PROFESSIONAL PRACTICE GUIDELINES

EQUIPMENT SAFETY

ANNUAL EQUIPMENT INSPECTION AND CERTIFICATION IN BRITISH COLUMBIA

VERSION 1.1
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ENGINEERS &
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BRITISH COLUMBIA

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PREFACE

These *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia* were developed by Engineers and Geoscientists British Columbia with the support of WorkSafeBC.

The guidance in this document will assist Engineering Professionals in carrying out annual Equipment inspection and Certification as required in the *Occupational, Health and Safety Regulation* (*OHSR*) of British Columbia in a consistent manner while incorporating best practices. This document was prepared for the information of Engineering Professionals, statutory decision makers, regulators, Equipment Owners, Equipment Operators, and other stakeholders who might be involved in, or have an interest in, annual Equipment inspection and Certification as required in the *OHSR*.

The guidance in this document provides the common expectations for Engineering Professionals and the various stakeholders with respect to the level of effort, due diligence, and standard of practice to be followed when carrying out Equipment inspection and Certification. This document should be read in conjunction with the *OHSR*. It is important to note that the content of this document is not intended to replace any provisions of the *OHSR* but to provide guidance in meeting these requirements.

These guidelines outline the appropriate standard of practice to be followed at the time they were prepared. However, this is a living document that is to be revised and updated as required in the future, to reflect the developing state of practice.

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ABBREVIATIONS

ABBREVIATION	TERM
BC	British Columbia
CGSB	Canadian General Standards Board
CSA	Canadian Standards Association
EOR	Engineer of Record
NDT	non-destructive testing
OEM	Original Equipment Manufacturer
OHSR	*Occupational Health and Safety Regulation*

DEFINED TERMS

The following definitions are specific to these guidelines. These words and terms are capitalized throughout the document.

TERM	DEFINITION
Act	*Engineers and Geoscientists Act* [RSBC 1996], Chapter 116.
Annual Inspection	As per the *OHSR*, an inspection required at least once every 12 months in accordance with good engineering practice.
Annual Mechanical and Controls Inspection	An Annual Inspection of Mechanical Components and Control Components of a piece of Equipment that is performed and documented by a Qualified Person in accordance with specifications provided by the Original Equipment Manufacturer(s), requirements of applicable codes or standards, and requirements of the Inspection Plan prepared by the Engineer of Record. The inspection of Mechanical Components typically involves, but is not limited to, the inspection of an Equipment's engines, pumps, hydraulic system components, gearboxes, bolts, brakes, bearings, and holding valves. The inspection of Control Components are for the purpose of ascertaining that those components are calibrated and operating properly, and this typically involves, but should be not limited to, the inspection of motors, hydraulic control systems, load moment indicators, warning lights or buzzers, limit switches, control levers, anti-two block devices, gauges, and interlocks.
Annual Mechanical and Controls Inspection Report	A report prepared by the Engineer of Record which records complete and concise information of the Annual Mechanical and Controls Inspection, any tests performed, and maintenance and repairs. The report must be kept permanently in a usable format and used as part of the Equipment log.
Annual Structural Inspection	An Annual Inspection of the Structural Components of the Equipment that is performed by qualified structural inspection personnel in accordance with specifications provided by the Original Equipment Manufacturer(s), requirements of applicable codes and standards, and requirements of the Inspection Plan and under the direct supervision of the Engineer of Record. This typically includes inspections to identify structural damage that may have occurred during service, such as bent, dented, or deformed members; cracks; missing components; corrosion; or signs of fatigue.
Annual Structural Inspection Report	A report prepared by the Engineer of Record which records complete and concise information of the Annual Structural Inspection, any tests performed, and repairs. The report must be kept permanently in a usable format and used as part of the Equipment log.
Association	The Association of Professional Engineers and Geoscientists of the Province of British Columbia, also operating as Engineers and Geoscientists BC.
Aerial Device	A device—extensible, articulating, or both—that is primarily designed and used to position personnel.

TERM	DEFINITION
Aerial Device – Firefighting	An aerial ladder, elevating platform, or water tower that is designed to position personnel, handle materials, provide continuous egress, or discharge water.
Authority Having Jurisdiction	The Workers' Compensation Board of British Columbia, operating as "WorkSafeBC", which is the statutory body in British Columbia with a public mandate and authority under Part 2 of the *Worker's Compensation Act* [RSBC 2019], Chapter 1, and the *Occupational Health and Safety Regulation (OHSR)*.
Bylaws	The Bylaws of the Association made under the *Act*.
Certification	A document signed and sealed by an Engineering Professional that contains a written statement confirming that the annual Equipment inspections have been completed and the requirements specified by the Authority Having Jurisdiction have been met.
Client	The person or entity that has retained the services of the Engineer of Record. Examples of Clients may include: • Equipment Operators (Owner or entity leasing the Equipment); • third party maintenance facilities (who perform the Preventive Maintenance tasks); and • non-destructive testing service providers (who perform the structural inspections).
Concrete Pump	A device for moving concrete or other liquid material through delivery lines, pipes, hoses, attachment components, transfer valves, and associated equipment through which material is pumped. (Also see the definition for "Placing Boom").
Control Component	Any component—whether electrical, hydraulic, mechanical, or a combination of each—that is used as part of the control system for a piece of Equipment, such as actuators, buttons, computer controllers, hoses, indicators, switches, sensors, wires, and valves.
Documentation	All documents related to the maintenance, inspection, repair, and operation of the Equipment. This includes but is not limited to the following: • Equipment manufacturer's maintenance manual • Equipment manufacturer's operation manual • Equipment manufacturer's bulletins • Equipment log • Periodic inspection reports • Annual Inspection reports • Personnel qualifications
Engineer of Record	The Engineering Professional who has been retained to certify the annual Equipment inspection in accordance with the applicable occupational health and safety regulations, and who has professional responsibility for any related engineering work that is undertaken and engineering documents that are produced.
Engineering Professional	Professional engineer or engineering licensee, who is registered or licensed by the Association and entitled under the *Act* to engage in the practice of professional engineering in British Columbia.
Engineering Specialist	An Engineering Professional who is highly skilled and experienced in a particular discipline or sub-discipline.
Engineers and Geoscientists BC	The business name for the Association.

TERM	DEFINITION
Equipment	Any equipment for which an inspection certified by an Engineering Professional is required or requested. Examples include, but are not limited to, Aerial Devices – Firefighting; Concrete Pumps, Placing Booms, and masts; Mobile Cranes; Movable Work Platforms; Tower Cranes; and vehicle-mounted Aerial Devices.
Equipment Operator	The entity that operates the Equipment. This could be the Owner or it could be a separate entity leasing the Equipment. This definition is distinct from the definition within the *OHSR*, in that the *OHSR* refers to the Equipment Operator as the individual who operates the Equipment.
Inspection Plan	A written document prepared by the Engineer of Record that outlines the required inspection work that must be performed (including with respect to Structural, Mechanical, and Control Components) before the Equipment may be certified as Safe for Use.
Limited Certification	A Certification that excludes inspection of certain components of the Equipment or restricts the use of the Equipment. For example, a Limited Certification may include only the Structural Components of the Equipment, or, alternatively, may only include the Mechanical and Control Components.
Manufacturer's Representative	A distributor or agent of the Original Equipment Manufacturer, who may sell, mount, service, and/or repair the Equipment.
Mechanical Component	Any component—whether electrical, hydraulic, mechanical or a combination of each—that is used as part of the mechanical system for a piece of Equipment, such as power take-off systems, pumps, hoses, valves, filters, wear pads, and actuators.
Mobile Crane	A machine for hoisting and moving objects by means of a movable boom.
Modification	Any change, repair, or replacement that results in a deviation from the original specifications provided by the Original Equipment Manufacturer. Examples of Modifications include the following: • replacing a hoist motor gear box with one supplied from a manufacturer other than the Original Equipment Manufacturer; • rewiring or implementing changes to the control systems (electrical or hydraulic) in ways that deviate from the Original Equipment Manufacturer's schematics; • replacing dielectrically insulated hydraulic hoses with non-insulated hoses; and • replacing a damaged work platform with a similar one from an Equipment manufacturer other than the Original Equipment Manufacturer. Ordinarily, a Modification should not be undertaken without: • validation by the Original Equipment Manufacturer; and • the approval of the Engineer of Record, if the requirements of any occupational health and safety regulation are applicable. Any Modification must be recorded in the inspection and maintenance records, and the Equipment operation and maintenance manuals must be revised as necessary to ensure adequate and appropriate information is available for the safe use and maintenance of the Equipment. This may include revising the maintenance instructions and specifications, operation instructions, and/or the rated capacity.
Movable Work Platform	Defined in the *OHSR* as "a work platform that may be repositioned during the course of the work." Examples are self-propelled elevating work platforms (scissor lifts) or self-propelled boom-supported elevating work platforms (manlifts).

TERM	DEFINITION
Operational Personnel	Personnel qualified to operate the Equipment, facilitate any mechanical or control inspections, or reposition the Equipment to allow access for the structural inspections.
Original Equipment Manufacturer	The company or commercial entity that originally manufactured the Equipment, or the entity that assembled the Equipment from multiple Original Equipment Manufacturers to sell under its own brand name.
Owner	The legal owner of the Equipment.
Placing Boom	A manual or power-driven slewable working device consisting of one or more extendable or foldable parts that support a delivery system for concrete and direct the discharge into the desired location. (Also see the definition for "Concrete Pumps").
Preventive Maintenance	Planned regular maintenance of the Equipment, as prescribed by the Original Equipment Manufacturer, that is intended to lessen the likelihood of Equipment failure and to prevent unplanned Equipment downtime. This may include changing oil and filters, lubricating parts, re-torqueing fasteners, and checking hydraulic systems.
Qualified Person	A person who, by possession of a recognized degree or certificate of professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated the ability to resolve or solve problems relating to the subject matter, and who is familiar with the provisions of the applicable standards that apply to the subject matter and its applications.
Safe for Use	The term stated on a Certification, as required by the Authority Having Jurisdiction, to certify that all inspections (structural, mechanical, and controls) required by the applicable occupational health and safety regulations were completed to the satisfaction of the Engineer of Record, that the equipment meets the annual inspection requirements of the *OHSR*, and that the Equipment is reasonably expected to perform safely until the next Certification is required.
Special Inspections	Inspections conducted by the Engineer of Record following shock loading, electrical contact, or other incidents; after repairs, alterations, or prolonged shutdowns; or upon request.
Structural Components	Any load-bearing or load-transferring components of the Equipment, such as outriggers, car bodies, vehicle mounts, boom sections, shafts, tower sections, winch mounts, pins, bolts, hooks, load blocks, and work platforms.
Tower Crane	A lifting machine consisting of a tower with a superstructure that rotates and includes a load, luffing boom, or jib; or includes a counterjib that extends in the opposite direction to the load, luffing boom, or jib. It could be hammerhead, flat-top, luffing, self-erecting, or another type that is assembled and disassembled for use at various sites.

VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
1.1	December 10, 2020	Minor editorial corrections.
1.0	January 23, 2020	Initial version.

1.0 INTRODUCTION

Engineers and Geoscientists British Columbia (the Association) is the regulatory and licensing body for the engineering and geoscience professions in British Columbia (BC). To protect the public, the Association establishes, maintains, and enforces standards for the qualifications and practice of its members and licensees.

The Association provides various practice resources to its members and licensees to assist them in understanding their professional and ethical obligations under the *Engineers and Geoscientists Act* (the *Act*). Those resources include professional practice guidelines, which inform on the standard of practice for specific professional activities. The Association works with experts in their fields to develop professional practice guidelines where additional guidance is beneficial.

The *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia* provides guidance to Engineering Professionals who are involved in Annual Inspection and Certification of Equipment in BC. This document should be read in conjunction with the British Columbia *Occupational Health and Safety Regulation* (*OHSR*). It is important to note that the content of this document is not intended to replace any provisions of the *OHSR*, but rather to provide guidance for compliance with those requirements.

1.1 PURPOSE OF THESE GUIDELINES

The following are the specific objectives of these guidelines:

1. Describe the standard of practice that Engineering Professionals should follow when carrying out Equipment inspection and Certification.
2. Specify the tasks and services that Engineering Professionals should complete to meet the appropriate standard of practice and fulfill their professional obligations under the *Act*. These obligations include the Engineering Professional's primary duty to protect the safety, health, and welfare of the public and the environment.
3. Describe the roles and responsibilities of the various participants/stakeholders involved in these professional activities. The document should assist in delineating the roles and responsibilities of the various participants/stakeholders, which may include Owners, Equipment Operators, Engineer of Record (EOR), Engineering Specialists, structural inspection personnel, mechanical and controls inspection personnel, and the Authority Having Jurisdiction.
4. Describe the skill sets that are consistent with the training and experience required to carry out these professional activities.
5. Provide guidance on the use of the Certification forms, which are prepared and sealed by the EOR. The purpose of these forms is to assist Engineering Professionals in considering and addressing relevant regulatory and technical issues, and provide a formal record of same to Clients and the Authority Having Jurisdiction.
6. Provide a Certification document, which the EOR must sign, seal, and date. This Certification will confirm that the Equipment is Safe for Use.

7. Provide guidance on how to meet the quality management requirements under the *Act* and Bylaws when carrying out the professional activities identified in these professional practice guidelines.
8. Raise awareness among the members of the Association of the requirements in the *OHSR*.
9. Establish a common level of expectation with respect to carrying out the Annual Inspection and Certification of Equipment for a range of stakeholders, including Engineering Professionals, Clients, Operators, and Owners.

1.2 ROLE OF ENGINEERS AND GEOSCIENTISTS BC

These guidelines were prepared by subject matter experts and reviewed at various stages by a formal review group. The final draft of these guidelines underwent a final consultation process with various committees and divisions of the Association. These guidelines were approved by the Association's Council and, prior to publication, underwent final legal and editorial reviews. These guidelines form part of the Association's ongoing commitment to maintaining the quality of professional services that Engineering Professionals provide to their Clients and the public.

