20-45 degrees, backwards bending >5 degrees with some rotation.			
High **neck repetition** (forward bending, backwards bending and twisting of 20-45 degrees) with some static loading when testing and servicing equipment.			
Moderate **bilateral shoulder repetition** (upwards reaching >90 degrees, reaching to the side, and in all directions) with some static shoulder postures when servicing equipment especially when working in cabinets and in tight locations.			
Low **bilateral elbow repetition** (bending/straightening the arms, turning the palms up/down, all directions) with some static elbow postures while servicing equipment especially when working in cabinets and in tight locations.			
Low **bilateral wrist repetition** (bending the wrists up/down, bending the wrists sideways, all directions) with some static wrist postures at mostly half range when using tools and holding and manipulating parts.			
Excellent **visual acuity, organization, attention to detail, memory,** and **decision making** skills are required.			

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Demand / Action		Check if Performed	Description & Potential Accommodations **Accommodation options noted in green*
Sensory	**Hearing / Speech:** • Conversation	✓	Phone and in person, with co-workers, dispatch, and supervisors. Audible sounds from testing equipment, emergency alarms.
	• Signals	✓	
	Vision: • 20 inches or less	✓	Close vision a requirement for inspection and repair. Reading documents, schematics and testing equipment. Far vision is required for driving, monitoring work areas and to perform visual inspections. Seeing colour is required for proper colour coded wiring, open and closed switches and signal detection. Depth perception is required for testing and working in small compartments that are energized.
	• 20 feet or more	✓	
	• Colour	✓	
	• Depth Perception	✓	
	Smelling		Ability to smell burning from equipment or wires is an asset but not essential.
	Tactile / Feeling		Most work is performed with gloves yet the ability to feel when cutting wires is an asset.
Environment	**Conditions of Work**		Typically outdoor work is performed in all weather conditions with some jobs performed indoors within electrical equipment buildings. Work may be performed alone while inspecting or in rural locations. May work in teams with Mechanical Technicians.
	Temperature / Humidity		Exposure to outdoor environment. Indoor work during the summer months can become hot.
	Noise		There is a constant hum from generating equipment. Cutting with power tools, emergency alarms, noise from clacking tools in the back of the service vehicle.
	Vibration		Impact tools and cutting tools along with vibration from poor driving conditions. Potential to wear antivibration gloves.
	Walking / Working Surface		Outdoor surfaces, indoor surfaces. May include rough terrain and uneven ground.
	Lighting		Sun/glare outdoors, dark/shadows indoors and outdoors and emergencies occurring at night. Head lamps, flashlights and vehicle mounted lights are available.
	Electrical		Work in and around live high voltage equipment.
	Sharp Objects		Blades, knives, saws, shears, sharp metal from equipment.
	Hot / Cold Hazards		Arc flashing (molten metal) from equipment failure. Touching cold metal when outdoors in the winter months.
	Chemical / Dust		PCBs in oil, asbestos from older equipment, blowing dust when outdoors, solvents, paint. Concrete or drywall dust when cutting while performing wiring work.
Tools	**Moving Machinery / Equipment**		Equipment fans, breakers, moving vehicles, cranes, skid steers.
	Hand / Sharp Tools		Involves cutting tools, knives and shears.
	Personal Protective Equipment		Safety glasses, safety boots, hearing protection, hard hat, winter clothing, high visibility vest/clothing, fall arrest system, nitrile, leather and cut resistant gloves, face shield, fire resistant clothing and arc flash rated clothing, aprons and gloves. Half and full respirators.
	Other Equipment / Supplies		Laptop computer, camera, binoculars, personal set of hand tools and testing instrumentation.

