PROFESSIONAL PRACTICE GUIDELINES

BUILDINGS

MECHANICAL ENGINEERING SERVICES FOR BUILDING PROJECTS

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PREFACE

These *Professional Practice Guidelines – Mechanical Engineering Services for Building Projects* were developed by Engineers and Geoscientists British Columbia to guide professional practice related to mechanical engineering services for building projects in British Columbia (BC). As part of its mandate to protect the public interest by setting and maintaining professional practice standards, Engineers and Geoscientists BC works with experts in their fields to develop professional practice guidelines for its Registrants.

The first version of these guidelines was published in 1993. This revision was undertaken to reflect current industry standards and practices and to update the content to reference the *Professional Governance Act*.

This document was prepared for the information of Engineering Professionals, statutory decisionmakers, regulators, the public, and other stakeholders who might be involved in, or have an interest in, mechanical engineering services for building projects in BC. They provide various stakeholders with clarity on the expected level of effort, due diligence, and practices to be followed when carrying out these projects.

These guidelines establish the expectations and obligations of professional practice in relation to the specific professional activity of mechanical engineering services for building projects 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
BCBC	*British Columbia Building Code*
CER	Civil Engineer of Record
CRP	Coordinating Registered Professional
EER	Electrical Engineer of Record
EMS	Energy Modelling Supervisor
GER	Geotechnical Engineer of Record
MER	Mechanical Engineer of Record
NBC	*National Building Code of Canada*
NECB	*National Energy Code of Canada for Buildings*
RPR	Registered Professional of Record
SRP	Supporting Registered Professional
VBBL	Vancouver Building By-law

DEFINED TERMS

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

TERM	DEFINITION
Act	*Professional Governance Act* [SBC 2018], Chapter 47.
Authority Having Jurisdiction	The jurisdictional body (usually municipal) with authority to administer and enforce the *British Columbia Building Code* (*BCBC*), the City of Vancouver Building By-law (VBBL), the *National Building Code of Canada* (*NBC*), or a local building bylaw or code, as well as government agencies that regulate a particular function in a building (for example, Technical Safety BC as a regulatory authority with respect to elevating devices, boilers, chillers, refrigeration plants, or gas and fuels systems).
Bylaws	The Bylaws of Engineers and Geoscientists BC made under the *Act*.
Client	The party who engages the Mechanical Engineer of Record to provide professional mechanical engineering services.
Commissioning	The documentation and verification necessary to ensure that the systems will function to meet design intent, and that the tuning of the systems will meet the Owner's operational requirements. Generally, the post-Commissioning phase would include monitoring through the first year of seasonal operations.
Contract Documents	All documents, including the engineering and architectural drawings and Specifications, referenced in the construction contract(s) for the construction of the building.
Coordinating Registered Professional	Defined in the *BCBC* as a Registered Professional retained to coordinate all design work and Field Reviews of the Registered Professionals who are required for a project.
Electrical Engineer of Record	The Engineering Professional with general responsibility for the electrical integrity and completeness of the electrical systems.
Engineering Professional	Professional engineers, professional licensees engineering, and any other individuals registered or licensed by Engineers and Geoscientists BC as a "professional registrant" as defined in Part 1 of the Bylaws.
Engineers and Geoscientists BC	The Association of Professional Engineers and Geoscientists of the Province of British Columbia, also operating as Engineers and Geoscientists BC.
Fabricator	The Subcontractor responsible for the supply and fabrication of components to satisfy a specific portion of a contract.

TERM	DEFINITION
Field Reviews	The reviews conducted at the site of the implementation or construction of the engineering work by an Engineering Professional, or a subordinate acting under the Engineering Professional's direct supervision, for the purpose of ascertaining whether the implementation or construction of the work substantially complies in all material respects with the engineering concepts or intent reflected in the engineering documents prepared for the work. Defined in the *BCBC* as follows: "Field Review means a review of the work (a) at a building site, and (b) where applicable, at locations where building components are fabricated for use at the building site that a Registered Professional in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the Registered Professional."
Field Services	The services provided by the Mechanical Engineer of Record to ascertain if the mechanical construction work is generally in accordance with the mechanical Contract Documents (see Section 3.3.2.6 Construction Stage, under the subsection Field Reviews).
Final Design Drawings	Drawings prepared by the Registered Professional of Record that reflect design changes made during construction and incorporate contract-related items such as addenda and change orders, but do not include as-constructed information provided by others. These drawings must be signed, sealed, and dated by the Registered Professional of Record who assumes overall responsibility for the design (see Section 4.1.2 Authenticating Documents).
Letters of Assurance	Uniform, mandatory documents that are intended to clearly identify the responsibilities of key individuals in a building project, and which are executed in accordance with the applicable building code.
Maintenance Manual	A collection of documentation (in paper or electronic form) containing all the necessary technical information on mechanical systems for the building Owner or operator to carry out maintenance and operation of the equipment installed under a contract.
Mechanical Engineer of Record	The Engineering Professional with general responsibility for the mechanical integrity of the mechanical systems (see Section 2.0 Roles and Responsibilities).
Owner	Any individual, firm, or corporation controlling the property under consideration during the period of application of the building code.
Prime Contractor	The contractor who is engaged to do substantially all of the construction work for a project, whether or not others are engaged as Subcontractors, material suppliers, or workers.

TERM	DEFINITION
Record Drawings	Drawings prepared as a record of what was actually constructed, which may include measurements, elevations, and sizes. Record Drawings are typically prepared by a Prime Contractor or Subcontractor and should not be sealed by the Registered Professional of Record, unless an appropriate declaration is added (see Section 4.1.2 Authenticating Documents).
Registered Professional	Defined in the *BCBC* as: "a) a person who is registered or licensed to practice as an architect under the *Architects Act*, or b) a person who is registered or licensed to practice as a professional engineer under the *Engineers and Geoscientists Act*." The *Engineers and Geoscientists Act* was replaced by the *Professional Governance Act* and Engineers and Geoscientists BC Bylaws on February 5, 2021. As per these legislative documents, the definition of professional engineer can include professional engineers and licensees having the appropriate scope of practice, all of whom must be qualified by training or experience to provide designs for building projects. In this document, Registered Professionals who are registered or licensed with Engineers and Geoscientists BC are referred to as "Engineering Professionals".
Registered Professional of Record	Defined in the *BCBC* as a Registered Professional retained to undertake design work and Field Reviews in accordance with Subsection 2.2.7. of Division C.
Registrant	Means the same as defined in Schedule 1, section 5 of the *Professional Governance Act*.
Specialty Engineer	The Engineering Professional who prepares the design and supervises the preparation of documents for specific elements of the project, such as seismic restraint and alternative energy systems. The Specialty Engineer seals specific element designs and documents prepared by or under the Specialty Engineer's direct supervision, and takes responsibility for such elements. In some circumstances, the Specialty Engineer provides supplementary supporting engineering services to the Mechanical Engineer of Record as a Supporting Registered Professional, and in this capacity would sign and seal Schedules S-B and S-C (see the definition for Supporting Registered Professional below).
Specifications	The written requirements for materials, construction, and the standards for products, systems, workmanship, quality, and services in a building project, as provided for in the Contract Documents.
Subcontractor	A contractor who has a contract with the Prime Contractor to provide labour, materials, and equipment for the execution and quality control of portions of the work shown in the Contract Documents. The Subcontractor's work is generally performed under the direct supervision of the Prime Contractor.
Submittal(s)	Items required by the Contract Documents to be submitted by the Prime Contractor, such as requests for payment, progress reports, shop drawings, manufacturer's literature on equipment, and schedules. Submittals are normally used by the Mechanical Engineer of Record to aid in determining if the work and work products conform to the intent of the Contract Documents.

TERM	DEFINITION
Supporting Registered Professional	The Registered Professional providing supplementary supporting design and Field Review services to the Mechanical Engineer of Record for mechanical building components, or subcomponents, (e.g., specialty mechanical elements, secondary mechanical elements). It is recommended that the Mechanical Engineer of Record obtain and retain in the project files Schedules S-B and S-C from the Supporting Registered Professional in the form provided in Appendix A of the *Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020). These schedules provide assurance confirming that the plans and supporting documents relating to the supporting engineering services for a particular mechanical component, or subcomponent, substantially comply, in all material respects, with the requirements of the applicable building code. If a sprinkler design is completed "for performance specification only" by a Registered Professional, then the sprinkler design engineer is considered the Registered Professional of Record, not the Supporting Registered Professional. The sprinkler design engineer is required to provide Schedules B and C-B, as defined in the *BCBC*.

VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
2.0	May 21, 2021	Updated to reflect current industry standards and practices and to reference the *Professional Governance Act*.
1.0	February 4, 1993	Initial version.

1.0 INTRODUCTION

Engineers and Geoscientists British Columbia is the regulatory and licensing body for the engineering and geoscience professions in British Columbia (BC). To protect the public, Engineers and Geoscientists BC establishes, monitors, and enforces standards for the qualification and practice of its Registrants.

Engineers and Geoscientists BC provides various practice resources to its Registrants to assist them in meeting their professional and ethical obligations under the *Professional Governance Act (*the *Act*) and Engineers and Geoscientists BC Bylaws (Bylaws). Those practice resources include professional practice guidelines , which are produced under the authority of Bylaw 7.3.1.

Each professional practice guideline establishes the expectations and obligations of professional practice that all Engineering Professionals are expected to have regard for in relation to a specific professional activity. Engineers and Geoscientists BC publishes professional practice guidelines on specific professional services or activities where additional guidance is deemed necessary. Professional practice guidelines are written by subject matter experts and reviewed by stakeholders before publication.

Having regard for professional practice guidelines means that Engineering Professionals must follow established and documented procedures to stay informed of, be knowledgeable about, and meet the intent of any professional practice guidelines related to their area of practice. By carefully considering the objectives and intent of a professional practice guideline, an Engineering Professional can then use their professional judgment when applying the guidance to a specific situation. Any deviation from the guidelines must be documented and a rationale provided. Where the guidelines refer to professional obligations specified under the *Act*, the Bylaws, and other regulations/legislation, Engineering Professionals must understand that such obligations may be mandatory.

These *Professional Practice Guidelines – Mechanical Engineering Services for Building Projects* provide guidance on professional practice for Engineering Professionals who might be involved in, or have an interest in, providing mechanical engineering services for building projects in BC.

These guidelines were first published in 1993. This revision reflects current industry standards and practices.

1.1 PURPOSE OF THESE GUIDELINES

This document provides guidance on professional practice to Engineering Professionals who carry out mechanical engineering services for building projects.

The purpose of these guidelines is to provide a common approach for carrying out a range of professional activities related to this work.

Following are the specific objectives of these guidelines:

1. Establish the expectations and obligations of professional practice that Engineering Professionals are expected to have regard for in relation to the specific professional activity outlined in these guidelines by:
   - specifying the tasks and/or services that Engineering Professionals should complete;
   - referring to professional obligations under the *Act*, the Bylaws, and other regulations/legislation; including the primary obligation to protect the safety, health, and welfare of the public and the environment; and

- describing the established norms of practice in this area.

2. 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 the Coordinating Registered Professional (CRP), Mechanical Engineer of Record (MER), Specialty Engineers, Owners, Authorities Having Jurisdiction, and contractors.
3. Define the skill sets that are consistent with the training and experience required to carry out these professional activities.
4. Provide guidance on the use of assurance documents, so the appropriate considerations (both regulatory and technical) are had for the specific professional activities.
5. Provide guidance on how to meet the quality management requirements under the *Act* and the Bylaws when carrying out the professional activities identified in these professional practice guidelines.

1.2 ROLE OF ENGINEERS AND GEOSCIENTISTS BC

These guidelines form part of Engineers and Geoscientists BC's ongoing commitment to maintaining the quality of professional services that Engineering Professionals provide to their clients and the public.

Engineers and Geoscientists BC has the statutory duty to serve and protect the public interest as it relates to the practice of professional engineering, including regulating the conduct of Engineering Professionals. Engineers and Geoscientists BC is responsible for establishing, monitoring, and enforcing the standards of practice, conduct, and competence for Engineering Professionals. One way that Engineers and Geoscientists BC exercises these responsibilities is by publishing professional practice guidelines as per Bylaw 7.3.1.

Guidelines are meant to assist Engineering Professionals in meeting their professional obligations. As such, Engineering Professionals are required to be knowledgeable of, competent in, and meet the intent of professional practice guidelines that are relevant to their area of practice.

The writing, review, and publishing process for professional practice guidelines at Engineers and Geoscientists BC is comprehensive. These guidelines were prepared by subject matter experts and reviewed at various stages by a formal review group, and the final draft underwent a thorough consultation process with various advisory groups and divisions of Engineers and Geoscientists BC. These guidelines and the current revision were then approved by Council and, prior to publication, underwent final editorial and legal reviews.

Engineers and Geoscientists BC 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 professional practice expectations and obligations 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.

1.3 INTRODUCTION OF TERMS

See the Defined Terms section at the front of the document for a full list of definitions specific to these guidelines.

1.4 SCOPE AND APPLICABILITY OF THESE GUIDELINES

These guidelines provide guidance on professional practice for Engineering Professionals who carry out the practice of mechanical engineering for buildings governed by the following parts of Division B of the *BC Building Code* (*BCBC*) and the City of Vancouver Building By-law (VBBL):

- Part 3 - Fire Protection, Occupant Safety and Accessibility
- Part 6 - Heating, Ventilating and Air-conditioning
- Part 7 - Plumbing Services
- Part 10 - Energy Efficiency
- Related sections from Part 4 - Structural Design
- Related sections from Part 9 - Housing and Small Buildings

These guidelines are not intended to provide technical or systematic instructions for how to carry out these activities; rather, these guidelines outline considerations to be aware of when carrying out these activities. Engineering Professionals must exercise professional judgment when providing professional services; as such, application of these guidelines will vary depending on the circumstances.