An Engineering Professional must exercise professional judgment when providing professional services; as such, deviation from strict adherence to these guidelines may be justifiable in certain circumstances or in the event that there are changes in legislation, regulations, codes, or standards subsequent to the publication of these guidelines. Where an Engineering Professional intends to substantially deviate from applying these guidelines, he or she should consider obtaining a second opinion from another Engineering Professional on the merits of the deviation, and must also make full disclosure of the intended deviation to the Client and the Authority Having Jurisdiction.

The Association supports the principle that appropriate financial, professional, and technical resources should be provided (i.e., by the Client and/or the employer) to support Engineering Professionals who are responsible for carrying out professional activities, so they can comply with the standard of practice provided in these guidelines.

These guidelines may be used to assist in the level of service and terms of reference of an agreement between an Engineering Professional and a Client.

These guidelines are intended to assist Engineering Professionals in fulfilling their professional obligations, especially regarding the first principle of the Association's Code of Ethics, which is to "hold paramount the safety, health and welfare of the public, protection of the environment and promote health and safety in the workplace."

1.3 INTRODUCTION OF TERMS

See the Defined Terms section for formal definitions specific to these guidelines.

1.4 SCOPE OF THESE GUIDELINES

This document provides guidance to Engineering Professionals for the Annual Inspection and Certification of the following types of Equipment, in accordance with the *OHSR*, the requirements of the Authority Having Jurisdiction, and their professional obligations:

1. Cranes and hoists (*OHSR*, Part 14)
2. Concrete Pumps, Placing Booms, and masts (*OHSR*, Part 20)
3. Aerial Devices (including Aerial Devices – Firefighting) (*OHSR*, Parts 13, 16, and 31)
4. Movable Work Platforms (*OHSR*, Part 13)

Future additions and revisions to the *OHSR* may require Annual Inspections and Certifications to Equipment types beyond those listed above; Engineering Professionals are expected to comply with the intent of these guidelines in these instances.

For example, a Tower Crane must have a structural inspection completed and certified by an Engineering Professional before each erection. In such cases, the Inspection Plan should take into account the specific requirements of the *OHSR* for the particular type of Equipment.

See Appendix A: Equipment Requiring Certification and Inspection for the types of Equipment for which Certification is specifically required by the *OHSR*. Table A - 1 provides a list that specifies the type of Certification required (e.g., structural only or structural, mechanical, and controls), and Table A - 2 provides photographic examples of Equipment types.

While the guidance in this document is specific to the requirement for Annual Inspections and Certifications as per the *OHSR* requirements, there may be circumstances where Engineering Professionals are engaged to carry out Equipment inspections and provide Certification beyond the annual requirement or in response to a Modification. In these situations, the guidance in this document may be applied. For example, the original manufacturer or CSA Standard may call for daily, monthly, or periodic inspections, or for Special Inspections. The guidance provided here may be applied to those situations as well.

1.5 APPLICABILITY OF THESE GUIDELINES

These guidelines provide guidance on professional practice for Engineering Professionals who are involved in the inspection of Equipment and who are expected to issue Certification. These guidelines are not intended to provide comprehensive instructions for how to carry out the inspections; rather, these guidelines outline issues which Engineering Professionals need to be aware of and should consider when carrying out the described activities. The technical aspects of those activities are addressed in industry standards.

An Engineering Professional's decision not to follow one or more aspects of these guidelines does not necessarily mean a failure to meet his or her professional obligations. The making of such a determination will depend upon the finding of relevant facts and assessment of whether reasonable and prudent Engineering Professionals would have acted differently in the circumstances.

The guidance in this document is informed by the *Engineers and Geoscientists Act*, the current *OHSR*, and other referenced codes and standards. These guidelines outline the appropriate standard of practice to be followed at the time they were prepared. However, this is a living document that is to be revised and updated as required in the future, to reflect the developing state of practice.

1.6 ACKNOWLEDGEMENTS

This document was prepared by the Association and WorkSafeBC and was reviewed by a group of technical and industry experts, as well as by various committees and divisions of the Association. Authorship and review of these guidelines does not necessarily indicate the individuals and/or their employers endorse all statements in these guidelines.

2.0 ROLES AND RESPONSIBILITIES

This section describes some of the typical responsibilities of the Client, the Engineer of Record (EOR), and the Authority Having Jurisdiction, as well as the typical flow of responsibilities among various participants on a project.

2.1 PROJECT ORGANIZATION

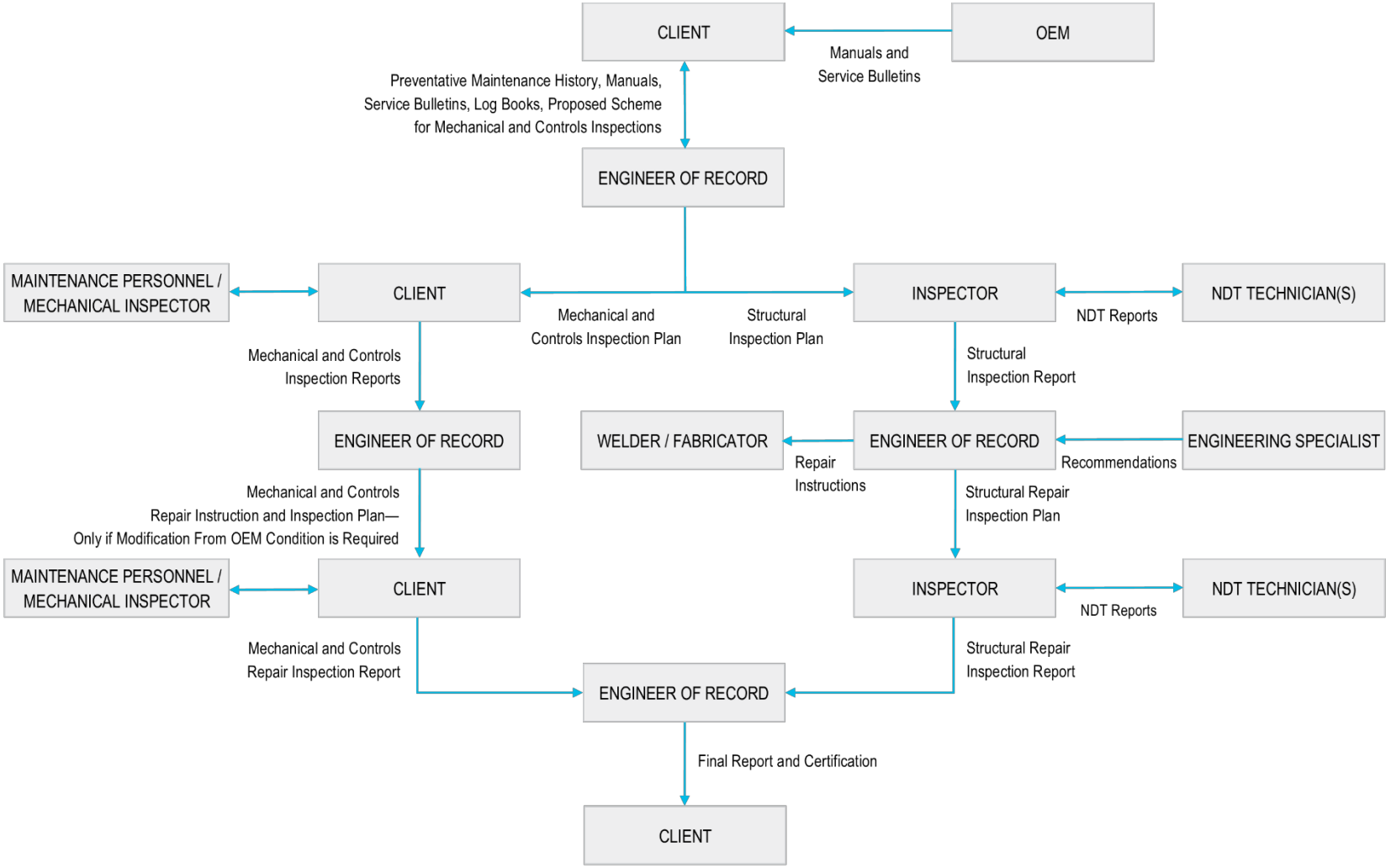
When an Engineering Professional is engaged to act as the EOR who conducts the inspection of Equipment and issues Certification, the Client could be either the Equipment Operator (Owner or entity leasing the equipment), a third-party inspection company, or a Manufacturer's Representative.

Organization of the inspections will vary according to the requirements of the project and the parties involved; however, in all cases, the project should be set up to facilitate the adequate flow of information among parties (see Figure 1: Flowchart Illustrating the Documentation Responsibilities and Requirements During the Equipment Inspection and Certification Process).

Regardless of the project organization, the various participants have specific responsibilities, as described in Section 2.2 Responsibilities.

The flowchart in Figure 1 assumes that a single EOR supervises all of the required inspections for the Equipment (structural, mechanical, and controls). However, the project can also be organized where two Engineering Professionals are involved in the Certification process, but only one takes overall responsibility as the EOR.

In such a case, the first Engineering Professional conducts or directly supervises the Annual Structural Inspection, and the second conducts or directly supervises the Annual Mechanical and Controls Inspection. The Engineering Professional who conducts or directly supervises the Annual Structural Inspection typically acts in the role of EOR for the entire Certification process. However, when certifying the Structural Components, Mechanical Components, and Control Components in such a case, the EOR must note that Certification of the Mechanical Components and Control Components is based on the assurance of the second Engineering Professional involved in the process.



NOTES:

NDT = non-destructive testing; OEM = Original Equipment Manufacturer

Figure 1: Flowchart Illustrating the Documentation Responsibilities and Requirements During the Equipment Inspection and Certification Process

2.2 RESPONSIBILITIES

2.2.1 EQUIPMENT OPERATOR

The Equipment Operator may be the Owner or a separate entity leasing the Equipment. The Equipment Operator is responsible for ensuring the Equipment complies with applicable regulations in the *OHSR* and is Safe for Use. In these guidelines, that means that the Equipment has been inspected and maintained and is being operated by qualified Operational Personnel in accordance with the *OHSR*, the instructions from the Original Equipment Manufacturer (OEM), and the applicable codes and standards referenced in the *OHSR*.

When arranging an inspection, the Equipment Operator should:

- ensure all Documentation is available for review, including OEM manual(s), OEM bulletins, the Equipment logbook, Preventive Maintenance records, post-incident inspection reports, and any previous Annual Inspection reports;
- ensure any known issues or concerns that may affect the safe operation of the Equipment are brought to the attention of the EOR, including any previous misadventures (for example, overturning, electrical contact, impacts, motor vehicle accidents, overloading) and any unusual maintenance and repair activity (such as activities outside of that normally prescribed by the OEM);
- ensure an appropriate scope of work and realistic schedules for the work are in place;
- ensure Equipment is maintained and inspected by appropriately Qualified Person(s) in accordance with the applicable *OHSR* requirements;
- ensure the Equipment is clean (that is, ensuring that excess grease, concrete, or other foreign material which may impede the inspection has been removed) and all components are readily accessible for inspection; and
- provide qualified Operational Personnel to operate the Equipment if setup or repositioning is required during inspection.

2.2.2 CLIENT

The Client is the person or entity that has retained the EOR and may be the Equipment Operator, a third-party maintenance facility or a non-destructive testing (NDT) service provider.

The Client should be aware that the scope of work and cost estimate of the EOR may have to be amended during the inspection process, depending on the inspection findings. The EOR should discuss and agree to the cost estimate with the Client before commencing work.

2.2.3 ENGINEER OF RECORD

The EOR must ensure that he or she is competent to certify the inspection of the Equipment. Competency requirements are outlined in Section 5.2 Education, Training, and Experience.

The EOR should then work with the Client, as appropriate, to develop a scope of work. The scope will include, but will not be limited to, the following:

- Collect and review any relevant required Documentation.
- Prepare the written Inspection Plan and distribute it to the appropriate parties.
- Confirm that the Annual Mechanical and Controls Inspection has been completed according to the Inspection Plan.
- Confirm the qualifications of mechanical maintenance and controls inspection personnel.
- Ensure that the inspection personnel performing the Annual Structural Inspection are qualified.
- Provide direct supervision of the structural inspection personnel, including direction as to which components require inspection and which inspection methods are to be used.

- Provide any repair instructions and re-inspection requirements, if required; repair instructions may be obtained from the OEM or provided by the EOR.
- Confirm the qualifications of repair personnel.
- Confirm that repairs have been completed in accordance with the supplied repair instructions.
- Confirm that any additional testing or inspections are completed, following completion of repairs.
- Provide an inspection Certification in a timely manner.

If the EOR determines that the Client is not fulfilling its responsibilities as described above, then the EOR should consider either:

- recommending in writing that the Client fulfills its responsibilities;
- offering an expanded scope of work to assist the Client in fulfilling its responsibilities; or
- withdrawing from the project.

2.2.4 ENGINEERING SPECIALIST

If the inspection reveals an issue that cannot be addressed with the OEM repair instructions, and the EOR does not have the required competency or qualification to provide the repair instructions, an appropriately qualified Engineering Specialist may be engaged. The following are examples of tasks for which an Engineering Specialist may be engaged if the EOR is not qualified:

- Welding repair instructions
- Structural analysis
- Mechanical analysis

2.2.5 INSPECTION PERSONNEL – STRUCTURAL

Structural inspection personnel may consist of either a single person who holds all the required inspection qualifications, or a team of practitioners, each of whom is qualified in a required inspection method. The EOR may also serve as one of the inspection personnel. Qualifications for inspection personnel are listed below.

There are two types of inspection personnel:

- **Inspector:** Generally, the inspector performs a visual inspection of the Equipment looking for damage, missing or improperly assembled parts, and conformance to the *OHSR* and standards. The inspector must be familiar with the applicable occupational health and safety regulations, and the relevant codes and standards for the type of Equipment being inspected. If the inspector is not the EOR, then the inspector must work under the direct supervision of the EOR and must be sufficiently familiar with the type of Equipment being inspected (and its components) to complete a competent inspection.