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Demand		Rate Requirement	Description of Tasks that Demand is Required & Potential Accommodations **Accommodation options noted in green*
Legend: NE = Not Essential | ND = Not Daily but essential | 5% or less = Rare Essential | 6-33% = Minor Essential Demand | >33% = Major Essential Demand			
Cognitive	**Reading:**		
	• English	**Minor**	Manuals, codes, work orders, instrument readings, schematics, safe work procedures, data numbers and readings from instrumentation.
	• French	**Varies by Province**	
	• Other	**No**	
	Writing:		
	• English	**Minor**	Inspection notices and corrective actions, emails with technical support staff.
	• French	**Varies by Province**	
	• Other	**No**	
	Verbal Communication:		
	• English	**Major**	System control, supervisors, teams, co-workers, Emergency Response personnel, customers.
	• French	**Varies by Province**	
	• Other	**No**	
	Supervising Others	**NE**	Not essential for all electricians; however, every group requires a lead person in charge. Mentoring of trainees, contractors and co-workers.
	Working to Speed	**Minor**	Work to standards, codes and safety procedures especially during outages and emergency situations. There is usually a time schedule per job, daily, weekly or monthly.
	Self-Supervision/ Working Alone	**Minor**	Working alone when conducting inspections or when performing tasks in the rural areas. Most work requires 2 or more electricians. Implement working alone procedures.
	Computer Usage	**Minor**	Email, work, MS Excel, PDFs, testing equipment software, maintenance standards, documentation.
	Math:		
	• Simple	**Minor**	Calculate transformer load, decipher test results, simple mental calculations or use MS Excel or calculators for more complex calculations.
	• Complex		
	Memory:		
	• Short Term	**Major**	High short term memory and long term memory demands including tracking progress and history of multiple types of equipment and procedures. Ability to alternate attention and maintain focus. Multiple sub-tasks, codes, standards and related documents are available for reference. Potential to take time for safety consideration, review documentation and consult with co-workers.
	• Long Term		
	Organization	**Major**	Assignment work decisions, organization of tools and instruments, documentation of changes and testing results. Organization of work due to weather forecasts (rain or high winds). Potential to involve co-workers in organizing work.
	Decision Making	**Major**	Problem solving decision, procedures continuously and especially in emergency response situations.
	Attention to Detail	**Major**	Ability to maintain focus continuously, maintain attention while driving, readings to 3 decimal points and measurements to 6mm of tolerance. Potential to have Supervisor review decisions.
	Problem Solving	**Major**	Ability to troubleshoot, repair and maintain equipment. Potential to have Supervisor review decisions.
	Emergency Management	**Minor**	Work with First Responders on emergencies, need to follow protocols.

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Demand / Action			Check if Performed	Duration	Frequency	Description & Potential Accommodations **Accommodation options noted in green*
Legend: NE = Not Essential | ND = Not Daily | Rare = 1-5% | Occasional = 6-33% | Frequent = 34-66% | Constant = 67-100%						
Strength	**Lifting**	Two Hands	✓	Occasional	Frequent lifts of hand tools, equipment and parts with both hands or just one hand. Varies depending on the task and need.	**Objects:** Ground with chain – 24lbs, toolbox 65 lbs, test kit – 74 lbs, CAPE Bridge testing – 50 lbs, ladder 48 lbs, drill press, transformer post and interrupters both weigh – 40lbs. Hand tools typical of under 10lbs. **Weight Max:** 74lbs | **Weight Typical:** 10-25lbs **Range of Lift:** ground level to workbench, waist to overhead. Possible to work in teams, may have others assist or perform lifts.
		One Hand	✓			
	Carrying	Two Hands	✓	Occasional	Carry tools and equipment to locations, up and down ladders. One and two handed carrying observed.	**Objects:** same as objects lifted. Tool bag ~12lb depending on task needs. **Weight Max:** 74lbs | **Weight Typical:** 10-25lbs **Distance:** less than 15 feet, vehicle parked close to the service. May be possible to have others perform carrying. | **Handles Present:** no for most tools.
		One Hand	✓	Rare		
	Pushing/ Pulling	Two Hands	✓	Occasional	Frequency is low due to one part at a time or a few exertions with tools. Varies during a shift depending on task. Relays and breakers are on a cart.	**Objects:** Breakers and relays **Force Max / Initial:** 40lbs Force Sustained 30lbs **Distance:** 3-4 feet | **Handles Present:** No May be possible to delegate high force tasks to other workers on short term basis.
		One Hand	✓			
Mobility	**Sitting**		✓	Occasional	While driving to locations and sitting in a chair when using testing equipment.	Duration of driving varies due to city and rural service calls. Documentation and testing durations are from 5-30 minutes. Rest breaks, proper adjustment of seat.
	Standing		✓	Occasional	Varies with 15-30 minutes at a time.	When grounding, testing and working in a cabinet continuously.
	Walking		✓	Occasional	Repetitive and continuous depending on the task.	Inspections of transmission sub-station may include all shift walking. Walking through snow and rough terrain are demands that also occur. Grips on boots to assist with walking in snow. Supports in boots.
	Foot Activation		✓	Rare	Repetitive while driving a service vehicle.	Gas and brake pedals while driving. Use of cruise control when safe to use.
	Crouching/Squatting		✓	Occasional	Intermittent with standing during a task, -1 to 5 minutes of crouching.	Inspection and repair can be knee height or lower. Crouching occurs in the back of the service vehicles. Provide a short stool to sit low to the ground.
	Kneeling		✓	Occasional	Intermittent with standing during a service, up to 5 minutes of kneeling to conduct a repair– one or both knees.	Use of a knees pad when longer durations as seen in breaker maintenance. Use knee pads that are built into coveralls.
	Climbing		✓	Rare	Climb to the top of equipment.	Step ladder, 20' ladders, work platforms. Potential to delegate to other co-workers.
	Balancing		✓	Frequent	Continuous due to uneven ground, usually small rocks or gravel. Balancing while on a structure.	Uneven ground, balancing required on step ladders and while on top of a structure.
	Crawling		**No**	ND	Duration is short and distance is less than a 1meter to crawl under or at ground level.	Occurs near breakers that are in tight areas indoors or when working below grade during installations.