While these guidelines identify how to carry out mechanical engineering for building projects in a way that reflects good professional practice, Engineering Professionals must also apply the relevant technical standards issued by other organizations. Sources for technical standards include technical societies, institutes, and standards associations, such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), WorkSafe BC, Technical Safety BC, NFPA (National Fire Protection Association), ASME (American Society of Mechanical Engineers), ASPE (Accounting Standards for Private Enterprises), and CSA (Canadian Standards Association).

An Engineering Professional's decision not to follow one or more aspects of these guidelines does not necessarily represent a failure to meet professional obligations. For information on how to appropriate depart from the practice guidance within these guidelines, refer to the *Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021a), Section 3.4.2.

These guidelines outline the professional services that should generally be provided by the Mechanical Engineer of Record (MER) in a building project. They specify tasks the MER should perform to achieve designs that serve the interests of the Client and protect public safety, and which are properly coordinated with the work of other design, fabrication, and construction team participants. These guidelines should assist in maintaining the integrity of the overall and detailed designs.

These guidelines also take into account the assurances that Authorities Having Jurisdiction may require from Engineering Professionals as set out in the Letters of Assurance.

See Appendix B: Letters of Assurance for information about the *BCBC* and VBBL Letters of Assurance for design and Field Reviews that an Authority Having Jurisdiction can require from an Engineering Professional.

1.5 ACKNOWLEDGEMENTS

This document was reviewed by a group of technical experts, as well as by various advisory groups and divisions of Engineers and Geoscientists BC. Authorship and review of these guidelines does not necessarily indicate the individuals and/or their employers endorse everything in these guidelines.

Engineers and Geoscientists BC thanks the authors and reviewers of the original document, as well as the authors and reviewers of this revision, for their time and effort in sharing their knowledge and experience.

In particular, Engineers and Geoscientists BC thanks Gordon McDonald, P.Eng, and Geoff McDonell, P.Eng, for their contributions as primary authors of this revision.

2.0 ROLES AND RESPONSIBILITIES

2.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organizations vary according to the needs of the project and the parties.

Examples of the following common organizational charts are included in Appendix A: Common Organizational Structures.

- Mechanical Engineer of Record (MER)/Coordinating Registered Professional Contract (Figure A1)
- Mechanical Engineer of Record (MER)/Owner Contract (Figure A2)
- Design/Build Contract (Figure A3)

How the MER is engaged and provides services for a building project may vary among building projects. The MER is responsible for ascertaining risks and responsibilities according to the MER's expertise, experience, capabilities, scope of work, and specific engagement obligations.

2.1.1 MANAGEMENT OF RISK

Management of risk for the Owner, constructor, Registered Professionals (RPs), the MER, and others is required in every building project. Effective control of risk in a professional practice requires implementation of a quality management program involving organizational and operational considerations.

Important elements of such a program include:

- effective documentation and communication of project requirements;
- clearly defined responsibilities of all project participants;
- effective systems for progress milestones with appropriate checks and reviews; and
- adequate professional liability insurance coverage.

Professional liability insurance is an important aspect of risk management for the Owner and RPs. Professional liability insurance can be provided by comprehensive project-specific insurance acquired by the Owner or, more commonly, practice policies purchased by the professional firms.

See also Section 4.0 Quality Management in Professional Practice.

2.1.2 COMMUNICATION AND COORDINATION

The degree of formality in documenting the various communications on a design project will vary with the scope and complexity of the building project. Project teams should integrate the following communication and coordination methods into their scope of services.

- Decisions and directives should be communicated in writing.
- Meetings between the Coordinating Registered Professional (CRP) and the Client should be recorded in meeting minutes or in a letter that confirms expectations.
- Information, such as design criteria, should be communicated by letter and copies provided to all members of the design team.
- Regular coordination meetings between the CRP and members of the design team should be conducted with an agenda and minutes should be distributed.
- Decisions and directives by the CRP should be communicated in writing with copies to all members of the design team. Communications among members of the design team on key assumptions and decisions should also be in writing and copies provided to the CRP.
- Documents, such as drawings and Specifications, should be distributed with transmittal forms.

- Project documentation should clearly establish a historical record of the design process, including all of the key decisions.
- The MER must be familiar with the responsibilities and the codes and standards that apply to the work (e.g., ventilation, plumbing, fire protection, seismic requirements) for which the MER takes responsibility under the Letters of Assurance. The MER should coordinate activities with any code consultants, architects, and other specialty professionals (e.g., building envelope consultant, energy modelling professional, civil consultant), as applicable.
- The respective RPRs should inform other members of the design team of design decisions that will affect their disciplines, check for conflicts between disciplines, and clarify areas where responsibilities are unclear.

2.2 RESPONSIBILITIES

The following sections outline the responsibilities of various potential project team members.

2.2.1 OWNER

For the design and construction of the project to meet appropriate standards of public safety and requirements of applicable building regulations, the Owner should:

- retain or cause to be retained qualified design professionals, including a CRP and an MER with responsibility for the design of the mechanical systems of the building;
- cooperate with the MER to set out a written description of the scope of the MER's services as referred to in Section 2.2.3 Mechanical Engineer of Record.
- proceed with the contemplated project only with adequate financing or sufficient budget;
- cooperate with the CRP to develop an adequate written description of the project;
- before commencement of mechanical engineering services, finalize or cause to be finalized a written agreement with the MER, either directly with the Owner or the CRP or another appropriate party;
- cooperate with the CRP and MER to establish a realistic schedule for providing mechanical engineering services;
- authorize in writing any additional services that may be required beyond the scope of the MER's contract;
- ensure all required approvals, licences, and permits from the Authorities Having Jurisdiction are obtained;
- recognize that unforeseen design changes may occur, so a reasonable contingency should be included in the Owner's budget;
- recognize that drawings, Specifications, and other documents prepared by the MER are for the project, and such documents should not be used or copied for other projects without the agreement of the MER and without advice from a qualified design professional;
- recognize that because code interpretation of the Authority Having Jurisdiction may differ from that of the MER or others, some changes may occur that affect the design;
- recognize that some changes may occur if specific equipment obtained by, and procedures used by, the contractor differ from those in the project documents (this may occur, for example, if specific equipment types are changed by the manufacturer, or become unavailable to the project at the time of construction);
- respond to the various reports and other recommendations by the CRP with decisions on all aspects of the project, and recognize that an Owner’s decision that overrules public safety and environmental considerations must be dealt with by any RP associated with the project in accordance with the applicable professional code of ethics;

- notify the Authority Having Jurisdiction in writing of any change in name of the CRP or RPR retained for Field Review during construction;
- ensure the CRP and RPRs retained for design and Field Review during construction submit completed schedules (the schedules must be signed by the responsible RPR in each of the applicable disciplines and should indicate the review of construction conforms to the drawings, Specifications, applicable standards, and the governing building code or building bylaw); and
- provide payment to the project team based on terms and conditions of the contract agreement(s);

If the Owner fails or refuses to carry out the obligations as set out above, the MER should:

- consider giving written notice to the Owner advising the Owner of the MER's recommendations; and
- consider whether the MER can continue with the project, because in any event the MER must comply with the minimum requirements as outlined in these guidelines.

2.2.2 COORDINATING REGISTERED PROFESSIONAL

To enable the MER to properly perform duties, the Coordinating Registered Professional should:

- interpret and define the needs of the Owner and, in doing so, define the Owner's intended functions and needs;
- identify any special design criteria, such as equipment and other requirements, and advise the MER accordingly;
- outline the scope of assignment to each design professional for design, preparation of Contract Documents, and review of work during construction and contract administration;
- provide timely information in sufficient detail as required, so the MER can adequately perform duties;
- coordinate and review the designs, drawings, and other Contract Documents produced by all participants of the design team;
- coordinate the communication of information between the Owner and the contractors and the design professionals, including the MER, so the work proceeds in a manner that complies with applicable codes and regulations and meets the Owner's needs;
- advise the Owner with respect to tendering procedures or other project delivery methods;
- advise the Owner of the requirements for Field Review;
- advise the Owner with respect to the incorporation of Commissioning into the design and Specifications for the project;
- prepare or assist the Owner in preparing, tender and Contract Documents;
- monitor the scope, schedule, and budget of the design and construction of the project as it progresses; and
- resolve with the Owner any changes needed to the scope, schedule, and budget.

See also Section 2.1.2 Communication and Coordination.

2.2.3 MECHANICAL ENGINEER OF RECORD

The MER is responsible for the mechanical integrity of the mechanical systems shown on Contract Documents prepared by the MER.

The MER may rely on other Engineering Professionals or Supporting Registered Professionals (SRPs) for elements of the mechanical and related systems, but the MER has the overall responsibility to ensure all design work is undertaken as necessary to achieve a mechanical system that meets acceptable engineering standards. When relying on other Engineering Professionals for such elements, the MER must require them to sign and seal the documents for such elements.

Unless otherwise noted, the MER is responsible for ensuring that the design and Field Review of any seismic restraint for mechanical elements is completed. This Field Review may be done by a Specialty Engineer. However, when a Specialty Engineer is retained to design the seismic restraint elements, the MER must review those design details for completeness. The MER must provide the seismic restraint information to the structural engineer of record for coordination with the building structural system.

This applies to any specialty engineering design and fabrications that fall under the MER's scope of work that have been delegated to Specialty Engineers, such as seismic restraint systems, fire-stopping systems, and other specialized systems that are sub-sets of the mechanical systems in the building.

The MER signs Schedule B, Assurance of Professional Design and Commitment for Field Review, regarding the mechanical design plans and supporting documents that the MER prepares.

The MER, together with the Client, is responsible for setting out a written description of the scope of the mechanical engineering services sufficient to enable and permit the MER to meet the design and Field Review requirements of these guidelines and applicable building regulations.

See also Section 2.1.2 Communication and Coordination.

2.2.4 SPECIALTY ENGINEER AND SUPPORTING REGISTERED PROFESSIONAL

Where a Specialty Engineer is engaged directly by the MER to provide mechanical engineering services (for example, as illustrated in Appendix A, Figure A1), the Specialty Engineer should work with the MER to clearly define the Specialty Engineer's scope of work.

Specialty Engineers are responsible for the integrity of their designs and must sign, seal, and date the documents prepared in their professional capacity or under their direct supervision.

Where a Specialty Engineer acts as a Supporting Registered Professional (SRP) (for example, by providing supporting engineering services to the MER), the Specialty Engineer must submit to the MER sealed, signed, and dated Schedules S-B and S-C from the *Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).

If specified by the MER, Specialty Engineers engaged by the Owner or contractor can be retained to prepare designs and drawings for such specific elements of the project such as seismic restraint or geoexchange systems.

Since a Specialty Engineer's work will be related to that of the CRP or certain RPRs, Specialty Engineers should establish their scope of services, including preparation of Contract Documents and Field Review, in collaboration with any other professionals whose work impacts the Specialty Engineer's discipline. The scope of services should be sufficient to meet the requirements of the RPR to which their work is related.

See also Section 2.1.2 Communication and Coordination.

2.2.5 PRIME CONTRACTOR

The Prime Contractor has a contractual relationship with the Owner. This contract usually states that the Prime Contractor is responsible for the labour, materials, and equipment for the work, as well as the construction methods, techniques, sequences, procedures, safety precautions, and programs associated with the construction work, as set out in the Contract Documents.

The Prime Contractor is responsible for providing reasonable notice to the MER when components are ready for Field Review. The presence of the MER during construction does not relieve the Prime Contractor of responsibility for constructing the project in accordance with the Contract Documents and good engineering practices, or of the responsibility for providing construction methods, techniques,

sequences, procedures, safety precautions, and programs necessary for the safety and suitability of the project.

The Prime Contractor should:

- coordinate the work of the Subcontractors;
- check that the work of Subcontractors is ready for Field Review, before initiating Field Review by the RPRs;
- provide reasonable notice to the RPRs when components are ready for Field Review;
- satisfy the RPR engaged to perform Field Reviews that the Prime Contractor understands the intent of the design, including any special features or construction sequences;
- direct and supervise construction personnel so the construction complies with the drawings and Specifications, and the work is conducted in a safe manner;
- notify the RPR engaged to perform Field Reviews of errors, omissions, and discrepancies discovered in the drawings and Specifications, and seek supplementary instructions from the RPR where necessary;
- ensure construction personnel comply with reasonable instructions and interpretations made by the RPR engaged to perform Field Reviews;
- start up and test, in a timely manner, all systems incorporated in the design;
- deliver operating and Maintenance Manuals and Record Drawings to the Owner in accordance with requirements specified in the Contract Documents;
- if requested, submit declarations during construction and at completion, stating conformity to drawings and Specifications;
- establish, in accordance with builders' lien legislation, when substantial completion and final completion is achieved; and
- where the Prime Contractor is responsible for designing and constructing a building project (e.g., a design-build project), the contractual responsibilities of the Prime Contractor include all items listed for the CRP, RPRs, and other design professionals; the responsibilities include review during construction.

2.2.6 AUTHORITY HAVING JURISDICTION

Authorities Having Jurisdiction are responsible for enforcing the codes, policies, guidelines, standards, and bylaws, or for assessing compliance with applicable codes, standards, and local bylaws.