  Depending on the governing code or standard, the inspector may be required to be certified for visual welding inspection. Many standards referenced by the *OHSR*, such as *CSA Z150 Safety Code for Mobile Cranes*, requires the inspector to be certified for visual weld inspection as per *CSA W178.2 Certification of Welding Inspectors*.

- **NDT technician**: The NDT technician performs any required non-destructive testing on critical or suspect items as identified by the inspector, the OEM, or the EOR. Three common types of NDT methods are employed in Equipment inspections:
  - Liquid penetrant testing
  - Magnetic particle testing
  - Ultrasonic testing

  In Canada, NDT personnel can be certified to *CAN/CGSB 48.9712 Qualification and Certification of NDT Personnel*, and Certification to this standard may be required by the applicable standard referenced in the *OHSR*.

2.2.6 INSPECTION AND MAINTENANCE PERSONNEL – MECHANICAL AND CONTROLS

Mechanical and controls inspection and maintenance personnel may consist of either a single person who holds all the required qualifications, or a team of practitioners, each of whom is qualified. These personnel could include mechanics, electricians, or other tradespeople involved in the inspection, maintenance, and repair of the electrical, mechanical, and control systems of the Equipment.

These personnel must be:

- assessed as qualified and competent by their employers for the inspection, maintenance, or repair work of the Equipment;
- familiar with
  - the Equipment to be maintained,
  - the requirements of the *OHSR* and applicable codes and standards, and
  - OEM Documentation, such as operation and maintenance manuals, as well as any applicable bulletins; and
- aware that any work performed that is considered a Modification requires the approval of the OEM or the EOR.

2.2.7 WELDERS AND FABRICATORS

Welders and fabricators may be employed to perform repairs, or to rebuild or fabricate a new component for the Equipment.

Weld repair personnel must:

- be qualified in accordance with the requirements of the applicable standard (most CSA standards require that welders be certified to *CSA W47.1 Certification of Companies for Fusion Welding of Steel*); and
- only perform weld repairs on load-bearing Structural Components based on documented repair instructions provided by the OEM or the EOR.

Welding and fabricating personnel involved in the rebuilding of components or fabrication of new components must:

- be qualified in accordance with the requirements of the applicable standard (most CSA standards require that welders be certified to *CSA W47.1 Certification of Companies for Fusion Welding of Steel*);
- only perform fabrication of load-bearing Structural Components based on specifications, drawings, or instructions provided by the OEM or the EOR; and
- be aware that any work performed that is considered a Modification requires the approval of the OEM or the EOR.

Most standards recognize that Equipment may be fabricated outside of Canada, and welding standards other than *CSA W59 Welded Steel Construction* may have been used in the original fabrication of the Equipment. In general, lifting Equipment is fabricated in accordance with the quality requirements of a structural welding code, and welding repairs should also be carried out in accordance with an applicable structural welding code.

In North America, the two most commonly used structural welding codes for steel are *CSA W59 Welded Steel Construction* and *AWS D1.1 Structural Welding Code – Steel*, both of which are appropriate welding standards for lifting Equipment (*CSA W59.2 Welded Aluminum Construction* and *AWS D1.2 Structural Welding Code – Aluminum* can be used for structural aluminum). These standards are appropriate for steel grades with strengths up to 700 MPa (100 ksi); for example, QT100, T1, or Weldox, which are typically used in crane construction. If ultra-high strength steels are used in fabrication, then these welding standards may not apply, and specific instructions for repair from the OEM may be needed.

2.2.8 REPAIR FACILITY

A repair facility can be an independent entity or the Manufacturer's Representative, and it may employ any combination of maintenance personnel or welders and fabricators. The requirements for that type of personnel, as outlined above, apply the same way whether or not they are employed by the repair facility.

2.2.9 WORKSAFEBC

WorkSafeBC, the Authority Having Jurisdiction, has a statutory mandate in BC and it has enforcement authority under the *Workers Compensation Act* and the *OHSR*.

With respect to Equipment, the role of the Authority Having Jurisdiction includes:

- making regulations and establishing guidelines and requirements for the protection of health and safety of workers and the occupational environment in which they work;
- conducting investigations and taking enforcement action for the purpose of protecting public safety and for ensuring compliance with the relevant regulations.
- reporting to the Association any suspected breaches by an EOR or an Engineering Professional of his or her professional obligations.

3.0 GUIDELINES FOR PROFESSIONAL PRACTICE

3.1 OVERVIEW

As discussed in Section 2.0 Roles and Responsibilities, the Annual Inspection of Equipment can involve many parties, including the Original Equipment Manufacturer (OEM) (or their local representative), the Owner and/or Equipment Operators, mechanics, and inspectors. The Certification of the Equipment may require input from all of those parties at various stages, but the Engineer of Record (EOR) will not typically have a direct relationship with every one of them.

Before commencing services, the EOR should meet with the Client to:

- develop the scope of work for basic services and additional services;
- agree on fees, payment schedule, and professional liability insurance; and
- ensure that the terms of the EOR's engagement for the provision of services are otherwise clearly understood by the parties and agreed upon.

The inspection and Certification process would typically proceed as follows:

1. Develop a written Inspection Plan.
2. Confirm the inspection of Mechanical Components and Control Components of the Equipment, including confirming that mechanical maintenance and inspection personnel are Qualified Persons.
3. Provide repair instructions for Mechanical Components and Control Components, and inspection criteria for the repairs, if required.
4. Carry out, or provide direct supervision for, the inspection of Structural Components of the Equipment
5. Provide repair instructions for Structural Components, and inspection criteria for the repairs, if required.
6. Ensure that all repairs of deficiencies have been performed, in accordance with the instructions provided.
7. Issue Certification that the Equipment is Safe for Use.

The following sections outline the standard of practice for Engineering Professionals when carrying out Equipment inspection and Certification, which is consistent with the requirements in the *OHSR* and the *Engineers and Geoscientists Act*.

3.2 INSPECTION PLAN

The first step of the Certification process is to develop a written Inspection Plan. The Equipment Operator is required under the *OHSR* to maintain the service history of the Equipment (e.g., the Equipment log). The EOR may not be familiar with the history of the Equipment requiring Certification, so the Equipment Operator is responsible for providing this information to the EOR at the start of the Certification project. If the Equipment Operator is not aware of this requirement, the EOR should inform and educate the Equipment Operator of its responsibility in writing.

At the start of the project, the Client must supply the EOR with the following Documentation:

- Equipment logbook
- OEM maintenance manual and service bulletins
- Previous inspection and Preventive Maintenance history

- Documentation that mechanical maintenance and repair personnel are Qualified Persons
- Any other supporting Documentation that may be relevant

Based on this Documentation, the EOR will create a written Inspection Plan that prescribes the components requiring inspection, the extent of the inspection, including the amount of disassembly required, and any non-destructive testing (NDT) or other testing for the specific Equipment, taking into consideration the following background information:

- Current versions of regulations, codes, and standards applicable to the Annual Inspection of the Equipment.
- Any specified requirements in the regulations, codes, or standards that apply to the inspection (for example, if it is a ten-year boom teardown inspection, a five-year teardown inspection of the load block on a Mobile Crane, or a dielectric test for an Aerial Device).
- Age of the Equipment, number of hours of use, severity of service, and operating environment.
- The EOR's own experience with the particular model of Equipment, including knowledge of reliability issues, design issues, or component problems.
- Specific requirements from the OEM that are included in the operation or service/maintenance manuals.
- Any special bulletins or recalls issued by the OEM that are specific to the piece of Equipment.
- The service and repair history of the Equipment, including any misadventures or known issues or concerns that may affect its safe operation.

The Inspection Plan typically includes the Structural Components, Mechanical Components, and Control Components of the Equipment. However, in some circumstances, only a structural inspection may be required. Some examples are lifting devices, which do not have Mechanical Components or Control Components, or Tower Cranes where only a structural inspection is required by the *OHSR*.

See Appendix A: Equipment Requiring Certification and Inspection for the types of Equipment for which Certification is specifically required by the *OHSR*. Table A - 1 provides a list that specifies the type of Certification required (e.g., structural only or structural, mechanical, and controls), and Table A - 2 provides photographic examples of Equipment types.

See Appendix D: Sample Inspection Plan for the suggested format of an Inspection Plan.

3.3 INSPECTION OF MECHANICAL AND CONTROL COMPONENTS

Mechanical and controls inspections are part of the ongoing Preventive Maintenance of the Equipment and are the responsibility of the Equipment Operator.

It is the responsibility of the Equipment Operator to ensure the maintenance and repair work is performed by or under the supervision of a Qualified Person. If the Equipment Operator has opted to use a third-party maintenance facility to complete these inspections, then the maintenance facility also has a responsibility to ensure their employees are qualified to perform the work.

The role of the EOR with regard to Certification of the Annual Mechanical and Controls Inspection is to confirm that the mechanical and controls inspections meet the requirements of the Inspection Plan (see Section 3.2 Inspection Plan).

The EOR must confirm the following:

- Mechanical inspection personnel are qualified to do the work. This means that the EOR knows who will perform the work and their qualifications, and the EOR is confident that they are competent to perform the work.
- The mechanical and controls Inspection Plan is appropriate for the specific type of Equipment being inspected and meets the requirements of the *OHSR*, the OEM's instructions, and the applicable standards.

- The mechanical and controls inspections are documented to the satisfaction of the EOR. See Section 3.7 Inspection Reports for recommended information to be included in the report.
- All items required for the mechanical and controls inspections have been completed, in accordance with the Inspection Plan.

If the EOR cannot confirm all of these requirements, then the EOR must communicate to the Client that the EOR has identified deficiencies that must be rectified before the EOR can include the Annual Mechanical and Controls Inspection in the Certification. The EOR can then provide guidance for how to address the identified deficiencies to satisfy the EOR.

Some components may not be strictly classified as either Mechanical Components or Control Components. For example, a hydraulic valve could be deemed a Mechanical Component, but it could also be deemed a part of an Equipment's control system. The EOR has discretion for the classification of such components, as long as the discretion is exercised reasonably in the circumstances, and the EOR provides clear direction for the inspection of the components to ensure that they are functioning properly.

3.4 REPAIR OF MECHANICAL AND CONTROL COMPONENTS

If the EOR identifies the need for a specific repair to either the Mechanical Components or Control Components, the EOR must communicate to the Client the specific items that require repair. The EOR and the Client can then work together to determine a course of action to complete the repairs to the satisfaction of the EOR.

3.5 INSPECTION OF STRUCTURAL COMPONENTS

Inspection of Structural Components of the Equipment is carried out either by the EOR (if qualified) or by a Qualified Person performing the work under the direct supervision of the EOR. The EOR is responsible for ensuring that Annual Structural Inspections are carried out according to the Inspection Plan, and that inspection personnel are qualified as outlined in Section 2.0 Roles and Responsibilities.

Inspection reports must be provided following each inspection. See Section 3.7 Inspection Reports for the recommended information that should be included in the reports. If there are deficiencies noted during the Annual Structural Inspection, the EOR must provide a written repair procedure and supervise the repairs, as outlined in Section 3.6 Repair of Structural Components.

Following completion of the structural inspections and the repairs, if required, the EOR must provide a final Annual Structural Inspection Report, which will accompany the Certification.

3.6 REPAIR OF STRUCTURAL COMPONENTS

If the structural inspection reveals deficiencies that require repair, the EOR is responsible for directly supervising the repairs. This may require input from the OEM or an Engineering Specialist (e.g., a materials or welding engineer), depending on the nature of the repair. Any repairs performed must ensure that the repaired Structural Component meets or exceeds the strength of the component in its original OEM condition.

With respect to structural repairs, the EOR must:

- determine the material grade and appropriate welding process;
- ensure written instructions are provided for the repair;

- discuss the repair strategy with the repair personnel or the repair facility;
- confirm the qualifications of personnel performing the repair;
- confirm that the repair facility has an appropriate welding procedure for the repair;
- specify any inspection, NDT, or additional requirements, such as load tests following completion of repairs, and;
- confirm that repairs have been completed to the satisfaction of the EOR through documented field review.

Certification of the Annual Structural Inspection cannot be provided until all structural repairs have been addressed.

3.7 INSPECTION REPORTS

All inspection reports should contain the following minimum information:

- Reference to the Inspection Plan
- Name of the EOR
- Unique identifier for the report (file number or work order number)
- Equipment information (make, model number, serial number, unit number)
- Inspector name(s) and qualifications
- Date of inspection
- The applicable standard or code to which the Equipment was inspected
- Description or list of components inspected
- Description or list of any deficiencies noted during the inspection
- Description of repairs completed and the name of the person who performed the repairs

3.8 CERTIFICATION

Final Certification of the annual Equipment inspection is provided using one of the Certification forms provided in Appendix C: Certification Assurance Forms.

Three Certification forms are available:

- **Safe for Use Certification Form – Structural, Mechanical, Controls**
  - This primary Certification form is used when the EOR takes overall responsibility for Certification of the Structural Components, Mechanical Components, and Control Components of the Equipment.
- **Limited Certification Form – Mechanical and Controls**
  - This Certification form is used when the EOR relies on the assurance of another Engineering Professional for inspection of the Mechanical Components and Control Components of the Equipment. The Engineering Professional who certified inspection of the Mechanical Components and Control Components of the Equipment completes this form and provides it to the EOR for the EOR's records. The EOR may base the full Certification of the Equipment on this Limited Certification and the EOR's own inspection of the Structural Components.
- **Limited Certification Form – Structural**
  - This Certification form is only used for inspections of simple structures that do not have Mechanical Components and Control Components (e.g., spreader bars and other below-the-hook lifting devices) or when only an Annual Structural Inspection is required.

Alternatively, the EOR may prepare a customized form for Certification; however, at minimum, the document should include the following information:

- Name, signature, and seal of the EOR
- Unique identifier for the report (file number or work order number)

- Equipment information (make, model number, serial number, unit number)
- Name and address of the current owner
- Inspector name(s) and qualifications
- Date of inspection
- List of referenced Annual Mechanical and Controls Inspection Report(s)
- List of referenced Annual Structural Inspection Report(s)
- Duration of Certification (i.e., one year from the date of Certification)
- A statement to the effect that the Equipment is Safe for Use, as defined in these guidelines

Note: It is not acceptable for the EOR to provide Certification if there are outstanding deficiencies that affect the safe performance of the Equipment or compliance of the Equipment with the *OHSR*.