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Legend: NE = Not Essential | ND = Not Daily | Rare = 1-5% | Occasional = 6-33% | Frequent = 34-66% | Constant = 67-100%					
Dexterity	**Gripping/Handling (Gross motor)**			Both hands required. Tools, equipment, parts require both hands to physically grip and manipulate. Using 2 wrenches, holding a part while positioning another are examples. Duration varies depending on task, 1-2 minutes of static loading.	**Objects:** power tools, wire stripping tools, manual drilling and wrenching tools. Pinning requires drilling though a bushing with force. **Weight Max:** 25lbs drill tool | **Weight Typical:** 2-8lbs hand tools **Exerted Forces** to push on tools, hold tools in place or squeeze tools was typical 25lbs with up to 100 lbs maximum. Potential to delegate high force gripping or fine finger movement tasks to other co-workers.
	Right Hand	✓	Frequent		
	Left Hand	✓			
	Either	✓			
	Pinching/Fine Finger Movement			Both hands required. Inspection and repair of equipment includes wires, small tools, manipulation of dials, buttons, computer keys.	**Objects:** small tools, fittings, equipment dials, assemble and disassemble of equipment. Terminating wires. **Weight:** 2-10lbs
	Right Hand	✓	Occasional		
	Left Hand	✓			
	Either	✓			
	Hand/Eye Coordination	✓	Frequent	Throughout the shift; varies with task.	Assemble, disassemble equipment, perform repairs, use small tools and using testing equipment.

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	Demand / Action	Check if Performed	Typical Posture Range of Motion (°)	Typical Repetition Rate/Hour	Description & Potential Accommodations *Accommodation options noted in green
Posture & Joint Position	**Neck Movement**				
	• Flexion (bent forward)	✓	☐ <20° ☒ 20-45° ☐ >45°	☐ <120 ☐ 120-180 ☒ >180 ☒ STATIC	Flexion while servicing equipment and using testing devices. Extension while inspecting and servicing, specifically grounding.
	• Extension (bent backwards)	✓	☐ <5° ☒ >5°		
	• Rotation (twist)	✓	☒ <45° ☐ >45°	☐ <120 ☐ 120-180 ☒ >180 ☐ STATIC	Inspecting, servicing, and driving. Blind spots and surroundings.
	• Lateral Flexion (bent to side)	✓	☐ <5° ☒ >5°	☒ <120 ☐ 120-180 ☐ >180 ☐ STATIC	For hard to see areas in cabinets and blind spots.
	Back Movement				
	• Flexion (bent forward)	✓	☐ <20° ☒ 20-45° ☐ >45°	☐ <12 ☐ 12-120 ☒ >120 ☐ STATIC	Flexion while servicing equipment and testing. Extension while inspecting and servicing, specifically grounding.
	• Extension (bent backwards)	✓	☐ <5° ☒ >5°		
	• Rotation (twist)	✓	☒ <15° ☐ 15-30° ☐ >30°	☒ <12 ☐ 12-120 ☐ >120 ☐ STATIC	Inspecting, servicing, and driving. Blind spots and surroundings.
	• Lateral Flexion (bent sideways)	✓	☒ <20° ☐ 20-45° ☐ >45°	☒ <12 ☐ 12-120 ☐ >120 ☐ STATIC	For hard to see areas in cabinets and blind spots.
	Shoulder Movement (Dominant)				
	• Flexion (raised in front of body)	✓	☐ <45° ☒ 45-90° ☐ >90°	☒ <90 ☐ 90-150 ☐ >150 ☒ STATIC	Dominant & non-dominant shoulder movements. Reaching inside equipment, various shoulder postures to perform work in tight locations and inside various types of equipment.
	• Extension (raised behind body)	✓	☒ <5° ☐ >5°		
	• Abduction (raised to side)	✓	☒ <45° ☐ 45-90° ☐ >90°	☒ <90 ☐ 90-150 ☐ >150 ☒ STATIC	Static work may involve extended reaches with work at shoulder height or above.
	• Adduction (across body)	✓	☒ <45° ☐ 45-90° ☐ >90°		
	• Rotation (turned in/out)	✓	☐ <5° ☒ >5°		
	Shoulder Movement (Non-dominant)				
	• Flexion (raised in front of body)	✓	☐ <45° ☒ 45-90° ☐ >90°	☒ <90 ☐ 90-150 ☐ >150 ☒ STATIC	Tasks observed included the use of both limbs for reaching, using tools and manipulation of parts and equipment.
	• Extension (raised behind body)	✓	☒ <5° ☐ >5°		
	• Abduction (raised to side)	✓	☒ <45° ☐ 45-90° ☐ >90°	☒ <90 ☐ 90-150 ☐ >150 ☒ STATIC	Tasks observed included the use of both limbs for reaching, using tools and manipulation of parts and equipment.
	• Adduction (across body)	✓	☒ <45° ☐ 45-90° ☐ >90°		
	• Rotation (turned in/out)	✓	☐ <5° ☒ >5°		
	Elbow Movement (Dominant)				
	• Pronation/Supination (palm down/up)	✓	☐ Neutral ☐ Partial ☒ Full	☒ <120 ☐ 120-180 ☐ >180 ☒ STATIC	Full pronation while working in cabinets and servicing equipment with forearm rotation when using tools.
	• Flexion/Extension (bent/straight)	✓	☐ Neutral ☐ Partial ☒ Full	☒ <120 ☐ 120-180 ☐ >180 ☐ STATIC	Full extension when working in cabinets and servicing equipment.