An Authority Having Jurisdiction may perform inspections as part of its compliance assessment. Authorities Having Jurisdiction can be provincial, municipal, townships, districts, or other organizations such as Technical Safety BC or WorkSafeBC.

The Authority Having Jurisdiction should:

- review submitted Contract Documents for compliance with the applicable building code and local bylaws;
- verify that the drawings are stamped by a Registered Professional authorized to practice in British Columbia;
- interpret the intent of the applicable building code, when requested;
- inform the Owner that the RPR engaged to perform Field Reviews will be required to submit a construction completion certificate (Schedule C in the *BCBC* and VBBL);
- inform the Owner that an occupancy permit or permission in writing to occupy will be required before permission will be granted to occupy the building;
- ensure the RPRs or another Registered Professional has been engaged to perform Field Reviews;
- issue building permits;

- provide site reviews specific to the building permit requirements for detailed checks of compliance with the applicable building code and bylaws;
- Issue stop-work orders on a project under construction, if it is determined that
  - the professional engaged to perform Field Reviews is not performing that function,
  - the building permit is invalid or does not exist,
  - construction is unsafe, and/or
  - site conditions are unsafe;
- inform Engineers and Geoscientists BC of any concerns regarding unskilled practice or unprofessional conduct by Engineering Professionals; and
- issue occupancy permits or permission in writing for occupancy.

2.2.7 MANUFACTURER/FABRICATOR

In some cases, the manufacturer designs and constructs a component of a building. If so, the manufacturer undertakes the responsibilities of a Specialty Engineer and should:

- design the manufactured building component in conformance with the design criteria supplied by the design professional (RPR or Specialty Engineer), the *BCBC*, and other standards, and with good engineering practice;
- prior to construction, supply shop drawings that include all necessary details and other information that may be required for the RPR or Specialty Engineer to undertake their work, and authenticate these drawings when requested by the RPR or Specialty Engineer;
- supply, prior to construction, when requested by the RPR or Specialty Engineer, a letter of certification stamped and signed by an RPR. The letter of certification should state that
  - the requirements specified by the RPR or Specialty Engineer, such as strength or performance, have been accommodated in the design, and
  - the process used in the fabrication of the components being supplied conforms to the *BCBC* or VBBL.

2.3 SELECTION OF CONSULTANTS

Resources available to assist in matters related to selection of consultants include the following documents published by Engineers and Geoscientists BC and the Association of Consulting Engineering Companies British Columbia (ACEC-BC):

- *Budget Guidelines for Consulting Engineering Services* (ACEC-BC and Engineers and Geoscientists BC 2009)
- *Consulting Engineers Fee Guideline* (ACEC-BC 2020a)
- *User Guide to Implementing Qualifications Based Selection* (ACEC-BC 2020b)

3.0 GUIDELINES FOR PROFESSIONAL PRACTICE

3.1 OVERVIEW

The following are general outlines of the services a Mechanical Engineer of Record (MER) should consider providing for a building project. These descriptions may assist an MER in explaining services to a Client or Owner.

These outlines are not intended to be exhaustive and should not be interpreted to detract in any way from other provisions of these guidelines.

3.1.1 CONSIDERATION OF RISK

The MER has a professional responsibility to uphold the principles outlined in the Engineers and Geoscientists BC Code of Ethics, including protection of public safety and the environment. As such, the MER must use a documented approach to identify, assess, and mitigate risks that may impact public safety or the environment when providing professional services.

One of the risk factors that must be considered is climate change implications. Engineering Professionals have a responsibility to notify their clients of future climate-related risks, reasonable adaptations to lessen the impact of those risks, and the potential impacts should a client refuse to implement the recommended adaptations. Engineering Professionals are themselves responsible for being aware of and meeting the intent of any climate change requirements imposed by a client or authority having jurisdiction.

Other areas of risk encountered in professional practice are quality, technical, financial, and commercial risks. Engineering Professionals should consider risks in such areas using techniques that are appropriate to their area of practice.

3.2 SCOPE OF SERVICES

Before commencing design services, the MER must meet with the Client, who is usually the Owner or the Coordinating Registered Professional (CRP), but who may be the contractor in a design-build contract, to:

- determine the terms of reference and the scope of work for basic services and additional services (see Section 3.3 Basic Mechanical Engineering Services and Section 3.4 Additional Mechanical Engineering Services);
- reach agreement on fees, payment schedule, and professional liability insurance coverage; and
- reach agreement on other contractual terms and conditions.

Information on recommended contract language is available in the ACEC-BC document titled “Contract Language Management Plan” (ACEC-BC 2019).

For a fast-track project, in addition to the above, the MER should:

- establish with the Client the terms and conditions under which preliminary or partially complete Contract Documents may be issued in advance, clearly define the requirements for partially complete Contract Documents, and outline any building permit requirements that might assist the Authority Having Jurisdiction in understanding partial Construction Document submissions and scopes for the proposed project schedule; and

- advise the Client that no part of the mechanical documents can be considered complete before all Contract Documents, including architectural, structural, mechanical, and electrical drawings are completed.

The MER has a professional responsibility to uphold the principles outlined in the Engineers and Geoscientists BC Code of Ethics, including protection of public safety and the environment. As such, the MER must use a risk-based approach to decision making when providing professional services, and one risk factor that must be considered is the implications of climate change.

The MER has a responsibility to notify the Client of future climate-related risks, reasonable adaptations to lessen the impact of those risks, and the potential impacts, should the Client refuse to implement the recommended adaptations. The MER also has a responsibility to be aware of and meet the intent of any climate change requirements imposed by the Client or the Authority Having Jurisdiction.

The RPRs should collaborate with the CRP to develop sufficiently detailed written descriptions of their respective scopes of services, in order to meet the design and Field Review requirements of these guidelines and applicable building regulations.

The RPRs should also inform other members of the design team of design decisions that will affect their disciplines, check for conflicts between disciplines, and clarify areas where responsibilities are unclear. For example, it is sometimes necessary to clarify the responsibilities between the disciplines of two or more RPRs, or among disciplines in the following areas:

- Responsibility for coordinating the work of a Specialty Engineer
- Responsibility for specification or Field Review of excavation and back-fill (i.e., either the CRP, architect of record, structural engineer of record, or geotechnical engineer of record could be responsible for these particular activities; therefore, the responsibility must be clearly understood on a project)
- Interface among disciplines (e.g., power requirements for mechanical controls and devices)
- Space requirements (e.g., for mechanical and electrical rooms)
- Responsibility for structural engineering input for secondary structural elements, including seismic restraint of mechanical systems and elements for coordination with the building structural system

In addition, Specialty Engineers should establish their scope of services in collaboration with any other professionals whose work impacts the Specialty Engineer's discipline. The scope of services should be sufficient to meet the requirements of the RPR to which their work is related.

See also Section 2.1.1 Management of Risk and Section 2.1.2 Communication and Coordination.

3.3 BASIC MECHANICAL ENGINEERING SERVICES

The stages of the basic services, as discussed in Section 3.3.2 Service Activities below, are generally organized in an agreement according to the sequential stages of a typical project.

Each stage of the basic services contains those items that often apply to the progress of work for that construction stage. However, the requirements of a specific project may require that certain basic services be performed out of the normal sequence or in different stages than what is described in the scope of services.

3.3.1 SERVICE AREAS OF RESPONSIBILITY

3.3.1.1 General Areas of Responsibility

Basic mechanical engineering and consulting services for buildings generally consist of the following general areas of responsibility:

- Plumbing systems, including water distribution, drainage, swimming pool systems, decorative fountain systems, compressed gases, fuel systems

(oil and gas), and specialty medical plumbing systems
- Fire suppression systems, including wet and dry sprinkler and standpipe systems and specialized fire suppression systems
- Smoke control systems, including emergency exhaust system for atrium and exit stair pressurizations
- Air distribution and ventilation systems, including those required for control of carbon monoxide, and specialized industrial ventilation systems, such as dust collection systems, explosion prevention systems, commercial kitchen exhaust systems, and heat recovery systems
- Hydronic (water-based fluid, with/without additives) heating and cooling plants and systems, including boilers, geoexchange systems, steam humidification and heating systems, packaged air/fluid source thermal heat pumps, and district energy plants and distribution system
- Direct expansion (refrigeration-based) systems, including space cooling/heating applications, and space/product refrigeration, including single space, multi-space, and whole building constant or variable refrigerant flow (VRF) systems
- Industrial fluid distribution systems, such as central lube oil distribution, compressed air and nitrogen systems, anti-freeze distribution systems, and specialty fluids distribution systems
- Mechanical and plumbing system requirements in the *BC Fire Code*, including the systems for drainage and containment of flammable liquids and effluent from fire
- Medical gases storage and distribution systems, and anesthetic gases scavenging systems
- Building automation and controls systems, including interfacing with building fire alarm and other building safety and security systems
- Seismic restraint and vibration isolation of all of the above systems
- Firestopping and fire resistance installations for the above systems
- Energy and sustainability performance aspects of all of the above systems
- Specification of testing, balancing, and Commissioning requirements for the mechanical systems
- Specification for the compilation of operating and Maintenance Manuals and data for the building systems

In addition, an MER with the appropriate experience and expertise may also be responsible for site utilities systems design (water, gas, and sanitary and storm drainage systems, including septic systems). In many building projects, a civil engineering consultant is engaged for the design of site utilities systems, and the MER terminates their building utility services connections just outside the building footprint, or at an agreed upon dividing point of the project. Therefore, the MER must verify this scope of work with the Owner or Client and the CRP before assuming responsibility.

The MER must also coordinate with and provide support services for the following aspects of a project that may span multiple disciplines, where required:

- Elevator and elevating devices systems control and machine rooms
- Electrical vault and electrical switchgear spaces
- Owner-supplied specialty equipment
- Commercial and residential kitchen equipment
- Medical sterilization equipment
- Other specialized equipment and systems, as required

Mechanical support services for these elements generally consist of provision of heating, cooling, ventilation, piped utility connections, and drainage provisions, which would be defined by the equipment supplier, designer, and/or specialty professional.

Elevating devices (elevators and escalators) are normally an engineered device element within the building, and are normally coordinated, selected, and administered by the CRP with structural engineering assistance.

As required, the MER should provide assurance statements for the design work completed, either through specific statements found in applicable professional practice guidelines or Authority Having Jurisdiction documents, or by using Schedules S-B and S-C (see Appendix B: Letters of Assurance).

3.3.1.2 Delegating Areas of Responsibility to Supporting Registered Professionals and Specialty Engineers

The MER should recognize when the required scope of work is outside the MER's abilities and expertise, and either engage SRPs and/or Specialty Engineers as required, or recommend that the Owner or Client engage them directly.

SRPs and/or Specialty Engineers may be engaged to provide mechanical engineering services for buildings for the following specialty systems and elements. When acting as an SRP under the MER's areas of responsibility, the work of the SRP may be defined and managed by others with input from the MER, or the SRP may be engaged directly by the MER. Where applicable, the designs provided by the SRP should be coordinated with the rest of the MER's scope of services. The following services that may be delegated are described in more detail in the subsections below:

- Geoexchange systems
- Fire suppression systems
- Seismic restraint engineering
- Firestopping elements and systems
- Specialized packaged systems, such as paint spray booths, abrasive blasting booths, specialized compressed gases systems, and specialized fueling systems
- Swimming pool systems and decorative fountains
- Alternative energy equipment and systems, such as bio-fuel boilers/heating plants, solar thermal systems, wind generator systems, and hydro-electric/micro-hydro systems
- Rainwater harvesting systems and water treatment systems
- Energy modelling

Specialty Engineers are responsible for the integrity of their designs and must sign, seal, and date the documents prepared in their professional capacity or under their direct supervision. Where a Specialty Engineer acts as a Supporting Registered Professional (SRP) (for example, by providing supporting engineering services to the MER), the Specialty Engineer must submit to the MER sealed, signed, and dated Schedules S-B and S-C.

Where the MER is responsible for and providing a performance-type Specification and drawing package to an SRP, the MER retains responsibility for signing the Schedule B Letter of Assurance and should obtain a Schedule S-B assurance document from the SRP for the detailed designs relating to their specialty system.

Delegation of common design scopes for mechanical engineering services for buildings are described in the following subsections.

Geoexchange Systems

Where a ground source heat exchange system is used as part of a water source heat pump heating/cooling equipment plant for a building, the MER may engage geoexchange system designers as subconsultants, or recommend that the Owner or CRP engage them directly.

The MER must inform the geoexchange system specialist of the anticipated yearly building energy demands for heating and cooling, and coordinate with other project team members to ensure the information is coordinated with the site utilities, landscaping plan, and any other jurisdictional requirements for the type of geoexchange system (e.g., open-loop direct well water systems, open loop or closed loop vertical boreholes, closed loop horizontal slinky coils).

Fire Suppression Systems

Two basic scenarios for providing sprinkler system design are defined in Division C, Section 3.2.4. of the *BCBC*. Different municipalities have specific requirements for which scenario to follow.

Scenario 1

- The RPR (either the MER or a specialty fire protection/sprinkler engineer) undertakes the complete detailed design of the sprinkler system prior to building permit, and submits a Schedule B including the fire suppression discipline with the building permit application. The RPR must undertake Field Reviews during construction and submit a Schedule C-B prior to occupancy permit.