As required by the *OHSR*, the full Certification of the Equipment must contain a statement that the inspected Equipment is Safe for Use. That statement must only be provided in circumstances where it is reasonable for the EOR to make the following assumptions:

- The Documentation provided by the Client is accurate and can be relied upon.
- The Certification applies to all components of the Equipment that are required for its safe operation. (Other components may or may not be included, as listed in the applicable inspection report; for example, some Equipment may come with accessories such as jibs, auxiliary winches, or attachments that are not required for the safe operation of the Equipment. These components would not necessarily be inspected unless requested by the Equipment Operator.)
- The Equipment has been designed, manufactured, and installed in accordance with good engineering practice.
- The Equipment will be operated, inspected, and maintained on an ongoing basis by the Equipment Operator in accordance with the applicable regulations in the *OHSR.* (Failure to do so will invalidate the Certification.)
- The Equipment will be immediately removed from service in the case of a misadventure.
- The Equipment can reasonably be expected to perform safely until the next inspection and Certification is required, if it is operated, inspected, and maintained according to the OEM instructions and the *OHSR*.
- The Equipment will not be modified from the inspected configuration. (Any Modification will invalidate the Certification.)

The term 'Safe for Use' must only be used on a Certification when all requirements of the Annual Inspection have been completed in accordance with the *OHSR*. If only a portion of the work was completed (for example, only the Annual Structural Inspection was completed on Equipment that requires annual structural, mechanical, and controls inspections) only a Limited Certification should be provided and the Equipment cannot be certified as Safe for Use.

See Appendix C: Certification Assurance Forms for examples of Certification forms and recommended wording.

Note that as defined in these guidelines, the term 'Modification' means "any change, repair, or replacement that results in a deviation from the original specifications provided by the OEM" (see the list of Defined Terms at the front of this document). Cranes that are designed to be dismantled and reassembled in different configurations (e.g., lattice boom crawlers) would not be considered to have been modified, provided all components used in the reassembly were included in the last Certification of the Equipment.

4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE

4.1 QUALITY MANAGEMENT REQUIREMENTS

Engineering Professionals must adhere to the applicable quality management requirements during all phases of the work, in accordance with the Association's Bylaws. It is also important that they be alert to whether they are obligated by the Authority Having Jurisdiction or by their service contract to adhere to additional quality management requirements.

To meet the intent of the quality management requirements, Engineering Professionals must establish and maintain documented quality management processes to ensure the following:

- The application of relevant professional practice guidelines
- Authentication of professional documents by the application of the professional seal
- Direct supervision of delegated professional engineering activities
- Retention of complete project Documentation
- Regular, documented checks using a written quality control process
- Documented field reviews of engineering designs/recommendations during implementation or construction
- Where applicable, documented independent review of structural designs prior to construction

4.1.1 PROFESSIONAL PRACTICE GUIDELINES

In accordance with the *Act*, s.4(1) and Bylaw 11I(4)(h), Engineering Professionals are required to comply with the intent of any applicable professional practice guidelines related to the engineering work they undertake. One of the three objectives of the Association, as stated in the *Act* is "to establish, maintain, and enforce standards for the qualifications and practice of its members and licensees". Practice guidelines are one means by which the Association fulfills this obligation.

These professional practice guidelines inform on the standard of practice for annual Equipment inspections and Certification in BC. Engineering Professionals who carry out these activities are required to meet the intent of these guidelines.

4.1.2 USE OF SEAL

In accordance with the *Act*, s.20(9), Engineering Professionals are required to seal all professional engineering documents they prepare or deliver in their professional capacity to others who will rely on the information contained in the documents. This applies to documents that Engineering Professionals have personally prepared and those that others have prepared under their direct supervision.

Failure to seal these engineering documents is a breach of the *Act*.

Engineering Professionals taking responsibility for inspection reports or Certifications must sign and seal those documents.

For more information, refer to *Quality Management Guidelines – Use of Seal* (Engineers and Geoscientists BC 2017).

4.1.3 DIRECT SUPERVISION

In accordance with the *Act*, s.1(1) and 20(9), the EOR is required to directly supervise any engineering work he or she delegates. When working under the direct supervision of the EOR, unlicensed persons or non-members may assist in performing engineering work, but they may not assume responsibility for it. When the EOR is an engineering licensee, he or she may only directly supervise work within the scope of his or her license.

With regard to direct supervision, the EOR should consider:

- the complexity of the project and the nature of the risks;
- which aspects of the work should be delegated;
- the training and experience of individuals to whom work is delegated; and
- the amount of instruction, supervision, and review required.

For more information, refer to *Quality Management Guidelines – Direct Supervision* (Engineers and Geoscientists BC 2018a).

4.1.3.1 Direct Supervision of Structural Inspection Field Work

Field work is one of the most critical aspects of an Annual Structural Inspection of Equipment. Therefore, careful consideration must be given to delegating field work.

Due to the complexities and subtleties of Equipment inspections, direct supervision of field work is difficult, and care must be taken to ensure that delegated work meets the standard expected of the EOR. Such direct supervision could typically take the form of specific instructions on what to observe, check, confirm, test, record, and report back to the EOR. The EOR should exercise judgment when relying on delegated field observations, and should conduct a sufficient level of review to have confidence in the quality and accuracy of the field observations. (See Section 4.1.6 Documented Field Reviews During Implementation or Construction.)

For more information, refer to *Quality Management Guidelines – Direct Supervision* (Engineers and Geoscientists BC 2018a).

4.1.3.2 Direction of Mechanical and Controls Maintenance Personnel

The annual Certification of Equipment relies in part on the confirmation that Equipment is properly maintained throughout the year. The EOR may not be involved in the hiring, training, or supervision of mechanical and controls maintenance and inspection personnel; therefore, this interaction does not meet the test of direct supervision. However, when the EOR is engaged to provide the annual Certification, the EOR can provide direction to the mechanical or maintenance personnel by:

- reviewing information on the training and experience of the personnel to reasonably assess their qualifications;
- reviewing the operation and maintenance Documentation with the mechanical or maintenance personnel;
- making site visits at a specified frequency with the mechanical or maintenance personnel to review any maintenance in progress; and
- identifying gaps in the maintenance activities and providing prescriptive instructions to be followed by personnel going forward.

4.1.4 RETENTION OF PROJECT DOCUMENTATION

In accordance with Bylaw 14(b)(1), Engineering Professionals are required to establish and maintain documented quality management processes that include retaining complete project documentation for a minimum of ten (10) years after the completion of a project or ten (10) years after the engineering documentation is no longer in use.

Project documentation in the context of this professional activity is any document that is evidence of engineering-related activities, events, or transactions, or is evidence that Engineering Professionals have met their professional and contractual obligations. Note that the defined term "Documentation" in these guidelines (see the Defined Terms section) may not necessarily describe the same information as that which meets the intent of the quality management guideline referenced below.

Many Engineering Professionals are employed by organizations that ultimately own the project documentation. Engineering Professionals are considered compliant with this quality management requirement when a complete set of project documentation is retained by the organizations that employ them using means and methods that are consistent with the Association's Bylaws and guidelines.

For more information, refer to *Quality Management Guidelines – Retention of Project Documentation* (Engineers and Geoscientists BC 2018b).

4.1.5 DOCUMENTED CHECKS OF ENGINEERING AND GEOSCIENCE WORK

In accordance with Bylaw 14(b)(2), Engineering Professionals are required to perform a documented quality checking process of engineering work, appropriate to the risk associated with that work.

Regardless of sector, Engineering Professionals must meet this quality management requirement. In this context, 'checking' means all professional deliverables must undergo a documented quality checking process before being finalized and delivered. This process would normally involve an internal check by another Engineering Professional within the same organization; at a minimum, Engineering Professionals are required to check their own work and retain documentation that the check has occurred. Where an appropriate internal checker is not available, an external checker (i.e., one outside the organization) must be engaged. Where an internal or external check has been carried out, this must be documented.

Engineering Professionals are responsible for ensuring that the checks being performed are appropriate to the level of risk. Considerations for the level of checking should include the type and complexity of Equipment being certified; the condition of the Equipment; the quality and reliability of background information, field data, and elements at risk; and the Engineering Professional's training and experience.

For more information, refer to *Quality Management Guidelines – Documented Checks of Engineering and Geoscience Work* (Engineers and Geoscientists BC 2018c).

4.1.6 DOCUMENTED FIELD REVIEWS DURING IMPLEMENTATION OR CONSTRUCTION

In accordance with Bylaw 14(b)(3), field reviews are reviews conducted at the site of the inspection or implementation of the engineering work. They are carried out by the EOR or a subordinate acting under the EOR's direct supervision (see Section 4.1.3 Direct Supervision).

Field reviews enable the EOR to ascertain whether the work substantially complies in all material respects with the engineering concepts or intent reflected in the engineering documents prepared for the work.

In regard to annual Certification of Equipment, if the EOR makes specific recommendations in the Inspection Plan or inspection report regarding the implementation of remedial work, the EOR has an obligation to inform the Client in writing that those works must be carried out by or under the direct supervision of the EOR.

For more information, refer to *Quality Management Guidelines – Documented Field Reviews during Implementation or Construction* (Engineers and Geoscientists BC 2018d).

4.1.7 DOCUMENTED INDEPENDENT REVIEW OF STRUCTURAL DESIGNS

Bylaw 14(b)(4) refers to an independent review in the context of structural engineering. An independent review is a documented evaluation of the structural design concept, details, and documentation based on a qualitative examination of the substantially complete structural design documents, which occurs before those documents are issued for construction. It is carried out by an experienced Engineering Professional qualified to practice structural engineering, who has not been involved in preparing the design.

In regard to annual Certifications of Equipment inspections, independent review would not be required unless the EOR recommends a repair that results in a structural design change from the original manufactured design. In this case, an independent review of the structural design would be required.

For more information, refer to *Quality Management Guidelines – Documented Independent Review of Structural Designs* (Engineers and Geoscientists BC 2018e).

5.0 PROFESSIONAL REGISTRATION & EDUCATION, TRAINING, AND EXPERIENCE

5.1 PROFESSIONAL REGISTRATION

It is the responsibility of Engineering Professionals to determine whether they are qualified by training and/or experience to undertake and accept responsibility for carrying out annual Equipment inspections and Certification (Code of Ethics Principle 2).

The *OHSR* specifically requires that Certification be issued by an Engineering Professional (meaning a professional engineer or an engineering licensee with a scope of practice approved by the Association that includes Certification of Equipment).

5.2 EDUCATION, TRAINING, AND EXPERIENCE

Annual Equipment inspections and Certification, as described in these guidelines, require minimum levels of education, training, and experience in many overlapping areas of engineering.

The Engineering Professional taking responsibility must adhere to the Association's Code of Ethics (to undertake and accept responsibility for professional assignments only when qualified by training or experience) and, therefore, must evaluate his or her qualifications and must possess the appropriate education, training, and experience to provide the services.

The level of education, training, and experience required of the Engineering Professional should be adequate for the complexity of the project.

Typical qualifications for the Engineer of Record (EOR) for annual Equipment inspections and Certification include the following education and experience:

- Minimum of three years of experience with Equipment inspections
- Knowledge of the Equipment to be inspected, including the operation and function of the individual components
- Knowledge of the requirements of the applicable sections of the *OHSR* and related codes and standards
- Knowledge of the non-destructive testing (NDT) inspection methods being used, including their applications and limitations
- Sufficient understanding of welding processes and procedures to ensure proper repair of components

The academic training for the above skill sets can be acquired by taking formal university or college courses or through continuing professional development. There may be some overlap in courses and specific courses may not correlate to specific skill sets. An Engineering Professional should also remain current with evolving topics through continuing professional development. Continuing professional development can include taking formal courses; attending conferences, workshops, seminars, and technical talks; reading technical publications; doing web research; and participating in field trips.

5.3 EDUCATION AND TRAINING FOR SPECIALTY SERVICES

It is not reasonable to expect that all EORs would have sufficiently broad education and experience to address all of the required components of the Certification of Equipment. Therefore, depending on the complexity of the Equipment being inspected, and the background of the EOR, Engineering Specialist(s) may be engaged to provide specialty engineering services.

An Engineering Specialist who offers specialized services may require specific education, training, and experience in addition to that discussed in Section 5.2 above.

6.0 REFERENCES AND RELATED DOCUMENTS

Documents cited in these guidelines appear in Section 6.1: Regulations, Section 6.2: References, and Section 6.3: Codes and Standards.

Related documents that may be of interest to users of these guidelines but are not formally cited elsewhere in this document appear in Section 6.4: Related Documents.

6.1 REGULATIONS

The following statutes and regulations are referenced in these guidelines.

Engineers and Geoscientists Act [RSBC 1996], Chapter 116.

Workers Compensation Act [RSBC 2019], Chapter 1.

Workers Compensation Act, Occupational Health and Safety Regulation, B.C. Reg. 296/97.

6.2 REFERENCES

The following documents are referenced in these guidelines.

Engineers and Geoscientists BC. 2017. Quality Management Guidelines: Use of Seal. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

Engineers and Geoscientists BC. 2018a. Quality Management Guidelines: Direct Supervision. Version 1.3. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

Engineers and Geoscientists BC. 2018b. Quality Management Guidelines: Retention of Project Documentation. Version 1.3. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

Engineers and Geoscientists BC. 2018c. Quality Management Guidelines: Documented Checks of Engineering and Geoscience Work. Version 1.3. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

Engineers and Geoscientists BC. 2018d. Quality Management Guidelines: Documented Field Reviews During Implementation or Construction. Version 1.3. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

Engineers and Geoscientists BC. 2018e. Quality Management Guidelines: Documented Independent Review of Structural Designs. Version 1.4. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2018 Aug 16]. https://www.egbc.ca/Practice-Resources/Quality-Management-Guidelines.

6.3 CODES AND STANDARDS

The following codes and standards are referenced in these guidelines.

