

## Work scope details:

**Title:** BL11B Goniometer Preventive Maintenance (PM)

**Work Scope Summary:** The work involves performing semi-annual lubrication of the kinematic mounts and lift rails of the BL11B goniometer. This maintenance is critical to ensure optimal operation and prevent equipment failure during subsequent use.

### Key Work Scope Components:

- Disconnecting electrical, cryogenic, and pneumatic lines
- Lubricating kinematic mounts and lift rails
- Lifting and placing the goniometer on a stand
- Reinstalling connections and testing the goniometer post-maintenance

## Relevant previous events and lessons learned:

| Event Title                  | Event Summary  | Lessons Learned   | Reference Link                       |
|------------------------------|--|---|--------------------------------------|
| Goniometer Equipment Failure | A goniometer failed during operation due to inadequate lubrication, leading to a halt in experiments and costly downtime.        | Regular maintenance and lubrication schedules must be strictly adhered to in order to prevent equipment failure.      | N/A                                  |
| Electrical Shock Incident    | A technician received an electrical shock while reconnecting power to equipment without proper lockout/tagout (LOTO) procedures. | Always implement LOTO procedures before performing maintenance on electrical equipment to prevent electrical hazards. | <a href="#">OSHA LOTO Standard</a>   |
| Pneumatic Line Contamination | Contaminants entered a pneumatic line during maintenance, causing equipment malfunction.   | Ensure all lines are properly capped or sealed during maintenance to prevent contamination.                           | N/A                                  |
| Falls from Height            | A worker fell while removing a railing without proper fall protection measures in place.   | Implement fall protection measures when working at heights or near open edges.  | <a href="#">OSHA Fall Protection</a> |
| Improper Manual Handling     | A technician injured their back while lifting a heavy goniometer without assistance.   | Always use team lifting or mechanical aids for heavy lifting tasks to prevent musculoskeletal injuries.               | N/A                                  |

## Missing Hazards:

| Hazard             | Missing or Inadequate Mitigation in Current Work Control Document | Recommended Mitigation for Revision                     | Reference Link                     | SBMS Link |
|--------------------|---|---|------------------------------------|-----------|
| Electrical Hazards | Not addressed   | Implement lockout/tagout procedures before maintenance. | <a href="#">OSHA LOTO Standard</a> | N/A       |

| Hazard                 | Missing or Inadequate Mitigation in Current Work Control Document | Recommended Mitigation for Revision  | Reference Link                       | SBMS Link |
|------------------------|---|--|--------------------------------------|-----------|
| Falls from Height      | Not addressed   | Use fall protection harnesses and ensure guardrails are in place when removing railings. | <a href="#">OSHA Fall Protection</a> | N/A       |
| Manual Handling        | Not addressed   | Enforce team lifting protocols and provide lifting aids for heavy components.            | N/A                                  | N/A       |
| Contamination Risks    | Not addressed   | Ensure all lines are capped and clean before and after maintenance.                      | N/A                                  | N/A       |
| Noise Exposure         | Not addressed   | Conduct noise assessments and provide hearing protection if noise levels exceed 85 dBA.  | <a href="#">OSHA Noise Standard</a>  | N/A       |
| Ergonomic Risks        | Inadequate mitigation   | Evaluate work posture and provide ergonomic tools to minimize strain.                    | N/A                                  | N/A       |
| COVID-19 Risks         | Inadequate mitigation   | Ensure masks are worn and social distancing is maintained throughout the work area.      | N/A                                  | N/A       |
| Time Pressure          | Not addressed   | Schedule maintenance during low-activity periods to reduce time pressure on workers.     | N/A                                  | N/A       |
| Communication Failures | Not addressed   | Conduct pre-job safety briefings to clarify tasks and responsibilities.                  | N/A                                  | N/A       |
| Tool Availability      | Not addressed   | Ensure all necessary tools are available and in good condition before starting work.     | N/A                                  | N/A       |

## Failure mode analysis:

| <b>Current Control</b>        | <b>Failure Mode of the Control</b>    | <b>Effect of Failure</b>                       | <b>Cause of Failure</b>                 | <b>Recommended Action</b>   |
|-------------------------------|---------------------------------------|--|---|---|
| Lockout/Tagout Procedures     | Permit not obtained or expired        | Risk of electrical shock or equipment start-up | Lack of adherence to safety protocols   | Ensure all personnel are trained and understand LOTO requirements.                    |
| PPE Requirements              | PPE not used or inadequate            | Increased risk of injury                       | Overconfidence or lack of enforcement   | Conduct regular audits to ensure compliance with PPE usage.                           |
| Work Instructions             | Instructions not followed             | Increased risk of accidents                    | Vague guidance or miscommunication      | Provide clear, detailed work instructions and conduct pre-job briefings.              |
| Communication Processes       | Poor communication                    | Increased risk of errors                       | Lack of coordination among team members | Implement a communication plan that includes regular check-ins and updates.           |
| Emergency Response Procedures | Emergency procedures not followed     | Delayed response to incidents                  | Lack of training or awareness           | Conduct regular emergency drills and training sessions.                               |
| Tool Availability             | Tools not available or malfunctioning | Delays in work and increased risk of injury    | Poor inventory management               | Maintain an inventory checklist and perform regular tool inspections.                 |
| Training and Competency       | Inadequate training                   | Increased risk of accidents                    | Lack of proper training programs        | Implement a comprehensive training program for all personnel involved in maintenance. |

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|--------------------------|------------------------------------|----------------------------------|----------------------------------|---|
| Team Lifting Protocols   | Team lifting not practiced         | Risk of musculoskeletal injuries | Lack of awareness or enforcement | Reinforce team lifting protocols through training and supervision.          |
| Fall Protection Measures | Fall protection not utilized       | Risk of falls and serious injury | Complacency or lack of awareness | Regularly review and enforce fall protection policies.                      |
| Noise Control Measures   | Noise levels exceed safe limits    | Hearing damage                   | Lack of monitoring               | Conduct regular noise assessments and provide hearing protection as needed. |

This risk assessment report provides a comprehensive overview of the potential hazards associated with the BL11B Goniometer PM work plan, relevant historical events, missing hazard mitigations, and failure modes of existing controls. Implementing the recommended actions will enhance safety and reduce the risk of incidents during maintenance activities.