Scenario 2

- The MER provides a detailed performance Specification for the sprinkler system design, as well as sufficiently detailed drawings to demonstrate the scope of work, the design intent, and layout feasibility with other components. The MER then submits a Schedule B with the building permit application with fire suppression system annotated as "For Performance Specification Only."
- The responsibly for full detailed sprinkler system design, including hydraulic calculations and sprinkler system shop drawings, would then be provided by a separate sprinkler system Specialty Engineer, typically through the MER as specified on the tender drawings and Specifications. This sprinkler system Specialty Engineer would then provide a Schedule B and Schedule C-B to the MER, prior to occupancy permit. The MER would then submit a different Schedule C-B with the fire suppression system annotated as "For Performance Specification Only."
- The MER must still be aware of and require knowledge of the applicable sprinkler system standards, building code classifications, and requirements for the fire suppression system, even when providing a "performance type" drawing and Specification approach to the building project.
- The MER would still have scope for construction administration, Field Reviews, and occupancy, as defined in the *BCBC*, which includes undertaking Field Reviews to determine substantial conformance to the performance Specification; monitoring the Field Reviews by the sprinkler system Specialty Engineer; reviewing shop drawings; taking an active role in witnessing the functional testing of the fire suppression system; collecting the Schedule C-B from the sprinkler system Specialty Engineer; and submitting the Schedule C-B to the CRP.

Seismic Restraint Engineering

This scope of services is frequently delegated to a seismic restraint systems Specialty Engineer who would select, design, and administer the construction and installation of seismic restraint systems.

The MER must still be aware of and require knowledge of the applicable seismic restraint standards, building code classifications, and requirements for the seismic restraint systems, even when providing a "performance type" drawing and Specification approach to the building project.

Firestopping Elements and Systems

On large complex projects—or small but highly technical projects—where firestopping of pipes, ducts, and mechanical components require a high level of technical expertise and design, a firestopping Specialist Engineer may be engaged to provide the necessary code compliance detailing, Field Reviews, and certifications.

Specialized Packaged Systems

Specialized packaged systems include packaged commercial paint spray booths, commercial large-scale abrasive blasting booths, medical gas processing and compressor systems, specialized gas processing and compressor systems, commercial fueling systems and components, and biofuel combustion and transfer systems.

If specialized packaged systems or processes are outside of the MER's experience and expertise, a Specialist Engineer can be engaged to provide specific design packages for those systems or components under the MER's coordination.

Swimming Pool Systems and Decorative Fountains

These types of systems may be delegated to a Specialty Engineer qualified in the field of swimming pool or water park systems design, whose work is coordinated by the MER. This Specialty Engineer would provide project coordination and infrastructure support design (e.g., water, drainage) for the swimming pool and water feature systems packages.

Swimming pool and water features systems frequently require specialized chemical treatment, filtration, and water purification that complies with the BC *Public Health Act* , which can be undertaken by a Specialist Engineer qualified in the field.

Alternative Energy Equipment and Systems

Examples of alternative energy equipment and systems include solar thermal heating systems, small (micro) hydroelectric generating systems, biofuel (wood pellet/wood fuel) boiler/burner systems, wind generators, and wind-powered pumping systems.

Where specialized and sometimes proprietary alternate energy systems are integrated into the building systems, a Specialist Engineer may be required to provide systems designs and construction administration.

Rainwater Harvesting, Storage, and Treatment, and Non-Potable Water Distribution Systems

The MER may be required to integrate a rainwater harvesting, storage, and treatment systems as part of a building plumbing system package.

If these systems are outside the expertise and experience of the MER, they may be delegated to a Specialty Engineer qualified in the field who works under the supervision of the MER. The Specialty Engineer would provide the design and specialized equipment Specifications and process controls and water treatment systems package.

Energy Modelling

This is frequently delegated to an energy modelling consultant. The MER must still coordinate with the energy modeller to provide building systems design information and ascertain that the energy modeller has coordinated with the architect and electrical Engineering Professional with sufficient information and specific design criteria and systems and equipment information.

The energy modeller must perform the scope of services in accordance with the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services* (AIBC and Engineers and Geoscientists BC 2018).

3.3.1.3 Coordinating with the Electrical Engineer of Record

Where the building heating systems use electric-resistance-type heating terminals, a common coordination issue may arise that must be resolved and agreed upon with the CRP, the MER, and the Electrical Engineer of Record (EER).

Normally, on smaller types of projects (e.g., for residential baseboards), the MER calculates heating requirements, and then the EER specifies and includes the administration of the electric-resistance heating terminals in the electrical engineering scope.

For larger projects with a variety of electric heating terminals, the MER may also specify the electric heating devices and accessories and require the EER to simply provide a power connection with the necessary *Electrical Code* connection requirements.

3.3.1.4 Identifying Common Responsibility Gaps

The following common responsibility gaps may occur during the building design process, so should be considered when developing a scope of services.

Perimeter Drainage/Weeping Tile

The geotechnical engineer of record has knowledge of the anticipated groundwater flows, and therefore specifies the design parameters for the drainage; that is, the backfill materials, filter materials, slopes, size, spacing, flow rate to be accommodated by sumps, pumps, and other downstream plumbing.

The subsystem drainage pipes could be shown on either architectural, structural, or mechanical drawings that also indicate the underground features of the building, such as the outline of the foundation systems and sumps. From the discharge point of the drainage system (i.e., into a sump), the MER would design and draw the system based on flow parameters provided by the geotechnical engineer of record.

Field Review of the perforated subsurface drainage pipe (i.e., up to but not including the sump) should be coordinated with and may be delegated to the geotechnical engineer of record.

Variable Frequency Drives

If the variable frequency drive is provided as an integral part of the mechanical equipment, it should be specified by the MER.

To ensure that the building electrical system can properly accommodate the equipment, the variable frequency drive Specification should be reviewed by the EER, including harmonic issues generated by variable frequency drives, per IEEE 519 – IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

If the variable frequency drive is not integral to the mechanical equipment, either the MER or EER may specify it. Both the MER and the EER should review the specified equipment to ensure it is compatible with the respective building systems. Any technical review of a variable frequency drive by either the MER or EER should include—to ensure compatibility of the equipment and the length of electrical feeds—the electrical motor that the drive serves.

Field Review of the installed equipment should be provided by both the MER and EER. Specific disciplines should review the equipment based on their area of expertise.

Field Reviews by Specialty Professionals

The Specialty Engineer always comes under the area of one of the RPRs or under the CRP. The appropriate RPR or CRP should determine whether Field Reviews are required for the particular aspect of the building and, if so, who is responsible for the Field Reviews for that work.

If the Specialty Engineer's Field Review is associated with a building code requirement, the Specialty Engineer should submit a Schedule S-C to the MER.

Controls and Power Wiring to Mechanical Packaged Equipment

The MER and the EER need to coordinate and agree on the trade scopes of work for controls and power wiring to mechanical packaged equipment, and clearly indicate this on the plans and Specifications. For example, where the MER specifies a packaged sump pump system with level controls, power supplies for the pumps will be required, as well as line and low voltage electrical wiring for the level controls, pump controls, and alarming systems, which also have to be connected to the building control system for emergency monitoring and alarming.

Common approaches include the following:

- Packaged equipment must have integral starters, and only power feeders would be provided by the electrical division/trade. The packaged equipment starters and interconnecting controls wiring must be provided by the mechanical Subcontractor.
- The electrical Subcontractor must provide all remote disconnect switches.

All control wiring (including building automation systems), except for fire alarms, must be provided by the mechanical Subcontractor under the direction of the MER. This also includes mechanical 120-volt control wiring and interlock, and control wiring between controls transformers and low-voltage terminal equipment, including infrared flushometers and transformers, sump pump controls, parkade gas-detection system controls, and parkade exhaust fans.

All electric tracing for freeze-protected piping systems must be designed by the MER, with power connections designed by the EER. The MER is required to coordinate the use of listed components and systems, where heat trace is used on sprinkler branch lines. All electric tracing must in a self-limiting type of cable. The MER must provide loads for the circuits to the EER for power connection requirements.

The MER and the controls Subcontractor must provide the EER with locations where power circuits are required for mechanical control systems; i.e., electronic devices (e.g., trap primers, infrared plumbing trim), control transformers, and building automation system panels. This includes the emergency boiler shutoff switch located at the boiler room. The emergency boiler shutoff switch must be supplied by the mechanical division and installed and wired by the electrical division.

Code Consultant Services

It is not a requirement in the *BCBC* to produce a building code compliance report or to have a code consultant on the project team. However, Owners and architects often engage the services of a code consultant to assist the project team in defining the requirements of Part 3 of the *BCBC*, as this often requires design coordination among multiple disciplines of the design team.

Nevertheless, the mechanical prescriptive design requirements of Part 3 are the responsibility of the MER, per Schedule B of the Letters of Assurance. Where the Part 3 requirements involve multiple disciplines, each discipline is responsible for their design elements. For example, the design of vestibules in parkades between elevators and stairwells serving occupancies above the level of the storage garage requires an architect to provide the vestibule design, and also requires the MER to ensure that it is ventilated according to the *BCBC*, Part 3 to prevent the migration of carbon monoxide. Reviews by the code consultant and the code compliance drawings may consider and interpret mechanical requirements in Part 3 of the *BCBC*, which facilitates early coordination of these requirements.

If the design does not meet the prescriptive requirements of the *BCBC*, an alternate solution may be required. It is the obligation of the RPR responsible for that element (e.g., mechanical, electrical, structural, or architectural) to raise this issue to the design team and CRP. If that design professional has the expertise required to prepare the alternate solution, then this can be done as an additional service. If they do not have the required expertise, then they must raise this with the CRP or Owner, who may need to engage the services of a specialist such as a code consultant

In addition, and in preparation for occupancy of the building, a code consultant may assist the CRP and RPRs with the Commissioning and fire and life-safety demonstrations with inspectors from the Authority Having Jurisdiction. This, however, does not remove the requirement that the MER must ensure that the mechanical systems are commissioned and operational for occupancy.

3.3.1.5 The MER as the Coordinating Registered Professional

For some building projects, the scope of work is primarily mechanical building systems in cost value or general scope, in which case the MER may be requested to assume the role of the CRP.

An MER acting as CRP is required to understand and coordinate other aspects of the project scope and engage subconsultants as required; for example, a code consultant, architect, electrical consultant, structural Consultant, industrial equipment specialists, or seismic consultant. In some cases, the Owner or Client may engage the other specialist consultants directly.

In either case, the MER should recognize when the scope of work is outside the MER's abilities and expertise, and either engage Specialty Engineers or SRPs, as required, or recommend that the Owner or Client engage other specialist consultants directly.

The CRP is responsible for setting out a written description of the scope of the subconsultant services sufficient to enable each discipline to meet the design and Field Review requirements of their respective professional practice guidelines and applicable codes and regulations.

Following are common examples of where an MER could act as the CRP:

- Office or retail tenant space renovations, where there is an interior designer but no registered architect engaged, and a building permit is required for the work
- Commercial cooking kitchen renovations and upgrades, where a building permit is required
- Boiler and chiller plant upgrading and replacement
- Energy systems retrofits and upgrading of building systems for energy efficiency improvements

Providing CRP services is an additional service for the MER, as outlined in Section 3.4 Additional Mechanical Engineering Services, and the general scope of services for an MER as a CRP are summarized in that section.

3.3.2 SERVICE ACTIVITIES

The following subsections describe the various stages of a typical project that involves mechanical engineering services. Each subsection contains basic services that often apply to the progress of work for that particular construction stage.

The mechanical engineering services described are noted in the stages where they most typically occur. However, depending on the requirements of a specific project, Client, or Authority Having Jurisdiction, the service activities may be performed out of the normal sequence or during different stages than those described here.

3.3.2.1 Conceptual or Schematic Design Stage

In this stage, the MER may provide the following services:

- Attend, as required, periodic meetings with the Client and design team to:
  - obtain the Client's instructions regarding the Client's functional, aesthetic, cost, and scheduling requirements;
  - prepare a preliminary design concept; and
  - report on the mechanical systems, considering economy, performance, capital cost, compatibility with other design elements, and requirements of relevant codes and authorities.
- Assist the CRP or Owner, as required to:
  - define the need for any specialty consulting services that may be required for the project (e.g., acoustical, fire protection, seismic, code, or Certified Professional);
  - develop or review the project schedule, including any milestone dates;
  - determine channels of communication, including coordination of services and requirements for site utilities design (e.g., by a civil Engineering Professional or others, or by the MER), elevators and elevating devices systems engineered by others but needing

some mechanical systems elements (e.g., cooling, ventilation, drainage), Owner-supplied equipment requiring mechanical services connections, or code consultant requirements;
  - determine drawing standards and Specifications format; and
  - determine the number and timing of project team meetings during each stage of the project.
- Establish dates by which information affecting the mechanical design will be needed from other disciplines.
- Conduct site investigations and review existing drawings, where appropriate.
- Establish criteria for the seismic consultant and other consultants, as required, and comment on reports presented.
- Identify mechanical design criteria, prepare preliminary calculations, and establish base load requirements for systems such as HVAC and plumbing and fire protection.
- Develop the mechanical scheme for the mechanical systems, including:
  - development of alternate schemes, where appropriate;
  - consideration of materials and systems suitable to the project requirements; and
  - consideration of the requirements of the other design professionals and provision of the information they require.
- Check applicable codes, regulations, and restrictions; insurance requirements; and other factors affecting the design of the project.
- Prepare a preliminary cost estimate or cooperate appropriately with others responsible for reporting the estimate. Cost estimates provided by the MER in the basic scope of work are intended to be Class D budgets for relative costs, and are not intended to be detailed project cost estimates (see Section 3.4 Additional Mechanical Engineering Services regarding scopes for cost estimating services).
- For retrofit projects or renovations of existing buildings, determine the requirements for upgrading existing mechanical systems in terms of life-safety, seismic, plumbing, and fire protection scopes, in coordination with the Client or Owner, the CRP, and the Authority Having Jurisdiction, based on the scope of the work.
- Consider implications of equipment weights, size, noise, vibration, seismic requirements, and other physical characteristics that are to be considered in the building mechanical design.
- Consider implications of the impact of noise and vibration from the mechanical systems on the Client's operational requirements, and recommend solutions through the use of a specialist, if necessary.
- Establish, where appropriate, comparative information to be used in selection of mechanical systems for the project.
- Provide, if required, brief outline Specifications for proposed materials and equipment.
- Describe the major mechanical system(s) and each significant component and material.
- Explain in writing to the Client all new construction materials or new techniques proposed for use in the project and their alternatives, including the risks, advantages, and disadvantages over both the short and long term, so the Client can weigh the choices and make an informed decision before the MER proceeds further.
- Determine the allocation of suitable space for mechanical rooms and other major mechanical installations for design options and common mechanical systems requirements, including consideration of equipment weights and electrical requirements.
- If required, advise the Client of the recommended mechanical systems, and review the effect of these systems on the mechanical construction budget for the project.