ANSI/ASNT CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel

ASME B30.4 Portal and Pedestal Cranes

ASME B30.5 Mobile and Locomotive Cranes

ASME B30.22 Articulating Boom Cranes

ASTM E543 Standard Specification for Agencies Performing Nondestructive Testing

AWS D1.1 Structural Welding Code – Steel

AWS D1.2 Structural Welding Code – Aluminum

AWS D14.3 Specification for Welding Earthmoving, Construction, and Agricultural Equipment

CAN/CGSB-48.9712 Non-destructive Testing – Qualification and Certification of NDT Personnel

CAN/CSA-C225 Vehicle-mounted Aerial Devices

CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms

CSA W47.1 Certification of Companies for Fusion Welding of Steel

CSA W59 Welded Steel Construction

CSA W59.2 Welded Aluminum Construction

CSA W178.2 Certification of Welding Inspectors

CSA Z150 Safety Code for Mobile Cranes

CSA Z151 Concrete Pumps and Placing Booms

CSA Z248 Code for Tower Cranes

NFPA 1914 Standard for Testing Fire Department Aerial Devices, 2002 Edition

6.4 RELATED DOCUMENTS

The following resources are provided for information.

Regulations

WorkSafeBC. 2020a. OHS Guidelines. [website]. [accessed: 2020 Nov 02]. https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-guidelines.

WorkSafeBC. 2020b. OHS Policies. [website]. [accessed: 2020 Nov 02]. https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-policies.

Codes and Standards

ANSI A92.2 Vehicle-mounted Elevating and Rotating Aerial Devices

ANSI A92.3 American National Standard for Manually Propelled Elevating Aerial Platforms

ANSI A92.5 Boom-Supported Elevating Work Platforms

ANSI A92.6 American National Standard for Self-Propelled Elevating Work Platforms

ANSI A92.8 American National Standard for Vehicle-Mounted Bridge Inspection and Maintenance Devices

ANSI A92.9 American National Standard for Mast Climbing Work Platforms

ANSI A92.20 Design, Calculations, Safety Requirements, and Test Methods for Mobile Elevating Work Platforms (MEWPs)

ANSI A92.22 Safe Use of MEWPs

ANSI A92.24 Training Requirements for the Use, Operations, Inspection, Testing and Maintenance of MEWPs

ANSI MH27.1 Specifications for Patented Track Underhung Cranes and Monorail Systems

ANSI SVIA-1 American National Standard for Four Wheel All-Terrain Vehicles – Equipment, Configuration, and Performance Requirements

ANSI/ITSDF B56.1 Safety Standard for Low Lift and High Lift Trucks

ANSI/ITSDF B56.6 Safety Standard for Rough Terrain Forklift Trucks

ASME B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

ASME B30.11 Monorails and Underhung Cranes

ASME B30.14 Side Boom Tractors

ASME B30.16 Overhead Hoists (Underhung)

ASME B30.17 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)

ASME B30.23 Personnel Lifting Systems

CMAA (Crane Manufacturers Association of America) Specification No. 70. Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

CMAA Specification No. 74. Specifications for Top Running and Under Running Single Girder Electric Overhead Cranes Utilizing Under Running Trolley Hoist

CSA B167 Safety Standard for Maintenance and Inspection of Overhead Cranes, Gantry Cranes, Monorails, Hoists, and Trolleys

CSA C22.2 No. 33 Construction and Test of Electric Cranes and Hoists

CSA B354.1 Portable Elevating Work Platforms

CSA B354.2 Self-propelled Elevating Work Platforms

CSA B354.5 Mast-climbing Work Platforms

CSA B354.6 Mobile Elevating Work Platforms – Design, Calculations, Safety Requirements, and Test Methods

CSA B354.7 Mobile Elevating Work Platforms – Safety Principles, Inspection, Maintenance, and Operation

CSA B354.8 Mobile Elevating Work Platforms – Operator (Driver) Training

CSA B354.9 Design, Calculations, Safety Requirements, and Test Methods for Mast Climbing Work Platforms (MCWPs)

CSA B354.10 Safe Use and Best Practices for Mast Climbing Work Platforms (MCWPs)

CSA B354.11 Training for Mast Climbing Work Platforms (MCWPs)

7.0 APPENDICES

APPENDIX A: EQUIPMENT REQUIRING INSPECTION AND CERTIFICATION

The tables in this appendix show the types of Equipment for which Certification is specifically required by the *Occupational Health and Safety Regulations* (*OHSR*).

- Table A - 1: List of Equipment Requiring Inspection and Certification According To the *OHSR* provides a list that specifies the type of Certification required (e.g., structural only or structural, mechanical, and controls)
- Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification provides visual examples.

These guidelines outline the appropriate standard of practice to be followed at the time they were prepared. However, over time, the regulations, standards, and requirements may be revised, which may not be reflected in these tables until the next revision of these guidelines.

It is the responsibility of the Engineer of Record (EOR) to confirm current regulatory requirements.

Note that the defined terms in this appendix are specific to these guidelines and are capitalized throughout the document. See the list of Defined Terms at the front of these guidelines for full definitions.

Table A - 1: List of Equipment Requiring Inspection and Certification According To the OHSR

EQUIPMENT TYPE [a]	STANDARDS [b,c]	CERTIFICATION REQUIRED [d]		REQUIRED STRUCTURAL INSPECTION QUALIFICATIONS [b, c, e]	RECOMMENDED REPAIR WELDING STANDARD [c, f]
		S	MC		
articulating boom cranes	• ASME B30.22 Articulating Boom Cranes	Yes	Yes	N/A	• AWS D14.3 Specification for Welding Earthmoving, Construction, and Agricultural Equipment
Concrete Pumps and Placing Booms	• CSA Z151 Concrete Pumps and Placing Booms	Yes	Yes	• CSA W178.2 Certification of Welding Inspectors • Qualified Person referenced in CSA Z151 standard must be a professional engineer as required by the *OHSR*	• CSA W59 Welded Steel Construction
Concrete Placing Boom masts	• CSA Z151 Concrete Pumps and Placing Booms	Yes	Yes	• CSA W178.2 Certification of Welding Inspectors • Qualified Person referenced in CSA Z151 standard must be a professional engineer as required by the *OHSR*	• CSA W59 Welded Steel Construction
fire truck Aerial Devices and ground ladders	• NFPA 1914 Standard for Testing Fire Department Aerial Devices	Yes	Yes	• ANSI/ASNT CP-189 Standard for Qualification and Certification of NDT Personnel • ASTM E543 Standard Specification for Agencies Performing NDT	• AWS D1.1 Structural Welding Code – Steel • AWS D1.2 Structural Welding Code – Aluminum
Mobile Cranes	• CSA Z150 Safety Code on Mobile Cranes • ASME B30.5 Mobile and Locomotive Cranes	Yes	Yes	• CSA W178.2 Certification of Welding Inspectors • CAN/CGSB-48.9712 Qualification and Certification of NDT Personnel	• CSA W59 Welded Steel Construction
self-propelled boom-supported elevating work platforms	• CAN/CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms	Yes	Yes	• CSA W178.2 Certification of Welding Inspectors • CAN/CGSB-48.9712 Qualification and Certification of NDT Personnel	• CSA W59 Welded Steel Construction • CSA W59.2 Welded Aluminum Construction
sign trucks	• CSA Z150 Safety Code on Mobile Cranes • ASME B30.5 Mobile and Locomotive Cranes • CAN/CSA-C225 Vehicle-Mounted Aerial Devices	Yes	Yes	• CSA W178.2 Certification of Welding Inspectors • CAN/CGSB-48.9712 Qualification and Certification of NDT Personnel	• CSA W59 Welded Steel Construction • CSA W59.2 Welded Aluminum Construction
Tower Cranes	• CSA Z248 Code for Tower Cranes	Yes	No	• CSA W178.2 Certification of Welding Inspectors • CAN/CGSB-48.9712 Qualification and Certification of NDT Personnel	• CSA W59 Welded Steel Construction
vehicle-mounted elevating work platforms	• CAN/CSA-C225 Vehicle-Mounted Aerial Devices	Yes	Yes	N/A	• AWS D1.1 Structural Welding Code – Steel • AWS D1.2 Structural Welding Code – Aluminum

NOTES:

Abbreviations: MC = mechanical and controls; N/A = not applicable; NDT = non-destructive testing; *OHSR* = *Occupational Health and Safety Regulation*; S = structural

[a] Capitalized terms in this column are formally defined terms. See the list of Defined Terms at the beginning of these guidelines.

[b] These guidelines outline the appropriate standard of practice to be followed at the time they were prepared. However, over time, the regulations, standards, and requirements may be revised, which may not be reflected in this table until the next revision of these guidelines. It is the responsibility of the Engineer of Record to confirm current regulatory requirements.

[c] See Section 6.3 Codes and Standards for a list of standards that appear in this table. Please note that version numbers have been removed from the standard titles; the version of each standard that applies is the version listed in the current *OHSR.*

[d] "Yes" indicates that Certification is required as per the *OHSR*, and "No" indicates that Certification is not required.

[e] In some cases, the referenced code does not define specific qualifications for the inspector; rather, they require inspections to be carried out by a Qualified Person, defined as:

> "A person who, by possession of an appropriate technical degree, certificate, professional standing, or skill and by knowledge, training, and experience, has demonstrated the ability to deal with problems relating to the subject matter, the work, or the project".

It is generally recommended that in Canada, NDT technicians should be certified to *CAN/CGSB 48.9712 Non-destructive Testing – Qualification and Certification of NDT Personnel*, and visual welding inspectors to *CSA W178.2 Certification of Welding Inspectors*.

[f] Most standards recognize that Equipment may be fabricated outside of Canada, and welding standards other than *CSA W59 Welded Steel Construction* may have been used in the original fabrication of the Equipment. In general, lifting Equipment is fabricated in accordance with the quality requirements of a structural welding code, and welding repairs should also be carried out in accordance with an applicable structural welding code.

In North America, the two most commonly used structural welding codes for steel are *CSA W59 Welded Steel Construction* and *AWS D1.1 Structural Welding Code – Steel*, both of which are appropriate welding standards for lifting Equipment (*CSA W59.2 Welded Aluminum Construction* and *AWS D1.2 Structural Welding Code – Aluminum* can be used for structural aluminum). These standards are appropriate for steel grades with strengths up to 700 MPa (100 ksi); for example, QT100, T1, or Weldox, which are typically used in crane construction.

If ultra-high strength steels are used in fabrication, then these welding standards may not apply, and specific instructions for repair from the Original Equipment Manufacturer may be needed.

Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification

EQUIPMENT TYPE [a]
ARTICULATING BOOM CRANES
 *Photo: R. Stewart, Arsenal Engineering, 2019*
CONCRETE PUMPS AND PLACING BOOMS
 *Photo: R. Stewart, Arsenal Engineering, 2019*

NOTE:

[a] Categories for Equipment Type correspond to those listed in Table A - 1 above.

Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification, continued

EQUIPMENT TYPE [a]
FIRE TRUCK AERIAL DEVICES
 *Photo: M. MacKay, Commercial Truck Equipment Corp., 2019*
MOBILE CRANES
 *Photo: M. MacKay, Commercial Truck Equipment Corp., 2019*

NOTE:

[a] Categories for Equipment Type correspond to those listed in Table A - 1 above.

Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification, continued

EQUIPMENT TYPE [a]
SELF-PROPELLED BOOM-SUPPORTED ELEVATING WORK PLATFORMS
MANLIFT
 *Photo: R. Stewart, Arsenal Engineering, 2019*

NOTE:

[a] Categories for Equipment Type correspond to those listed in Table A - 1 above.

Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification, continued

EQUIPMENT TYPE [a]
SIGN TRUCKS
 Photo: M. MacKay, Commercial Truck Equipment Corp., 2019
VEHICLE-MOUNTED ELEVATING WORK PLATFORMS
 Photo: R. Stewart, Arsenal Engineering, 2019

NOTE:

[a] Categories for Equipment Type correspond to those listed in Table A - 1 above.

Table A - 2: Photographs Illustrating the Types of Equipment Requiring Inspection and Certification, continued

EQUIPMENT TYPE [a]	
TOWER CRANES	
HAMMERHEAD	**SELF-ERECTING**
 *Photo: R. Stewart, Arsenal Engineering, 2019*	 *Photo: R. Stewart, Arsenal Engineering, 2019*

NOTE:

[a] Categories for Equipment Type correspond to those listed in Table A - 1 above.

APPENDIX B: CASE STUDIES

The following case studies illustrate different scenarios that may be encountered when certifying inspections of different kinds of Equipment.

These cases are fictitious and are intended to provide examples that may be followed when partitioning responsibility among different stakeholders in the construction team.

Note that the defined terms in this appendix are specific to these guidelines and are capitalized throughout the document. See the list of Defined Terms at the front of these guidelines for full definitions.

B1.1 MOBILE CRANE

BACKGROUND INFORMATION

Crane Co. owns a Mobile Crane, which they use for delivering trusses. The crane has been in service for five years. Crane Co. cannot provide evidence of past inspections or any service records for the crane. Under the *OHSR*, the crane must be inspected and maintained to the requirements of both an applicable standard defined in regulation and those of the Original Equipment Manufacturer (OEM). In this case, Crane Co. has elected to follow the standard *CSA Z150* which requires daily, periodic, and Annual Inspections of the crane and, every five years, a teardown inspection of the load block (swivel, hook, and block assembly). In addition, the OEM has supplied a service manual which details daily, weekly, monthly, and periodic (quarterly) inspections. The OEM also requires complete disassembly of the boom system every five years and confirmation of the stability of the unit annually. Crane Co. has approached Eng. Co. and asked for nondestructive testing (NDT) of the crane.

Based on the available information, Eng. Co. explains to Crane Co. that an NDT inspection of the crane will not meet the requirements of the *OHSR*. Given the age of the crane, the OEM specifications require a full teardown of the crane boom, as well as all of the inspections required by *CSA Z150* and the OEM. Eng. Co. recommends that Crane Co. hires the OEM's local representative, Serv. Co., to carry out the teardown work and the Annual Mechanical and Controls Inspection.