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Posture & Joint Position	**Elbow Movement (Non-dominant)**						
	• Pronation/Supination (palm down/up)	✓	☐ Neutral	☐ Partial	☒ Full	☒ <120 ☐ 120-180 ☐ >180 ☒ STATIC	Both arms are required when conducting work in cabinets and servicing equipment. Other tasks may require only dominant hand however it is more difficult and slower.
	• Flexion/Extension (bent/straight)	✓	☐ Neutral	☐ Partial	☒ Full	☒ <120 ☐ 120-180 ☐ >180 ☒ STATIC	
	Wrist Movement (Dominant)						
	• Flexion/Extension (bent up/down)	✓	☐ Neutral	☐ Partial	☒ >½ range	☒ <900 ☐ 900-1800 ☐ >1800 ☒ STATIC	Mid to full range motion in all directions required to manipulate tools and perform tasks. Full range of motion when there are space constraints.
	• Deviations (bent to side)	✓	☐ Neutral	☐ Partial	☒ >½ range	☒ <900 ☐ 900-1800 ☐ >1800 ☒ STATIC	
	Wrist Movement (Non-dominant)						
	• Flexion/Extension (bent up/down)	✓	☐ Neutral	☐ Partial	☒ >½ range	☒ <900 ☐ 900-1800 ☐ >1800 ☒ STATIC	Both wrists. One or the other may be holding an object while the other is performing a task with tools or parts. Static loading observed for both arms.
	• Deviations (bent to side)	✓	☐ Neutral	☐ Partial	☒ >½ range	☒ <900 ☐ 900-1800 ☐ >1800 ☒ STATIC	Share tasks with co-workers to reduce durations or specific end range movements. For all body movements.

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Optional Form

Can be used for Accommodation and Return to Work. **To be completed by employee's medical practitioner/ health care provider (do not include diagnosis).**

Employee's Name:

Are there any medical/health conditions that account for absence(s) from the workplace or would affect the employee's ability to perform his/her duties?
Yes ☐ **No** ☐
If yes, describe the employee's specific work-related limitations and/or restrictions.

Indicate duration of limitation(s) and/or restriction(s) identified above. **Permanent** ☐ **Temporary** ☐
If temporary, what is the expected duration?

Is employee involved in treatment and/or taking medication that may affect his or her ability to work, including regular attendance, and/or performing certain duties? **Yes** ☐ **No** ☐
If yes, describe the impact (i.e. medication may cause drowsiness, safety risk related to treatment, treatment requires intermittent absences from work.)

Are any further absences from work (e.g. surgery) anticipated at this time? **Yes** ☐ **No** ☐
If yes, please specify:

When is the date of your next assessment?

Name and address of medical practitioner/health care provider completing this form:

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