- Prepare a summary report that defines the mechanical systems selected for the project and outlines the reasons involved in the selection, including aspects of sustainability, energy, and operating costs, and ongoing maintenance requirements.
- Review, with the Commissioning Specialty Engineer, the design concept for conditions that affect the Commissioning function, and record the results of the review in a written report to the CRP as part of a schematic or concept design report.

A Client may assume responsibility for all or some of the conceptual or schematic design stage activities described above, provided:

- the MER's ability to satisfy the requirements of the subsequent stages of these guidelines is unimpaired;
- the responsibility for such preliminary design activities is clearly defined in writing; and
- the Client, in writing, waives the MER's responsibility for such preliminary design activities and their effect on the selection of the mechanical systems.

3.3.2.2 Design Development Stage

In this stage, after the selected scheme has been developed in sufficient detail to enable the preparation of the final design and construction documents by all participants of the design team, the MER may provide the following services:

- Attend meetings with the Client and design team, if required.
- Review the results of studies conducted by specialist consultants, such as geotechnical, fire protection, and code.
- Prepare preliminary mechanical analysis and design calculations for typical mechanical elements of the mechanical systems, and select appropriate equipment, including reviewing and summarizing local energy sources and costs required for mechanical systems options.
- Prepare preliminary service drawings based on information coordinated with other consultants.
- Prepare preliminary designs and drawings showing layouts of typical areas.
- Prepare or edit the outline Specifications for mechanical items, as required.
- Coordinate general mechanical design with space and servicing criteria to meet the requirements of the other design team participants. In particular, notify the EER of general points of interface between the two disciplines and determine as soon as possible the electrical characteristics and electrical requirements of general mechanical loads and potential conflicts between the mechanical and electrical riser locations.
- Update equipment weights, size, and other physical characteristics that are to be considered in the building's structural, mechanical, and electrical design.
- Determine the impact of noise and vibration from the mechanical systems, and recommend solutions or recommend involvement of specialty professionals, if necessary.
- Submit design development documentation for review and approval by the Client.
- Cooperate with others responsible for preparing the cost estimate.
- Establish procedures for quality control for the project.
- Confirm conditions that affect the Commissioning function with the Commissioning Specialty Engineer, and record the results of the review in a written report to the CRP.
- Prepare a design development report and submit it to the CRP.

3.3.2.3 Building Permitting Stage

In this stage, if a building permit is required, Letters of Assurance in the forms set out in Schedule A, Confirmation of Commitment By Owner and Coordinating Registered Professional, and Schedule B, Assurance of Professional Design and Commitment for Field Review, of the *BCBC* or VBBL must be submitted to the Authority Having Jurisdiction. If there is CRP on the project, the CRP must initial all Schedule B Letters of Assurance.

Division C, sentence 2.2.7.3.(3) of the *BCBC* or VBBL requires that an Engineering Professional "place their professional seal or stamp on the plans submitted by themselves in support of the application for a building permit, after ascertaining that they substantially comply with the governing Building Code/Building By-law and other applicable enactments respecting safety."

For building permit submission, the drawings may be indicated with a note, "Issued for Permitting Purposes Only." The Authority Having Jurisdiction will not accept drawings with a note similar to "Not for Construction." The MER should coordinate with the CRP and Prime Contractor to ascertain whether an "Issued for Construction" set of drawings will be used on the construction site.

Following is a summary of the minimum level of information required on mechanical drawings for permitting purposes, in order to meet the intent of the relevant provisions in the *BCBC* and VBBL. The mechanical drawings must:

1. be complete for their intended purpose;
2. substantially comply with the *BCBC*, VBBL, and other applicable enactments respecting safety (except for construction safety aspects);
3. contain sufficient detail to enable the design to be checked by another Engineering Professional for conformance to the *BCBC* and VBBL;
4. be appropriately checked, with records of the checks performed retained for a minimum of ten years; and
5. be sealed, signed, and dated by an Engineering Professional.

3.3.2.4 Contract Document Stage

During this stage, the CRP should have regular meetings, as necessary, with members of the design team and with the Owner, to maintain communication or to seek authorization regarding special areas that may be of concern. Minutes of meetings and letters confirming decisions must be maintained. (See also Section 2.1.2 Communication and Coordination.)

At the completion of this stage, the Owner considers the Contract Documents and authorizes the CRP to proceed to the tender phase.

Design notes are not normally submitted to the Owner unless specifically requested. However, they must be available for review, and should therefore be clearly documented in an appropriate format.

During this stage, the MER may provide the following services:

- Design the mechanical systems, including selecting and scheduling all mechanical equipment, components, accessories, and options required to meet the Owner's design intent and basis of design.
- Determine and specify in the Contract Documents which mechanical elements are to be designed by specialty professionals.
- Attend periodic coordination meetings, as required.
- Coordinate with the Authority Having Jurisdiction, as required.
- Establish testing and inspection requirements.
- Comply with fire resistance requirements as determined by the CRP or specialty professionals.
- Seal documents according to the *Act* and the Bylaws.
- Assist with building permit submissions, and provide Letters of Assurance and supporting documents and drawings, as required for "issued for Building Permit" purposes.

Mechanical Calculations

The MER must prepare mechanical calculations to support all mechanical designs. The mechanical calculations should be legible and presentable and retained by the MER for record purposes. Retained records of input and output of any computer analysis should be included, as well as descriptions of the software used.

Refer to the *Guide to the Standard for Retention of Project Documentation* (Engineers and Geoscientists BC 2021b).

In general, the information prepared in connection with the mechanical calculations include but are not limited to the following:

- Design criteria, including:
  - discussion and description of design basis, including assumptions;
  - building codes used with edition dates; and
  - a list of mechanical design parameters and provisions more stringent than those in the building code, as requested by the Client or otherwise used by the MER.
- Location diagrams for mechanical elements.
- Computer analysis and design results, if applicable.
  - Where energy modelling is required, refer to the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services* (AIBC and Engineers and Geoscientists BC 2018).
- Special studies and analysis where required by the code.

For critical design elements and where required by the code, work done by an Engineering Professional with limited experience must be checked by an independent Engineering Professional who is not involved in the project, but who is not necessarily from a separate company. The names of the mechanical design engineer(s) and design check engineer must be clearly indicated and dated on the calculation sheets, along with a table of contents for or index to the mechanical calculations.

Heat recovery systems designed by the MER must include estimated heat gains recovered from electrical equipment; for example, the EER may be required to determine the heat from other sources (e.g., transformers, computers, racks).

Mechanical Drawings

The MER must prepare complete contract drawings. The drawings should be made, where possible, to the same scale as the building layout drawings, and should define the work as follows:

- Where scale of drawings or complexity of work make the drawings difficult to read and interpret, separate drawings should be provided for areas of the work such as:
  - plumbing drainage;
  - heating, ventilating, and air conditioning;
  - fire protection;
  - process piping and equipment; and
  - other special systems as necessary, including details for installation of specific equipment and specific components specific installation details.
- Schematics and diagrams should be provided, as required, for all major systems with notes to describe the function of control, flow, and operation; this includes ventilation systems, hydronic heating and cooling systems, and life-safety interlocks and controls notes.
- Plot plans and/or site plans should be included that show water supply, gas supply, sanitary and drainage arrangements, and connections to public utility services or site utility services designed and coordinated by others (e.g., civil engineering consultant), as required, complete with invert elevations.
- Symbol lists and typical details should be included, where required, for all equipment, accessories, piping, and duct systems.
- Floor plan layouts for all piping and duct systems should be provided. Complete duct and pipe sizing should be shown on these documents. Sizes, types, locations, and capacities of all supply and exhaust

air terminals should be shown, together with type and location of valves.

- To avoid conflicts, supplementary details should be provided for boiler, equipment, and fan rooms and congested areas. For clarity, such details should be drawn in plan and elevation views at a scale of 1:50 (1/4" to the foot) or larger.
- Piping and duct work can be shown in single line, except where necessary to show arrangements and clearance for piping or duct work in ceiling spaces, shafts, header trenches, pipe chases, and tight or close-coupled equipment. This piping and duct work should be shown in double-line detail with appropriate valves, fittings, and accessories.
- Schedules should be included to provide capacities and details of performance of fans, air-handling units, and pumps. Alternatively, these schedules may be included in the Specifications.
- All drawings, as well as details, elevations, and sections, should be properly cross-referenced.
- Each mechanical drawing should contain:
  - the name of the project;
  - a north-pointing arrow;
  - the scale of the plan; and
  - the consultant's name and contact information.
- All equipment and devices that require connection to the electrical system must be coordinated with the EER. At a minimum, the power, control, and interlock requirement for each load should be indicated. Trade responsibilities and trade definition rules for the project should be established prior to passing information to the EER.
- The structural engineer of record should be provided with drawings and information indicating concrete bases, curbs, roof openings, floor openings, wall openings, structural member penetrations, and equipment weights and dimensions. The structural engineer of record also should be provided with details on the force imparted onto structural members due to piping expansion and anchorage.
- Mechanical site plans should incorporate:
  - the municipal address and legal description of the project;
  - mechanical utilities connections, with sizes, capacities, and design criteria (e.g., plumbing fixture count, flows, pressures);
  - invert elevation of underground services and connections;
  - gas supply information and meter location; and
  - coordination information for landscaping, architectural, and civil requirements.
- Plumbing and drainage plans should show:
  - pipe sizes;
  - direction of slope; and
  - fixtures or devices served.
- Roof drainage plans should:
  - indicate the area served and roof drain locations;
  - show flow rates and retention data for control-flow roof drains, if applicable;
  - indicate the shallowest invert on the lowest level, and leaving the invert (i.e., building connection) for both sanitary and storm-sewer mains; and
  - provide detail and dimensions for all drainage sumps and lift stations, including incoming and outgoing inverts.
- Water distribution plans should include:
  - the location and type of fixtures and equipment;
  - complete details of water-entry piping, including water meter, pressure reducing devices, and back-flow devices;
  - system layouts showing connection to fixtures complete with pipe sizes; and
  - for multi-story buildings, risers on floor plans, including riser diagrams where appropriate, and for clarity, larger-scale plans (1:50) should be provided for areas with a high density of fixtures.

- Where 3-D modelling is being used for the building and building systems design, the level of detail must be clarified and established by the design model manager (normally the CRP), and the above general guidelines must be modified to meet the requirements for the agreed level of detail. If a level of detail is required to include individual component technical attributes and bills of materials generation, it may be considered to be additional services rather than basic services, and must be agreed to in the initial scope of services.

Specifications

The MER must prepare Specifications using a format suitable for inclusion with the overall Contract Documents. The Specifications may be in a book format, or be text on drawing sheets, provided sufficient detailed project-specific Specifications are provided that enable the design intent to be constructed and operated.

The Specifications should include:

- standards, codes, and bylaws governing work;
- Submittals required;
- quality control requirements;
- acceptable materials and acceptable or alternate equipment;
- workmanship and fabrication requirements and standards;
- tolerances;
- information for temporary works and erection information, where necessary to ensure the intent and integrity of the design;
- construction inspection and testing;
- notification by the contractor before significant segments of the work are begun;
- warranties;
- performance criteria for design and detailing by specialty professionals;
- controls and automation requirements, including project-specific sequences of operation and interlocks to other building systems (e.g., lighting, security, energy metering, fire alarm system);
- operations and Maintenance Manual requirements;
- testing, balancing, and Commissioning requirements; and
- verification requirements, including project-specific close-out documentation requirements and materials required prior to occupancy.

Where appropriate, the Specifications may be abbreviated and become part of the drawings. The Specifications generally require that the MER's review of Submittals and inspection of work, as well as any testing by independent agencies reporting to the Client, are undertaken to inform the Client of the quality of the contractor's performance, and that the MER's review and testing are not for the benefit of the contractor. The contractor must provide its own independent quality control program.

The MER may also assist the Client in obtaining required approvals, licenses, and permits. This includes, but is not limited to, preparation and supply of Letters of Assurance and documents required by the Authority Having Jurisdiction.

3.3.2.5 Tendering Stage

The tendering stage begins when bid documents are issued for the call for tenders, which could include the initial tender packages for sequential/fast-tracked tendering and negotiated procurement project delivery processes. The tender phase ends at the completion of negotiations and allows the signing of a contract.