SCENARIO 1

Eng. Co. develops a written Inspection Plan that includes the following:

1. Eng. Co. will specify that a function test will be performed on the crane to determine if any conditions or abnormal operation can be observed that may require further investigation.
2. Serv. Co. will carry out the Annual Mechanical and Controls Inspection of the crane. This will include all items listed in the OEM service manual, including daily, weekly, monthly, and periodic inspections, as well as all items listed in *CSA Z150 Safety Code on Mobile Cranes*. In addition, Serv. Co. will complete a full teardown of the crane boom and a teardown inspection of the load block.
3. Eng. Co. will employ structural inspectors who will perform the visual inspection and required NDT on the crane and the disassembled crane boom and load block.
4. Serv. Co. will carry out a final operational check of the crane following reassembly, and will complete the stability check on the reassembled crane as per the OEM instructions.
5. Eng. Co. will witness a final operational check of the crane following reassembly.

Serv. Co. and Eng. Co. carry out this scope of work, and Serv. Co. provides inspection records to Eng. Co. Then, Eng. Co. confirms that all work has been completed as per the Inspection Plan, and on this basis issues a full

Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 1 Commentary

In this scenario, Eng. Co. has ensured that all inspections required by *CSA Z150 Safety Code on Mobile Cranes* and the OEM have been completed.

A potential area of concern is the lack of past inspection and Preventive Maintenance activity (or at least a lack of records documenting that fact) by Crane Co. Therefore, Eng. Co. must also consider whether the Inspection Plan will detect any issues that could arise in the future, resulting from the possible lack of Preventive Maintenance (for example, wear from lack of lubrication of parts).

Also, although Serv. Co. is the OEM's representative, Eng. Co. must confirm that the mechanics employed by Serv. Co. are suitably qualified to carry out the scope of work.

SCENARIO 2

Crane Co. contacts the OEM's local representative, Serv. Co., and receives a quote for the scope of work. Based on the quote, Crane Co. decides not to contract Serv. Co. and seeks a cheaper alternative. Two weeks later, Crane Co. comes back to Eng. Co. with records indicating that daily, weekly, monthly, and periodic inspections were completed internally. Crane Co. asks Eng. Co. to only carry out an Annual Structural Inspection of the crane and to certify the Mechanical Components and the Control Components based on Crane Co.'s own inspections. Eng. Co. agrees to this arrangement. Eng. Co. completes the Annual Structural Inspection and then issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 2 Commentary

In this scenario, Eng. Co. has not met its obligations under the *OHSR*.

Eng. Co. has not verified that the daily, weekly, monthly, and periodic inspections were carried out by Qualified Persons. Further, Eng. Co. did not prepare a written Inspection Plan, nor did it ensure that the required inspections including a full teardown of the crane boom, a teardown inspection of the load block, and annual stability testing were completed.

SCENARIO 3

Crane Co. is a large crane company that employs heavy duty mechanics and has a facility suitable for carrying out Annual Mechanical and Controls Inspections. Crane Co. asks Eng. Co. if the Annual Mechanical and Controls Inspection could be completed by Crane Co. Eng. Co. asks to meet with the mechanics Crane Co. proposes to carry out the work. Through discussions with the mechanics, Eng. Co. determines that they have significant industry experience and are capable of performing the scope of work. As such, Eng. Co. develops a written Inspection Plan that includes all the components listed in Scenario 1.

Crane Co. and Eng. Co. carry out this scope of work, and Crane. Co. provides inspection records to Eng. Co. Then, Eng. Co. verifies that all work has been completed as per the Inspection Plan, and on this basis issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 3 Commentary

In this scenario, Eng. Co. has ensured that all inspections required by *CSA Z150 Safety Code on Mobile Cranes* and the OEM have been completed.

A potential area of concern is the lack of past inspection and Preventive Maintenance activity (or at least a lack of records documenting that fact) by Crane Co. Therefore, Eng. Co. must also consider whether the Inspection Plan will detect any issues that could arise in the future, resulting from the possible lack of Preventive Maintenance (for example, wear from lack of lubrication of parts).

Another area of concern is the potential conflict of interest presented by using mechanics employed by Crane. Co. to carry out an Annual Mechanical and Controls Inspection on their own Equipment. Eng. Co. should use its judgment to assess the risk that the inspections were not carried out and reported reliably. One possible way to mitigate the risk would be to witness the final operational check of the crane to confirm that the crane operates smoothly and that all safety features perform as expected.

SCENARIO 4

Four months after the scope of work listed in Scenario 1 is completed, a WorkSafeBC officer comes onto the job site and asks to see the crane's inspection paperwork and Preventive Maintenance records. During the period since the Annual Inspection, the crane has required daily, weekly, monthly, and periodic inspections, as defined by the OEM. These inspections have not been completed, which has invalidated the Certification provided by the Engineer under Scenario 1. Crane Co. engages Eng. Co. to recertify the crane. Eng. Co. develops a written Inspection Plan that includes the following:

1. Serv. Co. will carry out the Annual Mechanical and Controls Inspection of the crane. This will include all items listed in the OEM service manual, including daily, weekly, monthly, and quarterly periodic inspections, as well as all items listed in *CSA Z150 Safety Code on Mobile Cranes*.
2. Eng. Co. will carry out the visual inspections and NDT of the Structural Components of the crane.

Serv. Co. and Eng. Co. carry out this scope of work, and Serv. Co. provides inspection records to Eng. Co. Then, Eng. Co. verifies that all work has been completed as per the Inspection Plan, and on this basis issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 4 Commentary

In this case, Eng. Co. has ensured that all inspections required by the OEM and by *CSA Z150 Safety Code on Mobile Cranes* have been completed.

A potential area of concern is that the lack of inspection and Preventive Maintenance activity may have caused a crane component to fail prematurely. In this example, we are assuming that the Engineer of Record (EOR) for Eng. Co. has extensive knowledge of this model of crane and has been able to determine the amount of use. Thus, given the short period of time since the Annual Inspection, it is unlikely that any issue would arise that would not be found during the OEM-specified quarterly periodic inspection.

Alternatively, the EOR for Eng. Co. could restrict the length of the Certification. The EOR could choose to only certify the Equipment for a period of eight months (which would keep the Equipment on a set Annual Inspection frequency based on the first inspection performed).

SCENARIO 5

One year after the Certification described in Scenario 1 is issued, Crane Co. brings the crane back to Eng. Co. for its Annual Inspection. Eng. Co. requests inspection and maintenance records for the crane for the past year, which Crane Co. is once again unable to provide. Eng. Co. notes that the teardown inspection of the swivel, hook, and block assembly, and the full teardown of the boom were completed one year earlier. On this basis, Eng. Co. develops a written Inspection Plan that includes the following:

1. Eng. Co. specifies that a function test is to be performed on the crane to determine if any conditions or abnormal operation can be observed that may require further investigation.
2. Serv. Co. will carry out the Annual Mechanical and Controls Inspection of the crane. This will include all items listed in the OEM service manual, including daily, weekly, monthly, and periodic inspections, as well as all items listed in *CSA Z150 Safety Code on Mobile Cranes*.

3. Eng. Co. will carry out the visual inspection and NDT of the Structural Components of the crane.
4. Serv. Co. will perform a stability check on the reassembled crane, as per the OEM instructions

Serv. Co. and Eng. Co. carry out this scope of work, and Serv. Co. provides inspection records to Eng. Co. Then, Eng. Co. confirms that all work has been completed as per the Inspection Plan. Eng. Co. notes in its inspection report that in the past Crane Co. has not inspected or maintained the crane as required by the *OHSR*, and highlights that failure to do so invalidates their inspection and Certification. On the basis of the structural, mechanical, and controls inspections, Eng. Co. issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 5 Commentary

In this scenario, Eng. Co. has ensured that all inspections required by the OEM and by *CSA Z150 Safety Code on Mobile Cranes* have been completed.

Similar to Scenario 1, a potential area of concern is the lack of past inspection and Preventive Maintenance activity (or at least a lack of records documenting that fact) by Crane Co. Therefore, Eng. Co. must also consider whether the Inspection Plan will detect any issues that could arise in the future, resulting from the possible lack of Preventive Maintenance (for example, wear from lack of lubrication of parts).

SCENARIO 6

Seven months after the scope of work listed in Scenario 1 is completed, the crane is involved in a misadventure that results in a 30% overload of the crane. Crane Co. brings the crane back to Eng. Co. and asks what they need to do to safely continue using the crane. Eng. Co. requests inspection and maintenance records for the crane for the past seven months, which Crane Co. is able to supply.

Eng. Co. explains to Crane Co. that the *OHSR* requires that after a crane is in a misadventure it cannot be returned to service until a Professional Engineer has supervised an inspection on the crane and certified it as Safe for Use. Similarly, *CSA Z150* requires a Special Inspection of the crane (i.e., an inspection that does not fall within the regular inspection and maintenance schedule) any time after any form of actual, suspected, or potential damage is sustained from a crane incident.

Based on this, Eng. Co. develops a written Inspection Plan for the Special Inspection that includes the following items:

1. Serv. Co. will carry out the Annual Mechanical and Controls Inspection of the crane. This will include all items listed in the OEM service manual, including daily, weekly, monthly, and quarterly periodic inspections, as well as all items listed in *CSA Z150 Safety Code on Mobile Cranes*.
2. Eng. Co. will carry out the visual inspections and NDT of the Structural Components of the crane.

Serv. Co. and Eng. Co. carry out this scope of work, and Serv. Co. provides inspection records to Eng. Co. Then, Eng. Co. verifies that all work has been completed as per the Inspection Plan, and on this basis issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 6 Commentary

In this case, Eng. Co. has not necessarily ensured that all inspections required by the OEM have been completed. For this crane, the operator manual contains specific instructions for crane inspection following an overload. Before certifying the crane as Safe for Use, Eng. Co. should have reviewed these instructions and confirmed that their structural, mechanical, and controls inspections covered all the items required by the OEM. For other types of crane, the manual might not contain similar instructions. If this is the case, it is prudent to contact the OEM for guidance on how to proceed with the Special Inspection.

B1.2 MOVABLE WORK PLATFORM

BACKGROUND INFORMATION

Rent Co. owns a fleet of manlifts. Rent Co. operates its own maintenance facility and has crane mechanics on staff who perform Preventive Maintenance activities. Rent Co. has an existing relationship with Eng. Co., and together they have implemented an inspection and Preventive Maintenance program that includes daily, monthly, and Annual Inspections and Preventive Maintenance, as per the OEM recommendations. Under the *OHSR*, the Equipment must be inspected and maintained to both the requirements of an applicable standard defined in regulation and those of the OEM. In this case Rent. Co. has elected to follow the standard *CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms*, which requires daily, frequent (monthly), and periodic (annual) inspections of the Equipment. Eng. Co. has confirmed that the Preventive Maintenance program for the crane also includes all items required by *CSA B354.4*.

Rent Co. requests that Eng. Co. perform an Annual Inspection on one of its Equipment and provide complete Preventive Maintenance and inspection records for the units.

SCENARIO 1

Eng. Co. reviews the Preventive Maintenance and inspection records and confirms that all Mechanical Components and Control Components have been inspected and maintained as per the requirements of the OEM and *CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms*. On this basis, Eng. Co. develops a written Inspection Plan that includes the following:

1. Eng. Co. will carry out visual inspection of the Structural Components of the Equipment, as well as NDT of critical and suspect areas.
2. Eng. Co. will witness an operational check of the Equipment and confirm that it is operating as intended by the OEM.

Eng. Co. confirms that all work has been completed as per the Inspection Plan, and on this basis issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 1 Commentary

As Eng. Co. was previously involved in setting up the inspection and Preventive Maintenance program for the company, it is reasonable that it could accept records of these inspections as proof of required inspections of the Mechanical and Control Components.

One potential area of concern is the potential conflict of interest of having employees of Rent Co. inspect their own Equipment; however, this is mitigated by the fact that Eng. Co. has witnessed a final operational check of the crane.

In this scenario, Eng. Co. has not verified the qualification of the personnel involved in the inspection; this is an item that should be addressed prior to Certification.

SCENARIO 2

Eng. Co. reviews the Preventive Maintenance and inspection records and finds gaps in the records where the required frequent and periodic inspections of the Equipment were not completed as expected. Further, Eng. Co. notes that Rent Co. has recently hired new mechanics that Eng. Co. does not know. On this basis, Eng. Co. develops a written Inspection Plan for the Equipment that includes the following:

1. Rent Co. will supply Eng. Co. with evidence of their new Equipment mechanics' qualifications.
2. Rent Co. will carry out the Annual Mechanical and Controls Inspection of the Equipment. This will include all items listed in the OEM service manual, including daily, monthly, and Annual Inspections, as well as all items listed in *CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms*.
3. Eng. Co. will carry out visual inspection of the Structural Components of the Equipment, as well as NDT of critical and suspect areas.

4. Eng. Co. will witness an operational check of the Equipment and confirm that the Equipment is operating as intended by the OEM.

Eng. Co. verifies that all work has been completed as per the Inspection Plan, and on this basis issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the Equipment valid for a period of one year.

Scenario 2 Commentary

As Eng. Co. was previously involved in setting up the inspection and Preventive Maintenance program for the company, it is reasonable that it could accept records of these inspections as proof of required inspections of the Mechanical Components and Control Components.

However, the gaps found in the inspection records should prompt Eng. Co. to question whether the inspection and Preventive Maintenance program is functioning as intended. It is recommended that the Eng. Co. EOR brings this issue to the attention of the Client to ensure it is aware that some deficiencies exist in their inspection and maintenance program, and that a failure to operate and maintain the Equipment in accordance with the requirements of the OEM and *OHSR* may void the Certification.

In this scenario, Eng. Co. has ensured that all inspections required by the OEM and by *CSA B354.4 Self-propelled Boom-Supported Elevating Work Platforms* have been completed. However, Eng. Co. must also consider whether the Inspection Plan will detect any potential issues that could arise in the future, resulting from the lack of Preventive Maintenance.