At the completion of the tendering stage, the Owner considers the tender report and authorizes the CRP to proceed based on specific instructions on all items that will affect the awarding of the contract.

During the tendering stage, the MER may provide the following services:

- Assist in the preparation of prequalification documents, if required.
- Attend a mandatory site visit (for a project related to an existing building), if required.
- Assist in reviewing bidder's qualifications, if required.
- Assist in analysis and evaluation of tenders submitted.

- Assist the Client in answering queries raised by the bidding contractors, and issue mechanical addenda and clarification of mechanical documents, as required.
- Assist in the preparation of the contract, if required.

3.3.2.6 Construction Stage

This stage begins with the signing of the contract for construction, and ends with the issuance of Schedule C of the *BCBC* or VBBL and certificate of final acceptance.

Field Services During Construction

It is essential that Field Services be provided for all systems for which the MER is responsible, to ascertain whether or not the work is generally in accordance with the mechanical Contract Documents and substantially complies with the *BCBC* or VBBL.

Field Services are the responsibility of the MER; however, where practical, the MER may delegate these duties to others, provided the MER reviews and directly supervises the Field Services. See the *Guide to the Standard for Documented Field Reviews During Implementation or Construction* and the *Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021c and 2021d)

Field Services provided by the MER should not be construed as relieving the contractor of responsibility for building the project according to the Contract Documents, controlling the progress, providing safe working conditions, or correcting any deviations from the project requirements.

Note that some items reviewed by the MER may also require review by other members of the design team or by testing and inspection agencies. Such work may include proprietary products and mechanical elements designed by others. This includes review of Field Reviews provided by any specialty or supporting professionals involved in the building project.

Field Services may vary depending on the complexity of the job and should include, but not necessarily be limited to, the following:

- Attend construction meetings, if required.
- Confirm communication channels and procedures.
- Assist in confirming, reporting, and scheduling procedures for testing and inspections.
- Assist in confirming procedures for shop drawings and other Submittals.
- Confirm that the qualifications of manufacturers meet the Specifications.
- Advise the contractor and the CRP on the interpretation of the mechanical drawings and Specifications, and issue supplementary details and instructions during the construction period, as required,
- If requested, advise the Client on the validity of charges for additions to, or deletions from, the contract and on the issue of change orders.
- Review and comment on, if requested by the Client, the contractor's applications for progress payments, and estimate, if required, completed work and materials on site for payment according to the terms of the construction contract.
- Review reports from the testing and inspection agencies, to determine if the agency has verified compliance of the reported item of work with the mechanical Contract Documents, and initiate any necessary action.
- Conduct substantial performance Field Reviews of the mechanical components of the project, note deficiencies, and inspect completed corrections.
- Submit, if required, Letters of Assurance and Final Design Drawings to the Authority Having Jurisdiction.
- Attend the start-up of the mechanical systems and respond as required to any design-related operational difficulties.
- Arrange and perform Field Reviews when the contractor has applied for substantial completion of the project, prepare a list of deficiencies (e.g., workmanship, completeness, functionality), and, when these have been rectified, issue the final report.

Review of Submittals

Submittals should be reviewed for general compliance with the mechanical Contract Documents; however, this does not include checking dimensions or quantities or reviewing the contractor's safety measures or methods of construction. In addition, the responsibility for the shop drawing compilation, generation, and initial review for compliance is the responsibility of the contractor.

The review of Submittals should include the following:

- Review the shop drawings and other Submittals for conformance with the Contract Documents and the intent of the design. This includes confirming compliance with specified performance or technical requirements that are necessary to meet the design intent.
- Confirm that the Submittals have been reviewed by the Prime Contractor and relevant Subcontractor before review by the MER.
- When required by the Contract Documents, the MER must confirm that the shop drawings bear the signature and professional seal of the Specialty Engineer responsible for the design of specialty systems such as seismic elements and connections and sprinklers. Responsibility for the detail design remains with the Specialty Engineer whose seal and signature appear on the drawings. To clarify responsibility, the Specialty Engineer may qualify the extent of work that has been designed by the Specialty Engineer.
- Review Record Drawings prepared and submitted by the contractor on white prints or mylar copies to reflect "Record" condition of the project as turned over to the Client. The Client must be advised that these drawings are prepared by the contractor and have been reviewed only for general conformity to the drawing standards and the intent of the design, and that the MER cannot accept responsibility for their accuracy.
- Arrange for the contractor to submit and review the operating and Maintenance Manual for the equipment and systems supplied on the project. The data submitted should include manufacturer's recommendations for maintenance of each piece of equipment and other information that will enable the Client to assume operation of the building.

Field Reviews

Field reviews should include, but not necessarily be limited to, the following:

- Visit the site at intervals appropriate to the stage of construction to observe the quality and the progress of the construction of those elements designed by the MER. At the discretion of the MER, proprietary products, connections, and other seismic restraint elements designed by Specialty Engineers should be inspected by those Specialty Engineers at the appropriate stage of construction and reported in writing to the MER.
- With respect to firestopping and seismic restraint of mechanical services and elements, the MER can request a written letter from the contractor or respective materials supplier. The letter must confirm that a proven certified product for the application with the supporting shop drawings has been used, a site inspection has been carried out, and the firestopping products and seismic products have been certified, tested, and listed by an accredited testing agency and meet the suppliers' requirements for the specific installations. The MER may also defer to a Specialty Engineer and obtain a supporting Schedule S-C assurance document for the firestopping and seismic installations. It is the MER's responsibility to ensure that the continuity of fire separations at HVAC penetrations is maintained according to the Schedule B Letter of Assurance.
- With respect to fire suppression systems, where the MER has taken responsibility for the entire sprinkler design and installation (see Scenario 1 under Fire Suppression Systems in Section 3.3.1.2), then the Field Review requirements outlined in this section are required.

- With respect to fire suppression systems, where the MER has taken responsibility for the sprinkler design and installation (see Scenario 2 under Fire Suppression Systems in Section 3.3.1.2)—which is the "For Performance Specification Only" scenario—the MER must:
  - provide Field Reviews of the fire suppression system to confirm substantial conformance to the performance Specification;
  - monitor that Field Reviews are being undertaken by the sprinkler Specialty Engineer; and
  - witness the integrated life-safety Commissioning tests to ensure that the testing shows that the design intent is met in coordination with components provided by other disciplines.
- Where the fire protection systems are designed by, and the installation supervised by, a Specialty Engineer who has been engaged directly by the Owner or Client, that Specialty Engineer would normally submit the Field Reviews directly to the Owner or Client and provide the required services described in the *Guidelines for Fire Protection Engineering Services in Building Projects* (Engineers and Geoscientists BC 2013).
- Prepare site visit reports outlining observations and deficiencies in the work and bring them to the attention of the contractor's site representative.
- Distribute site visit reports to the CRP and other parties such as the Prime Contractor and Owner, as required. Where the Owner directly retains the services of the MER, it is recommended that the Owner also be sent copies of the reports.
- Conduct a final project review and advise the Client of continuing or newly observed defects or deficiencies in the project.

3.4 ADDITIONAL MECHANICAL ENGINEERING SERVICES

In addition to the basic services, the MER may provide additional services, if the MER and the Client reach appropriate mutual agreements.

These additional services are not considered to be intrinsic parts of the basic services discussed in Section 3.3 Basic Mechanical Engineering Services, and are not part of the minimum services that the MER should provide under these guidelines, except as agreed upon in a contract.

The Client should retain the MER to provide additional services, in order to review items designed by others to confirm compatibility with the design of the mechanical systems. Scopes of additional services and recommended fees are also summarized in the *Consulting Engineers Fee Guideline* (ACEC-BC 2018).

The following are examples of additional services:

- Being engaged as the CRP for a project that requires additional administration and subconsultant management services.
- Being engaged in an integrated design team contract and project delivery approach where the project performance goals become a shared risk/reward contract with the Owner.
- Being engaged or requested to supervise and manage a contractor's site installation works, a contractor's schedule management, work progress, and/or detailed installations.
- Being engaged to provide post-occupancy operational reviews and troubleshooting of the building systems over the first year or some term of occupancy, after the building has been turned over to the Owner or Client.
- Design work resulting from changes to the project as originally described and agreed to under the contract between the MER and Client, such as changes in scope, complexity, diversity, or magnitude of the project.

- Preparation of alternate mechanical designs and related documentation, after the mechanical system was selected during the conceptual and schematic design stages.
- Review, design, and documentation of alternate or substitute systems, if requested by the CRP, the Client, or the contractor, for tendering to obtain competitive bids for items such as proprietary products.
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, or phased or fast-track construction.
- Review of alternate designs or products after completion of the Contract Documents.
- Work resulting from changes necessary because of construction cost over-run outside the control of the MER.
- Translation of Contract Documents into a second language, conversion to other units, or special preparation of drawings for reduction.
- Programming of such items as Owner's equipment and mechanical systems, where investigation and analysis must determine user requirements for a statement of system requirements, materials, and performance.
- Analysis of long-range plans as defined by the CRP, and attendant preliminary sketches and reports (master planning).
- Preparation of alternative building or system designs and attendant documentation, when required by the CRP or Client, either for review or for competitive tender prices.
- Travelling time outside of normal requirements.
- Construction or project management services.
- Energy analysis and value engineering (lifecycle costing) analysis, including schematics, where required by the CRP or Client.
- Design and construction administration of specialized building systems that are not required by the *BCBC* but are enhanced building systems features, such as rainwater harvesting and non-potable water treatment systems, and renewable energy systems. These systems may be included by the MER in the basic services as required, or broken out as additional services, depending on the project requirements.
- Preparation of designs and documentation for future implementation not included in construction contract.
- Preparation of bills of material or schedules of material at any time during the project, including building information modelling (BIM), where specific equipment and systems attributes are incorporated into the design model to create bills of materials and operational information.
- Resident engineering services during construction, or supplying resident staff on the project, to determine if the contractor is carrying out their work in accordance with the Contract Documents. If required by the CRP, resident services may include recording all details of construction for final revision of the plans or drawings to show the work on Record Drawings. "Services" as described do not include the direction of persons or the selection, direction, or approval of methods and equipment employed by the contractor in any phase of the construction, or the placing in operation of any plant or equipment.
- Preparation of drawings, Specifications, and change orders, and administration of contract additions and/or deletions that are initiated by the Client but either have not been implemented or result in a reduction or increase in the contract price.
- Certification inspections and testing of life-safety systems, where required by the Authority Having Jurisdiction.
- Testing of building systems requiring confirmation of conformance with Specifications.
- Preparation of operating and Maintenance Manuals.
- Preparation of Record Drawings, where requested. (In this case, the MER does not guarantee the accuracy of information provided by the contractor to the MER.)

- Providing services after expiry of the period of one year following the certification of substantial performance.
- Complete or partial revision of design documents previously approved by the Client or in keeping with written instructions or drawings previously received from the Client.
- Commissioning of building mechanical systems, including training of personnel and providing operating and maintenance assistance.
- Advisory services, including:
  - testimony;
  - consultation and advice;
  - appraisals;
  - valuations;
  - research; or
  - other services leading to specialized conclusions and recommendations.
- Surveys of existing mechanical equipment, including elaborate surveys or measurements and evaluation of existing mechanical equipment; i.e., securing of information on special existing loadings, such as unusual equipment requirements or unusual construction.
- Balancing of air and water/liquid systems that involves the actual detailed balancing and adjustment of air and water/liquid systems, including adjustment of heating, air conditioning, ventilation systems, and piping networks as installed. Note that it is customary to include in the Specifications a detailed outline of the balancing procedure, and to provide an allowance in the construction contract for the Contractor to engage the services of a skilled technician who will supervise and assist the contractor in the proper balancing procedure and prepare the balancing reports for submission to the MER.
- Computerized energy analysis involving the use of computer programs to simulate the amount of energy used in building. The analysis capabilities provided by the software allows for optimization of the effects of varying architectural features, mechanical systems, and electrical systems.
- Fast-track construction, when in order to facilitate an earlier-than-normal construction start, the CRP or project manager requests the MER to prepare several separate bid packages instead of one package, which is the norm. In this case, complete tender documentation necessitating extra work on the part of the MER is required for each bid package.
- Site work elements beyond the property line or beyond the demarcation line agreed to with a site civil engineer.
- Seismic restraints designed by Specialty Engineers for mechanical systems.
- Review of design drawings or Specifications prepared by others, to determine adequacy of anchorage of seismic elements for mechanical equipment.
- Preparation or assistance with the preparation of detailed cost estimates. The MER must inform the Client of the variables inherent in the estimate and the expected degree of variation from the estimate. Where the degree of variation is critical, the Owner should have the estimate independently verified.
- Filing application for and obtaining permits.
- Preparation of demolition documents.
- Tenant-related design services.
- Design or review of the effects of the contractor's methods, procedures, or construction equipment on the structure.
- Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor.
- Work due to extended time schedules for design or construction.
- Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including associated preparation.
- Work resulting from damage from fire, man-made disasters, or natural disasters.
- Authorized overtime work requiring premium pay.