One potential area of concern is the potential conflict of interest of having employees of Rent Co. inspect their own Equipment; however, this is mitigated by the fact that Eng. Co. has witnessed a final operational check of the Equipment.

B1.3 MOBILE CRANE

BACKGROUND INFORMATION

Crane Co. owns a lattice boom crawler Mobile Crane, which it recently purchased from an auction. The crane is approximately eight years old and has been in operation for 9,200 hours. Under the *OHSR*, the crane must be inspected and maintained to the requirements of both an applicable standard defined in regulation and those of the OEM. In this case, Crane Co. has elected to follow the standard of *CSA Z150 Safety Code on Mobile Cranes*, which requires daily, periodic, and Annual Inspections of the crane, and, every five years, a teardown inspection of the swivel, hook, and block assembly. In addition, the OEM has supplied a service manual which details daily, weekly, monthly, quarterly, semi-annual, Annual, and bi-Annual Inspections. The EOR for Eng. Co. has reviewed the service manual and noted that the OEM also requires replacement of the hydraulic hoses between 4,000 to 8,000 hours of operation, and replacement of the electrical harnesses and cables after 8,000 hours of operation. Crane Co. has approached Eng. Co. and asked for an NDT inspection of the crane.

Based on the available information, Eng. Co. explains to Crane Co. that an NDT inspection of the crane will not meet the requirements of the *OHSR*. All the inspections required by *CSA Z150* and the OEM must be completed, and given the age of the crane, the OEM requires that the hydraulic hoses and electrical harnesses and cables must also be replaced.

SCENARIO 1

Crane Co. is under a tight deadline and wants to deploy its crane to a job site in the next week. It is unaware of its obligations under the *OHSR* and believes that the crane requires only a quick NDT inspection.

Eng. Co. talks to Crane Co.'s maintenance manager and asks for the Preventive Maintenance records. Crane Co. has some recent inspection records, but they are not detailed. Further, Crane Co. has no records of inspection or maintenance from the period prior to its

purchase of the crane in an auction three months before. Crane Co. states that the crane had previously belonged to Lift Co., which is a respected industry leader in the field of materials handling and has comprehensive programs for inspection and Preventive Maintenance. Crane Co. states that although it has no written records of past Preventive Maintenance, the fact that the crane previously belonged to Lift Co. means that it is a "good crane" and that Eng. Co. should have no issue signing off on it.

Eng. Co. agrees with this rationale, since Lift Co. has an excellent reputation in the industry. Eng. Co. carries out an Annual Structural Inspection on the crane and then issues a full Structural, Mechanical, and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 1 Commentary

In this scenario, Eng. Co. has not met its obligations under the *OHSR*. Eng. Co. has not verified that the daily, weekly, monthly, quarterly, semi-annual, annual, and bi-Annual Inspections were carried out by a Qualified Person. Further, Eng. Co. did not prepare a written Inspection Plan, nor did it ensure that required activities including a teardown inspection of the swivel, hook, and block, and replacement of hydraulic hoses and electrical cables have been completed.

SCENARIO 2

Crane Co. is under a tight deadline and wants to deploy its crane to a job site in the next week. It is unaware of its obligations under the *OHSR* and believes that the crane requires only a quick NDT inspection.

Eng. Co. talks to Crane Co.'s maintenance manager and asks for Preventive Maintenance records. Crane Co. has inspection records that are kept in a logbook. Upon reviewing the logbook, Eng. Co. confirms that the hydraulic hoses and the electrical cables and connectors were replaced by the previous Owner, but it is difficult for Eng. Co. to confirm that all items required by the OEM have been inspected.

Eng. Co. provides Crane Co. with a set of checklists from the OEM for the daily, weekly, monthly, quarterly, semi-annual, Annual, and bi-Annual Inspections and asks Crane Co. to go through their logbook to confirm all items have been completed. Four days later, Crane Co. supplies a partially completed set of checklists to Eng. Co., which shows that Crane Co. has records of completing all items required for the daily, weekly, monthly, and quarterly inspections, and most of the items for the semi-annual, annual and bi-Annual Inspections.

Eng. Co. then creates a list of items yet to be completed, and supplies this list to Crane Co. Then, Crane Co. arranges to have these items completed. Eng. Co. completes an Annual Structural Inspection on the crane and witnesses a final operational check on the crane, during which it is confirmed that the crane and all of its safety features operate as intended by the OEM.

Eng. Co. issues a full Structural, Mechanical and Controls – Safe for Use Certification for the crane valid for a period of one year.

Scenario 2 Commentary

In this scenario, Eng. Co. has, in principle, ensured that all inspections required by the OEM and by *CSA Z150 Safety Code on Mobile Cranes* have been completed. However, by relying on Crane Co. to compile service records into an acceptable format, it is possible that Crane Co. may miss some items. A potentially better solution would be to arrange for a complete inspection of the crane by Qualified Persons, using the OEM-supplied checklists.

SCENARIO 3

Crane Co. is under a tight deadline and wants to deploy its crane to a job site the following week. It is unaware of its obligations under the *OHSR* and believes that the crane requires only a quick NDT inspection.

Crane Co. has some recent inspection records, but they are not detailed. Further, Crane Co. has no records of inspection or maintenance from the period prior to its

purchase of the crane in an auction three months before. Crane Co. states that the crane had previously belonged to Lift Co, which is a respected industry leader in the field of materials handling and has comprehensive programs for inspection and Preventive Maintenance. Crane Co. states that although it has no written records of past Preventive Maintenance, the fact that the crane previously belonged to Lift Co. means that it is a "good crane" and that Eng. Co. should have no issue signing off on it.

Eng. Co. disagrees with this rationale and explains to Crane Co. that in order meet the requirements of the *OHSR*, both the Annual Mechanical and Controls Inspection, as well as the Annual Structural Inspection, must be completed. Eng. Co. directs Crane Co. to refer to the Engineers and Geoscientists BC *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia* and the *OHSR*. Eng. Co. also informs Crane Co. that if it does not have instructions or Documentation for the Annual Mechanical and Controls Inspection, Eng. Co. can assist Crane Co. in developing them.

Crane Co. refuses to perform the Annual Mechanical and Controls Inspection, as it believes that would be too expensive, and it does not have time to complete that before its project commences.

Eng. Co. has two options for responding to Crane Co.'s decision:

- Option 1

  Eng. Co. informs Crane Co. that Eng. Co. can perform the Annual Structural Inspection and provide Crane Co. with a Structural Inspection Certification. However, in order to do so, Eng. Co. will need to create a written Inspection Plan, which may require disassembly of components for inspection—a step that may not be required during a typical inspection, but is required in this case due to the lack of Documentation currently available.

  Additionally, Eng. Co. informs Crane Co. that Eng. Co. will clearly note on its Documentation that the Annual Mechanical and Controls Inspection was not completed, and that the Certification will only apply to the Annual Structural Inspection. If Eng. Co. is questioned by WorkSafeBC, it is also obligated to inform WorkSafeBC that Crane Co. has declined to complete the mandatory Annual Mechanical and Controls Inspection.

- Option 2

  Eng. Co. declines to provide any services to Crane Co.

Scenario 3 Commentary

In this scenario, Eng. Co. has two options available, as described above.

If Eng. Co. chooses to proceed with Option 1, it must clearly communicate to Crane Co. the scope of the work that Eng. Co. will perform, and that the Certification Eng. Co. will provide is not sufficient for Crane Co. to comply with the requirements of an Annual Inspection Certification as per the *OHSR*.

Under Option 2, the EOR for Eng. Co. may decide that Crane Co.'s refusal to comply with the *OHSR* could signal other potential issues in dealing with Crane Co. with respect to any work that Eng. Co. may perform; therefore, Eng. Co. may decline to provide any services to Crane Co.

B1.4 AERIAL DEVICE

BACKGROUND INFORMATION

Power Co. owns a vehicle-mounted, insulated Aerial Device. The device was qualified as a category B unit for work at voltages up to 69 kV, in accordance with *CAN/CSAC225 Vehicle-mounted Aerial Devices*. Under the *OHSR*, the Aerial Device must be inspected and maintained in accordance with the requirements of the OEM and *CAN/CSA-C225*, which requires daily, monthly (frequent), and annual (periodic) inspections. One of the requirements of the annual (periodic) inspections is a dielectric test to confirm the insulating properties of the boom.

SCENARIO 1

As a large utility company, Power Co. has its own maintenance and repair facility. Power Co. has a wide variety of Equipment, including several different models of insulated Aerial Devices from multiple manufacturers. To simplify the work carried out by its mechanics, Power Co. has developed a generic Preventive Maintenance and inspection program for all its Equipment. This includes daily, monthly, and Annual Inspections. Power Co. employs an Engineering Professional, Eng. K, in its maintenance facility who has ensured that this generic program covers all items required by the OEM and *CAN/CSA-C225 Vehicle-mounted Aerial Devices*. Power Co. also has an internal facility to carry out annual dielectric tests on its insulated Equipment.

Based on Power Co.'s internal inspection and maintenance programs, Eng. K has issued a Limited Certification for the Mechanical Components and the Control Components.

Eng. Co. has been hired by Power Co. to perform an Annual Structural Inspection. Eng. Co. creates a written Inspection Plan that includes visual inspection and NDT of the Aerial Device. The Annual Structural Inspection reveals no areas of concern. Eng. Co. issues a Safe For Use Certification – Structural, Mechanical, and Controls on the basis of its Annual Structural Inspection and the Limited Certification – Mechanical and Controls it received from Eng. K.

Scenario 1 Commentary

In this scenario, two separate Engineering Professionals have taken responsibility for the inspection and Preventive Maintenance of the crane.

Eng. K. has provided a Certification for the Annual Inspection of the Mechanical and Control Components, while the EOR for Eng. Co. has provided an annual Certification for the inspection of the Structural Components.

The EOR for Eng. Co. has then acted as the EOR for the overall annual Certification by issuing a Safe For Use Certification – Structural, Mechanical and Controls, which indicates who was responsible for each portion of the work performed and states that the Equipment is Safe for Use.

SCENARIO 2

As a large utility company, Power Co. has its own maintenance and repair facility. Power Co. has a wide variety of Equipment, including several different models of insulated Aerial Devices from multiple manufacturers. To simplify the work carried out by their mechanics, Power Co. has developed a generic Preventive Maintenance and inspection program for all of its Equipment. This includes daily, monthly, and Annual Inspections. Power Co. employs an Engineering Professional, Eng. K, in its maintenance facility, who has ensured that this generic program covers all items required by the OEM and *CAN/CSA C225 Vehicle-mounted Aerial Devices*. Power Co. also has an internal facility to carry out annual dielectric tests on its insulated Equipment.

Based on Power Co.'s internal inspection and maintenance programs, Eng. K has issued a Limited Certification for the Mechanical and Control Components of an insulated Aerial Device.

Eng. Co. has been hired by Power Co. to perform an Annual Structural Inspection on the insulated Aerial Device. Eng. Co. creates a written Inspection Plan that includes visual inspection and NDT of the Aerial Device. While performing the inspection, Eng. Co. notices that there are black (non-insulated) hydraulic hoses installed that pass through the insulated section of the Aerial Device. Based on Eng. Co.'s knowledge of the applicable standard, it knows that the use on non-insulated hoses is not permitted on an Aerial Device that is classified for use as insulating. However, Eng. Co. does not note this in its inspection report, as it believes Eng. K is responsible for the Mechanical Components and the Control Components. Eng. Co. issues a Safe For Use Certification – Structural, Mechanical, and Controls on the basis of its Annual Structural Inspection and on the Limited Certification – Mechanical and Controls it received from Eng. K.

Scenario 2 Commentary

In this scenario, Eng. K. may be found to have demonstrated negligence or unprofessional conduct, or to have breached the Association's Code of Ethics, as a result of issuing a Certification for Equipment that had a deficiency.

Although Eng. Co. is not formally responsible for the inspection of the Mechanical Components and the Control Components, its EOR could also be found to have demonstrated unprofessional conduct, or to have breached the Association's Code of Ethics (by failing to hold paramount the safety, health, and welfare of the public), as a result of not informing Eng. K. that Eng. Co. had noted the non-insulated hydraulic hoses during its Annual Structural Inspection.

In this situation, the EOR for Eng. Co. should have followed up with Eng. K. for answers as to why non-insulated hydraulic hoses had been used in an insulated Aerial Device. This would have given Eng. K. an opportunity to review and audit Power Co.'s inspection program and rectify the deficiency.

APPENDIX C: CERTIFICATION ASSURANCE FORMS

The following Certification forms have been developed to address inconsistencies and confusion with the documentation of Certifications that have been submitted in the past. These forms provide a level of clarity to Clients and WorkSafeBC personnel when they review documentation of Certifications.

These forms also assist in mitigating the risks to the Engineering Professional issuing the Certification, as they were developed by the Association in consultation with WorkSafeBC.

While use of these forms is not mandatory, Engineering Professionals providing Certifications for Equipment are expected to otherwise adhere to these guidelines and provide a satisfactory form of Certification.

Below is a summary of the purpose of each form; more information on these forms can be found in Section 3.8 Certification of these guidelines. Capitalized and underlined words in the forms are defined terms; see the Defined Terms section of these guidelines.

- **Safe for Use Certification Form – Structural, Mechanical, Controls**
  - This primary Certification form is used when the Engineer of Record (EOR) takes overall responsibility for Certification of the Structural Components, Mechanical Components, and Control Components of the Equipment.
- **Limited Certification Form – Mechanical and Controls**
  - This Certification form is used when the EOR relies on the assurance of another Engineering Professional for inspection of the Mechanical Components and Control Components of the Equipment. The Engineering Professional who has certified inspection of the Mechanical Components and Control Components of the Equipment completes this form and provides it to the EOR for the EOR's records. The EOR may base the final full Certification of the Equipment on this Limited Certification and the EOR's own inspection of the Structural Components.
- **Limited Certification Form – Structural**
  - This Certification form is only used for inspections of simple structures that do not have Mechanical Components and Control Components (e.g., spreader bars and other below-the-hook lifting devices) or where only an Annual Structural Inspection is required.