3.4.1 MECHANICAL ENGINEER AS COORDINATING REGISTERED PROFESSIONAL

Where the MER assumes the role of the CRP, the following general aspects of the project management services must be applied:

- Ensure proper communication of information between the Owner, the contractor, and the design team, so the work proceeds in a manner that complies with applicable codes and regulations and meets the Owner's needs.
- Engage and coordinate the work of all subconsultants, and ensure that all subconsultants have the appropriate experience and resources to fulfill their discipline responsibilities.
- Arrange for all necessary preliminary studies and estimates, on behalf of the Owner.
- Arrange for, and coordinate the work of, all specialty consultants and testing agencies on behalf of the Owner.
- Outline the scope of assignment to each design professional for design, preparation of Contract Documents, and review of work during construction and contract administration.
- Ensure all design disciplines adhere to project cost and quality parameters during the design process.
- Provide timely information in sufficient detail as required by the design team to adequately perform its duties.
- Ensure proper review of the designs, drawings, and other Contract Documents produced by the design team, including interdisciplinary review.
- Draft the forms of tenders and, if required, arrange for project tendering, review of tenders, and awarding of contract on behalf of the Owner.
- Inform the design team of tender call results.
- Provide the design team with necessary documentation needed for contract administration.
- Process shop drawings to and from the subconsultants and Contractor, and administer progress claims reviews, site instructions, and change order requests.
- Organize, schedule, and attend job meetings and ensure attendance by all design disciplines; and provide Field Reviews, including administering Field Reviews conducted by subconsultants.
- Coordinate and administer project closeout requirements and documentation, including providing contract completion certification, as required.
- Perform envelope thermal performance calculations for overall and effective U-values.
- Perform, or arrange for a Specialty Engineer to perform, harmonic distortion calculations for the impact of mechanical equipment-generated harmonics.

3.5 FABRICATION DRAWINGS AND DOCUMENTS

Fabricators and/or manufacturers must produce all necessary drawings and documents to represent the work covered by their contract with the contractor. These drawings and documents are prepared following a review of the drawings, Specifications, and Contract Documents supplied by the MER and following the resolution of any errors or requested changes.

Fabrication drawings and documents usually include the following:

- Shop Drawings: Drawings produced by the Fabricator and/or manufacturer to provide all information necessary for shop personnel to fabricate and assemble the items. Shop drawings must be sealed, signed, and dated when incorporating design by the Specialty Engineer and/or the equipment Fabricator or manufacturer.
  - Refer also to the *Professional Practice Guideline – Shop Drawings* (Engineers and Geoscientists BC 2015).

4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE

4.1 QUALITY MANAGEMENT REQUIREMENTS

Engineering Professionals must adhere to applicable quality management requirements during all phases of the work, in accordance with the Engineers and Geoscientists BC Bylaws and quality management standards.

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

- Use of relevant professional practice guidelines
- Authentication of professional documents by 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 and/or recommendations during implementation or construction
- Where applicable, documented independent review of structural designs prior to construction
- Where applicable, documented independent review of high-risk professional activities or work prior to implementation or construction

4.1.1 USE OF PROFESSIONAL PRACTICE GUIDELINES

Engineering Professionals are required to comply with the intent of any applicable professional practice guidelines related to the engineering work they undertake. As such, Engineering Professionals must implement and follow documented procedures to ensure they stay informed of, knowledgeable about, and meet the intent of professional practice guidelines that are relevant to their professional activities or services. These procedures should include periodic checks of the Engineers and Geoscientists BC website to ensure that the latest versions of available guidance are being used.

For more information, refer to the *Quality Management Guides –Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021a), which also contains guidance for how an Engineering Professional can appropriately depart from the guidance provided in professional practice guidelines.

4.1.2 AUTHENTICATING DOCUMENTS

Engineering Professionals are required to seal all Documents, including electronic files that they prepare or deliver in their professional capacity to others who will rely on the information contained in them. This applies to Documents that Engineering Professionals have personally prepared and those that others have prepared under their direct supervision.

Failure to appropriately seal Documents is a breach of the Bylaws.

For more information, refer to the *Quality Management Guides – Guide to the Standard for the Authentication of Documents* (Engineers and Geoscientists BC 2021e).

4.1.3 DIRECT SUPERVISION

Engineering Professionals are required to directly supervise any engineering work they delegate. When working under the direct supervision of an Engineering Professional, an individual may assist in performing engineering work, but they may not assume responsibility for it. Engineering Professionals who are professional licensees engineering may only directly supervise work within the scope of their licence.

When determining which aspects of the work may be appropriately delegated using the principle of direct supervision, the Engineering Professional having ultimate responsibility for that work should consider:

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

Careful consideration must be given to delegating field reviews. Due to the complex nature of field reviews, Engineering/ Professionals with overall responsibility 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. When delegating field review activities, Engineering Professionals must document the field review instructions given to a subordinate. (See Section 4.1.6 Documented Field Reviews During Implementation or Construction.)

For more information, refer to the *Quality Management Guides – Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021d).

4.1.4 RETENTION OF PROJECT DOCUMENTATION

Engineering Professionals are required to establish and maintain documented quality management processes to retain complete project documentation for a minimum of ten (10) years after the completion of a project or ten (10) years after an engineering document is no longer in use.

These obligations apply to Engineering Professionals in all sectors. Project documentation in this context includes documentation related to any ongoing engineering work, which may not have a discrete start and end, and may occur in any sector.

Many Engineering Professionals are employed by organizations, which ultimately own the project documentation. Engineering Professionals are considered compliant with this quality management requirement when reasonable steps are taken to confirm that (1) a complete set of project documentation is retained by the organizations that employ them, using means and methods consistent with the Engineers and Geoscientists BC Bylaws and quality management standards; and (2) they consistently adhere to the documented policies and procedures of their organizations while employed there.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Retention of Project Documentation* (Engineers and Geoscientists BC 2021b).

4.1.5 DOCUMENTED CHECKS OF ENGINEERING AND GEOSCIENCE WORK

Engineering Professionals are required to perform a documented quality checking process of engineering work, appropriate to the risk associated with that work. All Engineering Professionals must meet this quality management requirement.

The checking process should be comprehensive and address all stages of the execution of the engineering work. This process would normally involve an internal check by another Engineering Professional within the

same organization. Where an appropriate internal checker is not available, an external checker (i.e., one outside the organization) must be engaged. In some instances, self-checking may be appropriate. Where internal, external, or self-checking has been carried out, the details of the check must be documented. The documented quality checking process must include checks of all professional deliverables before being finalized and delivered.

Engineering Professionals are responsible for ensuring that the checks being performed are appropriate to the level of risk associated with the item being checked. Considerations for the level of checking should include:

- the type of item being checked;
- the complexity of the subject matter and underlying conditions related to the item;
- the quality and reliability of associated background information, field data, and elements at risk; and
- the Engineering Professional's training and experience.

As determined by the Engineering Professional, the individual doing the checking must have current expertise in the discipline of the type of work being checked, be sufficiently experienced and have the required knowledge to identify the elements to be checked, be objective and diligent in recording observations, and understand the checking process and input requirements.

For critical design elements of the mechanical system, or where there are significant life-safety implications, or where required by the *BCBC*, the design must be checked by an independent engineer, not necessarily from a separate company. The independent review must be documented and the documentation retained as described in Section 4.1.4 Retention of Project Documentation.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work* (Engineers and Geoscientists BC 2021f).

4.1.6 DOCUMENTED FIELD REVIEWS DURING IMPLEMENTATION OR CONSTRUCTION

Field reviews are reviews conducted at the site of the construction or implementation of the engineering work. They are carried out by an Engineering Professional or a subordinate acting under the Engineering Professional's direct supervision (see Section 4.1.3 Direct Supervision).

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

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction* (Engineers and Geoscientists BC 2021c).

4.1.7 DOCUMENTED INDEPENDENT REVIEW OF HIGH-RISK PROFESSIONAL ACTIVITIES OR WORK

Engineering Professionals must perform a documented risk assessment prior to initiation of a professional activity or work, to determine if that activity or work is high risk and requires a documented independent review.

If the activities or work are deemed high risk, and an independent review is required, the results of the risk assessment must be used to (1) determine the appropriate frequency of the independent review(s); and (2) determine if it is appropriate for the independent reviewer to be employed by the same firm as the Professional of Record, or if the independent reviewer should be employed by a different firm.

The documented independent review of high-risk professional activities or work must be carried out by an Engineering Professional with appropriate experience in the type and scale of the activity or work being reviewed, who has not been involved in preparing the design.

The documented independent review must occur prior to implementation or construction; that is, before the professional activity or work is submitted to those who will be relying on it.

For critical design elements of the mechanical system, or where there are significant life-safety implications, or where required by the *BCBC*, the design must be checked by an independent engineer, not necessarily from a separate company. The independent review must be documented and the documentation retained.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Activities or Work* (Engineers and Geoscientists BC 2021g).

4.2 OTHER QUALITY MANAGEMENT REQUIREMENTS

Engineering Professionals must also be aware of any additional quality management requirements from other sources that are relevant to their work, which may include but are not limited to:

- legislation and regulations at the local, regional, provincial, and federal levels;
- policies of Authorities Having Jurisdiction at the local, regional, provincial, and federal levels;
- agreements and service contracts between clients and Engineering Professionals or their firms; and/or
- standards for engineering firms, particularly those that apply to quality management system certification, such as the ISO 9000 family.

Engineering Professionals should assess any areas of overlap between the Engineers and Geoscientists BC quality management requirements and the requirements of other applicable sources. If the requirements of different sources overlap, Engineering Professionals should attempt to meet the complete intent of all requirements.

Where there are conflicts between requirements, Engineering Professionals should negotiate changes or waivers to any contractual or organizational requirements which may conflict with requirements of legislation, regulation, or the Engineers and Geoscientists BC Code of Ethics. Generally, no contractual obligation or organizational policy that may apply to an Engineering Professional will provide justification or excuse for breach of any of the Engineering Professional's obligations under any legislation, regulation, or the Engineers and Geoscientists BC Code of Ethics. Where such conflicts arise and cannot be resolved, Engineering Professionals should consider seeking legal advice from their own legal advisers on their legal rights and obligations in the circumstances of the conflict, and they may also seek practice advice from Engineers and Geoscientists BC on any related ethical dilemma that they may face in the circumstances.

4.3 PRACTICE ADVICE

Engineers and Geoscientists BC provides their Registrants and others with assistance addressing inquiries related to professional practice and ethics.

Practice advisors at Engineers and Geoscientists BC can answer questions regarding the intent or application of the professional practice or quality management aspects of these guidelines.

To contact a practice advisor, email Engineers and Geoscientists BC at practiceadvisor@egbc.ca.

5.0 PROFESSIONAL REGISTRATION & EDUCATION, TRAINING, AND EXPERIENCE

5.1 PROFESSIONAL REGISTRATION

Engineering Professionals have met minimum education, experience, and character requirements for admission to their professions. However, the educational and experience requirements for professional registration do not necessarily constitute an appropriate combination of education and experience for mechanical engineering services for building projects. Professional registration alone does not automatically qualify an Engineering Professional to take professional responsibility for all types and levels of professional services in this area of practice.

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 mechanical engineering services for building projects (Code of Ethics Principle 2).

5.2 EDUCATION, TRAINING, AND EXPERIENCE

The practice of mechanical engineering for building projects, as described in these guidelines, requires minimum levels of education, training, and experience in many overlapping areas of engineering.

Engineering Professionals who take responsibility for mechanical engineering for building projects must adhere to the second principle of the Engineers and Geoscientists BC Code of Ethics, which is to "practice only in those fields where training and ability make the registrant professionally competent" and, therefore, must evaluate their own 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. This section describes indicators that Engineering Professionals can use to determine whether they have an appropriate combination of education and experience.

Note that these indicators are not an exhaustive list of education and experience types that are relevant to mechanical engineering for building projects. Satisfying one or more of these indicators does not automatically imply competence in mechanical engineering for building projects.

Typical qualifications for the lead Engineering Professional or a team of professionals may include education and experience in the following areas:

- Mechanical engineering
- Basic knowledge of electrical and civil engineering
- Basic knowledge of architecture and sustainability

Engineering Professionals should not act as a Mechanical Engineer of Record (MER) unless they have obtained a minimum of two years of experience under the direct supervision of another MER. These two years of experience can be gained while going through the four years of training under the Engineer-in-Training (EIT) program.

The experience gained in order to practice as a MER must be relevant to the type of work and projects for which the MER will be taking responsibility.

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.

5.2.1 EDUCATIONAL INDICATORS

Certain indicators show that Engineering Professionals have received education that might qualify them to participate professionally in mechanical engineering for building projects. Educational indicators are subdivided into formal education (such as university or engineering school) and informal education (such as continuing education).

Formal educational indicators include having obtained or completed one or more of the following:

- An undergraduate-level degree in mechanical engineering or a related engineering field from an accredited engineering program
- Formal certification as a Certified Professional

Informal educational indicators include having participated in or undertaken one or more of the following:

- Training courses facilitated by the Engineering Professional's employer that focus on mechanical engineering for buildings, or related topics such as civil and electrical engineering, architecture, and sustainability.
- Continuing education courses or sessions offered by professional organizations (such as Engineers and Geoscientists BC) that focus on building projects.
- Conferences or industry events that focus on relevant topics in mechanical engineering or building topics.
- A rigorous and documented self-study program involving a structured approach that contains materials from textbooks and technical papers on topics relating to building projects and the practice of mechanical engineering.

5.2.2 EXPERIENCE INDICATORS

Certain indicators show that Engineering Professionals have an appropriate combination of experience that might qualify them to participate professionally in mechanical engineering for building projects.

Experience indicators include having completed one or more of the following:

- For an extended duration (greater than one year) and/or as an Engineering-in-Training (EIT)/ Geoscientist-in-Training (GIT), participated in the practice of mechanical engineering for building projects under the direct supervision of an Engineering Professional with an appropriate combination of education and experience.
- Participated in past projects working alongside experienced building consultants, and developed a sufficient knowledge of mechanical engineering, and basic understanding of civil and electrical engineering, architecture, and sustainability.
- Participated in academic or industry working groups that focus on professional topics relating to the practice of engineering for building projects.