SAFE FOR USE CERTIFICATION FORM – STRUCTURAL, MECHANICAL, CONTROLS

This certificate is to be read and completed in conjunction with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*. Capitalized and underlined words are defined terms; see the **Defined Terms** section of the guidelines.

Equipment make:	_____	Engineering firm:	_____
Equipment model:	_____	Engineer of Record (EOR):	_____
Serial number:	_____	Professional designation:	_____
Unit number (optional):	_____	Professional association:	_____
Inspection Plan reference:	_____	Certificate date:	_____
Certificate reference:	_____	Certificate expiry date:	_____

COMPONENTS EXCLUDED FROM CERTIFICATION

The following components are excluded from the Certification of this Equipment:

☐ Pin on jib ☐ Hydraulic jib ☐ Auxiliary winch ☐ Grapple

☐ Heavy lift block ☐ Other: _____

ANNUAL STRUCTURAL INSPECTION

I have prepared the referenced Annual Structural Inspection Report in accordance with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia* and confirm that the information recorded in it is accurate.

Annual Structural Inspection Report reference: _____

That report must be read in conjunction with the following statement.

In preparing the Annual Structural Inspection Report, I have:

[Check to the left of applicable items. If any items are not checked, the reasons should be explained in the Annual Structural Inspection Report*.]*

___ 1. Collected and confirmed appropriate background information

___ 2. Established a written Inspection Plan for the Structural Components of the Equipment, based on this background information

___ 3. Carried out, or directly supervised, the structural inspections of the Equipment, in accordance with the written Inspection Plan

___ 4. Confirmed that any required structural repairs or Modifications were completed either following instructions from the Original Equipment Manufacturer or under the direct supervision of a qualified Engineering Professional

___ 5. Incorporated recommendations and/or assessments from other Engineering Specialists

continued…

ANNUAL MECHANICAL AND CONTROLS INSPECTION

Check one:

☐ I confirm that the referenced Annual Mechanical and Controls Inspection Report has been prepared in accordance with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*, and that the information recorded in it is accurate.

Annual Mechanical and Controls Inspection Report Reference: _____

That report must be read in conjunction with the following statement.

In confirming the contents of the Annual Mechanical and Controls Inspection Report, I have:

[Check to the left of applicable items. If any items are not checked, the reasons should be explained in the Annual Mechanical and Controls Inspection Report*.]*

___ 1. Collected and confirmed appropriate background information

___ 2. Established a written Inspection Plan for the Mechanical Components and Control Components of the Equipment, based on this background information

___ 3. Reviewed my Client's records for inspection and Preventive Maintenance of Mechanical Components and Control Components and confirmed that these records indicate that all Mechanical Components and Control Components required by the Inspection Plan have been inspected and that there are no deficiencies that would affect the safe operation of the Equipment

___ 4. Confirmed the qualifications of the personnel performing the work

___ 5. Identified, characterized, and determined the magnitude of deficiencies in the safe operation of the Equipment

☐ I base my Certification of the Mechanical Components and Control Components of the Equipment on the opinion of another qualified professional:

Name of professional: _____ Professional association: _____

Professional designation: _____ Certificate reference: _____

Annual Mechanical and Controls Inspection Report reference: _____

☐ This Equipment has no Mechanical Components or Control Components.

continued…

CERTIFICATION

I am a qualified Engineering Professional and I hereby certify that, prior to the expiry date indicated above, the referenced Equipment is Safe for Use as required by the *Occupational Health and Safety Regulations* (B.C. Reg 296/97).

I provide this Certification based on the facts as set out in the referenced inspection reports and the reasonable assumptions and assessments that I have made in accordance with the guidance in the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*.

(Seal and Signature)

Date: _____

LIMITED CERTIFICATION FORM – MECHANICAL AND CONTROLS

This certificate is to be read and completed in conjunction with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*. Capitalized and underlined words are defined terms; see the **Defined Terms** section of the guidelines.

Equipment make:		Engineering firm:	
Equipment model:		Engineer of Record (EOR):	
Serial number:		Professional designation:	
Unit number (optional):		Professional association:	
Inspection Plan reference:		Certificate date:	
Certificate reference:		Certificate expiry date:	

COMPONENTS EXCLUDED FROM CERTIFICATION

The following components are excluded from the Certification of this Equipment:

☐ Pin on jib ☐ Hydraulic jib ☐ Auxiliary winch ☐ Grapple
☐ Heavy lift block ☐ Other: _____

ANNUAL MECHANICAL AND CONTROLS INSPECTION

I confirm that the referenced Annual Mechanical and Controls Inspection Report has been prepared in accordance with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*, and that the information recorded in it is accurate.

Annual Mechanical and Controls Inspection Report reference: _____

That report must be read in conjunction with the following statement.

In confirming the contents of the Annual Mechanical and Controls Inspection Report, I have:
[Check to the left of applicable items. If any items are not checked, the reasons should be explained in the Annual Mechanical and Controls Inspection Report*.]*

___ 1. Collected and confirmed appropriate background information

___ 2. Established a written Inspection Plan for the Mechanical Components and Control Components of the Equipment, based on this background information

___ 3. Reviewed my Client's records for inspection and Preventive Maintenance of Mechanical Components and Control Components and confirmed that these records indicate that all Mechanical Components and Control Components required by the Inspection Plan have been inspected and that there are no deficiencies that would affect the safe operation of the Equipment

___ 4. Confirmed the qualifications of the personnel performing the work

___ 5. Identified, characterized, and determined the magnitude of deficiencies in the safe operation of the Equipment

continued…

CERTIFICATION

I am a qualified Engineering Professional and I hereby provide a Limited Certification of only the Mechanical Components and the Control Components of the referenced Equipment for the period prior to the expiry date indicated above.

I provide this Limited Certification based on the facts as set out in the referenced Annual Mechanical and Controls Inspection Report and the reasonable assumptions and assessments that I have made in accordance with the guidance in the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*.

(Seal and Signature)

Date: _____

LIMITED CERTIFICATION FORM – STRUCTURAL

This certificate is to be read and completed in conjunction with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*. Capitalized and underlined words are defined terms; see the **Defined Terms** section of the guidelines.

Equipment make:	_____	Engineering firm:	_____
Equipment model:	_____	Engineer of Record (EOR):	_____
Serial number:	_____	Professional designation:	_____
Unit number (optional):	_____	Professional association:	_____
Inspection Plan reference:	_____	Certificate date:	_____
Certificate reference:	_____	Certificate expiry date:	_____

COMPONENTS EXCLUDED FROM CERTIFICATION

The following components are excluded from the Certification of this Equipment:

☐ Pin on jib ☐ Hydraulic jib ☐ Auxiliary winch ☐ Grapple

☐ Heavy lift block ☐ Other: _____

ANNUAL STRUCTURAL INSPECTION

I have prepared the referenced Annual Structural Inspection Report in accordance with the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*, and confirm that the information recorded in it is accurate.

Annual Structural Inspection Report reference: _____

That report must be read in conjunction with the following statement.

In preparing the Annual Structural Inspection Report, I have:

[Check to the left of applicable items. If any items are not checked, the reasons should be explained in the Annual Structural Inspection Report*.]*

___ 1. Collected and confirmed appropriate background information

___ 2. Established a written Inspection Plan for the Structural Components of the Equipment, based on this background information

___ 3. Carried out, or directly supervised, the structural inspections of the Equipment, in accordance with the written Inspection Plan

___ 4. Confirmed that any required structural repairs or Modifications were completed, either following instructions from the Original Equipment Manufacturer or under the supervision of a qualified Engineering Professional

___ 5. Incorporated recommendations or assessment results from other Engineering Specialists

continued…

CERTIFICATION

I am a qualified Engineering Professional and I hereby provide a Limited Certification of only the Structural Components of the referenced Equipment for the period prior to the expiry date indicated above.

I provide this Limited Certification based on the facts as set out in the referenced Annual Structural Report and the reasonable assumptions and assessments that I have made in accordance with the guidance in the *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia*.

(Seal and Signature)

Date: _____

APPENDIX D: SAMPLE INSPECTION PLAN

The sample Inspection Plan in this appendix has been tailored according to the Scenario 1 case in Appendix B: Case Studies of these guidelines, under Section B1.1 Mobile Crane.

Inspection Plans are not required to be laid out in this exact format; however, this example shows the typical logical flow of information and level of detail required for a Safe for Use Certification.

Capitalized and underlined words are defined terms; see the Defined Terms section of these guidelines.

ENG. CO. – CRANE INSPECTION PLAN

Make	National	**Plan number**	EC-4321
Model	900A	**Revision number**	0
Serial number	1234	**Date**	26 Aug 2019
In-service date	01 Aug 2013	**Engineer of Record (EOR)**	Eng. One
Last boom teardown	Unknown	**Structural inspections**	Eng. Co. (EC)
Last hook block teardown	Unknown	**Mechanical and controls inspections**	Serv. Co. (SC)
Governing standard	CSA Z150		

ITEM #	ITEM	ACTIVITIES	ACCEPTANCE CRITERIA	RESPONSIBLE PARTY	COMPLETE (✓)
1	2	3	4	5	6
1.0	**PRELIMINARY DOCUMENTATION**				
1.1	Equipment logbook	SC to submit to EOR to review	Not applicable	EOR	
1.2	OEM maintenance manual	SC to submit to EOR to review	Not applicable	EOR	
1.3	Service bulletins	SC to submit to EOR to review	Not applicable	EOR	
2.0	**INSPECTOR QUALIFICATIONS**				
2.1	Structural inspector qualifications	Inspector to submit to EOR for review	CSA W178.2 *Guidelines*, Section 2.25	EOR	
2.2	NDT technicians qualifications	Technicians to submit to EOR for review	CAN/CGSB 48.9712	EOR	
2.3	Mechanical and maintenance personnel qualifications	SC to qualify their inspectors and submit records to EOR	*Guidelines*, Section 2.26	SC	
2.4	Crane operator	SC to confirm operator is qualified	Fulford CraneSafe Certificate, Level D	SC	

ENG. CO. – CRANE INSPECTION PLAN

Make	National	**Plan number**	EC-4321
Model	900A	**Revision number**	0
Serial number	1234	**Date**	26 Aug 2019
In-service date	01 Aug 2013	**Engineer of Record (EOR)**	Eng. One
Last boom teardown	Unknown	**Structural inspections**	Eng. Co. (EC)
Last hook block teardown	Unknown	**Mechanical and controls inspections**	Serv. Co. (SC)
Governing standard	CSA Z150		

ITEM #	ITEM	ACTIVITIES	ACCEPTANCE CRITERIA	RESPONSIBLE PARTY	COMPLETE (✓)
3.0	**CRANE INSPECTION**				
3.1	Inspection Plan	EOR to complete Inspection Plan and provide it to the applicable personnel	Not applicable	EOR	
3.2	Preliminary operations check	SC to carry out initial operations check, and record results on operations checklist	CSA Z150	SC	
3.3	Boom disassembly	SC to disassemble boom	CSA Z150	SC	
3.4	Load block disassembly	SC to disassemble load block	CSA Z150	SC	
3.5	Structural inspection (disassembled)	EC to carry out structural inspection of crane while disassembled, and record results on structural inspection checklist	CSA Z150	EC	
3.6	Mechanical and controls inspection (after reassembly)	SC to carry out OEM-scheduled maintenance, including daily, weekly, monthly, and periodic inspections, and record results on OEM-supplied checklist	National 900A maintenance manual CSA Z150	SC	
3.7	Stability test	SC to stability test crane as per OEM instructions, and record results on stability test form	National 900A maintenance manual	SC	
3.8	Final operations test	SC to perform final operations test; EC to witness and record results on operations checklist	CSA Z150	SC	
4.0	**STRUCTURAL REPAIRS**				
4.1	OEM repair available	SC to confirm if OEM repair instruction exists	Not applicable	SC	
4.2	Confirm materials	If OEM instructions are not available, EC to confirm material grade	Not applicable	EC	
4.3	Welding procedure	SC to confirm they have a suitable welding procedure for material and position, and submit to EOR for review	CSA W59	SC	

ENG. CO. – CRANE INSPECTION PLAN

Make	National	**Plan number**	EC-4321
Model	900A	**Revision number**	0
Serial number	1234	**Date**	26 Aug 2019
In-service date	01 Aug 2013	**Engineer of Record (EOR)**	Eng. One
Last boom teardown	Unknown	**Structural inspections**	Eng. Co. (EC)
Last hook block teardown	Unknown	**Mechanical and controls inspections**	Serv. Co. (SC)
Governing standard	CSA Z150		

ITEM #	ITEM	ACTIVITIES	ACCEPTANCE CRITERIA	RESPONSIBLE PARTY	COMPLETE (✓)
4.4	Welder qualifications	SC to confirm they have a suitable welder for process and position, and submit welder qualifications for review	CSA W47.1	SC	
4.5	Repair procedure	EOR to develop repair procedure (if OEM procedure not available)	CSA Z150 CSA W59	EC	
4.6	Re-inspection	EC to re-inspect weld repairs, and record results on structural inspection checklist	CSA W59, Section 12	EC	
5.0	**MECHANICAL AND CONTROLS REPAIRS**				
5.1	Modifications	SC to notify EOR of any proposed Modifications to the crane	*OHSR*	SC	
6.0	**FINAL CERTIFICATION**				
6.1	Review inspection and repair records	EOR to review all inspection and repair records and this Inspection Plan, to confirm all items have been completed	*OHSR* CSA Z150	EC	
6.2	Issue Certification	EOR to issue Certification of the crane using the appropriate Safe For Use Certification form	*Guidelines*	EC	

NOTES:

Capitalized and underlined words are defined terms. See the **Defined Terms** section of the Engineers and Geoscientists British Columbia *Professional Practice Guidelines – Annual Equipment Inspection and Certification in British Columbia* (*Guidelines*)

Abbreviations:

CSA = Canadian Standards Association
EC = Eng. Co.
EOR = Engineer of Record
OEM = Original Equipment Manufacturer
OHSR = *Occupational Health and Safety Regulation*
SC = Serv. Co.

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