6.0 REFERENCES AND RELATED DOCUMENTS

Documents cited in these guidelines and appendices appear in Section 6.1: Regulations and Section 6.2 References.

Related documents that may be of interest to users of these guidelines but are not formally cited elsewhere in this document appear in Section 6.3: Related Documents.

6.1 REGULATIONS

The following regulations are referenced in these guidelines:

Architects Act [RSBC 1996], Chapter 17.

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

Professional Governance Act [SBC 2018], Chapter 47.

Public Health Act [SBC 2008], Chapter 28.

6.2 REFERENCES

The following documents are referenced in these guidelines:

Architectural Institute of British Columbia (AIBC) and Engineers and Geoscientists BC. 2020. Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals. Vancouver and Burnaby, BC: AIBC and Engineers and Geoscientists BC. [accessed: 2020 Sep 18]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

AIBC and Engineers and Geoscientists BC. 2018. Joint Professional Practice Guidelines – Whole Building Energy Modelling Services. Vancouver and Burnaby, BC: AIBC and Engineers and Geoscientists BC. [accessed: 2020 Sep 18]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Association of Consulting Engineering Companies British Columbia (ACEC-BC). 2020a. Consulting Engineers Fee Guideline. Vancouver, BC: ACEC-BC. [accessed: 2020 Sep 18]. https://acec-bc.ca/2020/02/2020-consulting-engineers-fee-guideline/.

ACEC-BC. 2020b. User Guide to Implementing Qualifications Based Selection. Vancouver, BC: ACEC-BC. [accessed: 2020 Sep 18]. https://acec-bc.ca/2020/09/user-guide-to-implementing-qualifications-based-selection/.

ACEC-BC. 2019. Contract Language Management Plan. Vancouver, BC: ACEC-BC. [accessed: 2020 Sep 18). https://acec-bc.ca/2019/11/contract-language-management-plan/.

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British Columbia (BC) Building Code (BCBC). 2018. Letters of Assurance. [website]. [accessed: 2020 Sep 18]. http://www.bccodes.ca/letters-of-assurance.html.

City of Vancouver. 2019. City of Vancouver Building By-law 2019. Vancouver, BC: City of Vancouver. [accessed: 2020 Nov 30]. http://www.bccodes.ca/vancouver-bylaws.html.

Engineers and Geoscientists BC. 2021a. Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines. Version 1.1. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 13]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021b. Quality Management Guides – Guide to the Standard for Retention of Project Documentation. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 7]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021c. Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 7]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021d. Quality Management Guides – Guide to the Standard for Direct Supervision. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 7]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021e. Quality Management Guides – Guide to the Standard for the Authentication of Documents. Version 3.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 7]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021f. Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 7]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021g. Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Activities or Work. Version 1.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Apr 27]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2015. Professional Practice Guidelines – Shop Drawings. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2020 Sep 18]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2013. Professional Practice Guidelines – Fire Protection Engineering Services for Building Projects. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2020 Sep 18]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2010. Bulletin K: BCBC – Letters of Assurance in the BC Building Code and Due Diligence. (September 2010). Burnaby, BC: Engineers and Geoscientists BC 2010. [accessed: 2020 Sep 18]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Province of British Columbia. 2010. Guide to the Letters of Assurance in the B.C. Building Code 2006. (December 2010). Victoria, BC: Building and Safety Standards Branch. [accessed: 2020 Sep 18]. http://www.bccodes.ca/letters-of-assurance.html.

6.3 RELATED DOCUMENTS

The following resources provide general information on consulting engineering practices:

Canadian Construction Documents Committee (CCDC). 2020. CCDC Contract Forms. [web page]. [accessed: 2020 Sep 18]. https://www.ccdc.org/documents/set/contract-forms/

Engineers Canada. 2019. National Engineering Guidelines and Engineers Canada Papers. [web page]. [accessed: 2020 Sep 18]. https://engineerscanada.ca/regulatory-excellence/national-engineering-guidelines

Joint Federal Government / Industry Cost Predictability Taskforce. 2012. Guide to Cost Predictability in Construction: An Analysis of Issued Affecting the Accuracy of Construction Cost Estimates. Ottawa, ON: Canadian Construction Association. [accessed: 2020 Sep 18]. https://www.cca-acc.com/best-practices-resources/cca-documents/general-publications/guide-to-cost-predictability-in-construction/.

Professional Engineers Ontario (PEO). 1997. Guideline – Professional Engineers Providing Mechanical and Electrical Engineering Services in Buildings. Toronto, ON: PEO. [accessed: 2020 Sep 18]. https://www.peo.on.ca/knowledge-centre/practice-advice-resources-and-guidelines/practice-guidelines.

7.0 APPENDICES

Appendix A: Common Organizational Structures 42

- Figure A1: Mechanical Engineer of Record (MER)/Coordinating Registered Professional Contract
- Figure A2: Mechanical Engineer of Record (MER)/Owner Contract
- Figure A3: Design/Build Contract

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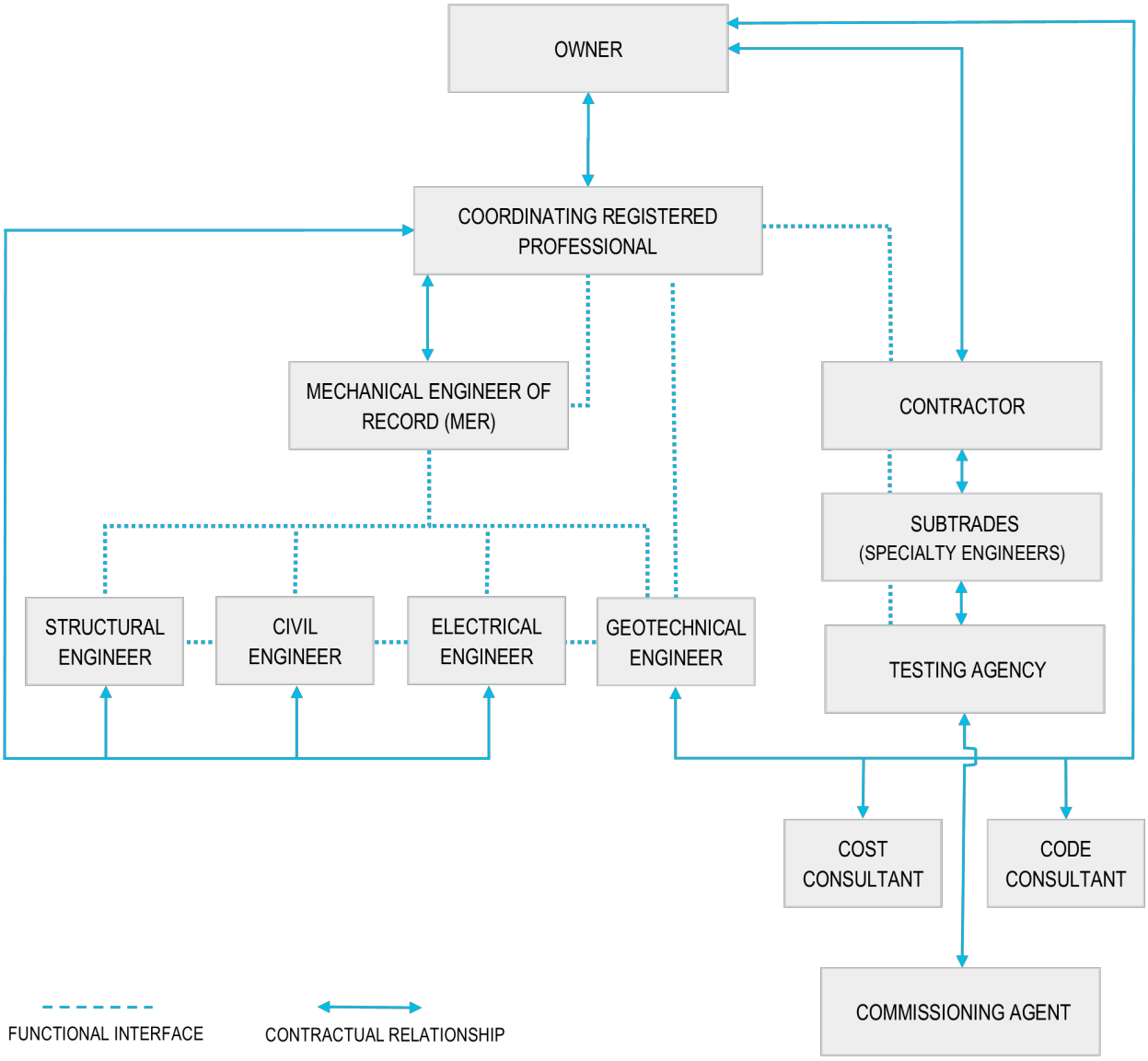
APPENDIX A: COMMON ORGANIZATIONAL STRUCTURES

Project organizations vary according to the needs of the project and the parties. Examples of the following common organizational charts are included in Appendix A:

- Figure A1: Mechanical Engineer of Record (MER)/Coordinating Registered Professional Contract
- Figure A2: Mechanical Engineer of Record (MER)/Owner Contract
- Figure A3: Design/Build Contract

See Section 2.0 Roles and Responsibilities for more discussion.

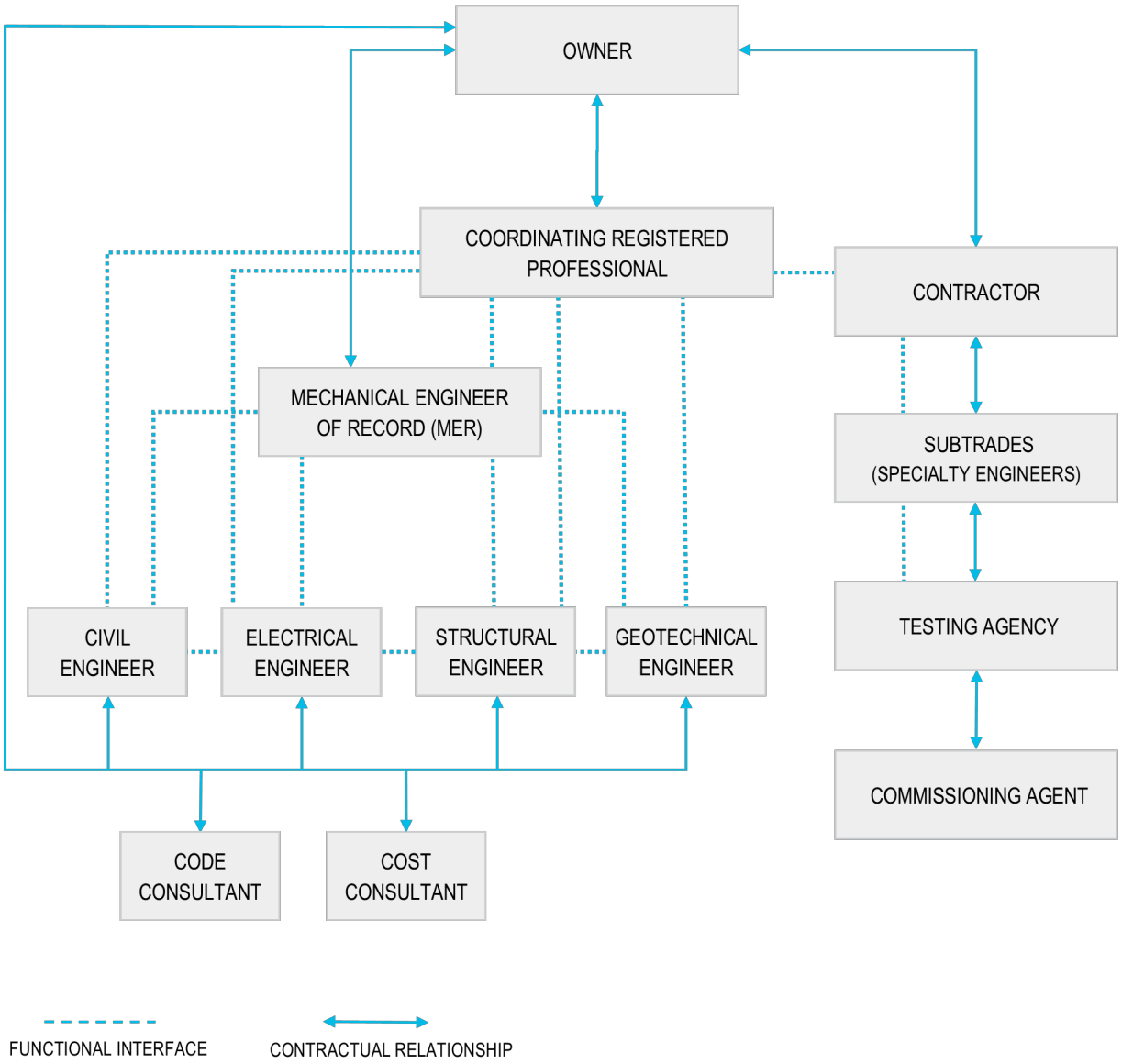
FIGURE A1: MECHANICAL ENGINEER OF RECORD (MER)/COORDINATING REGISTERED PROFESSIONAL CONTRACT



NOTES:

1. The Specialty Engineer may be hired by the Owner, by the Mechanical Engineer of Record (MER), or by contractors.
2. It must be noted that in some circumstances, the MER will be the Coordinating Registered Professional or will take the role of the Coordinating Registered Professional.

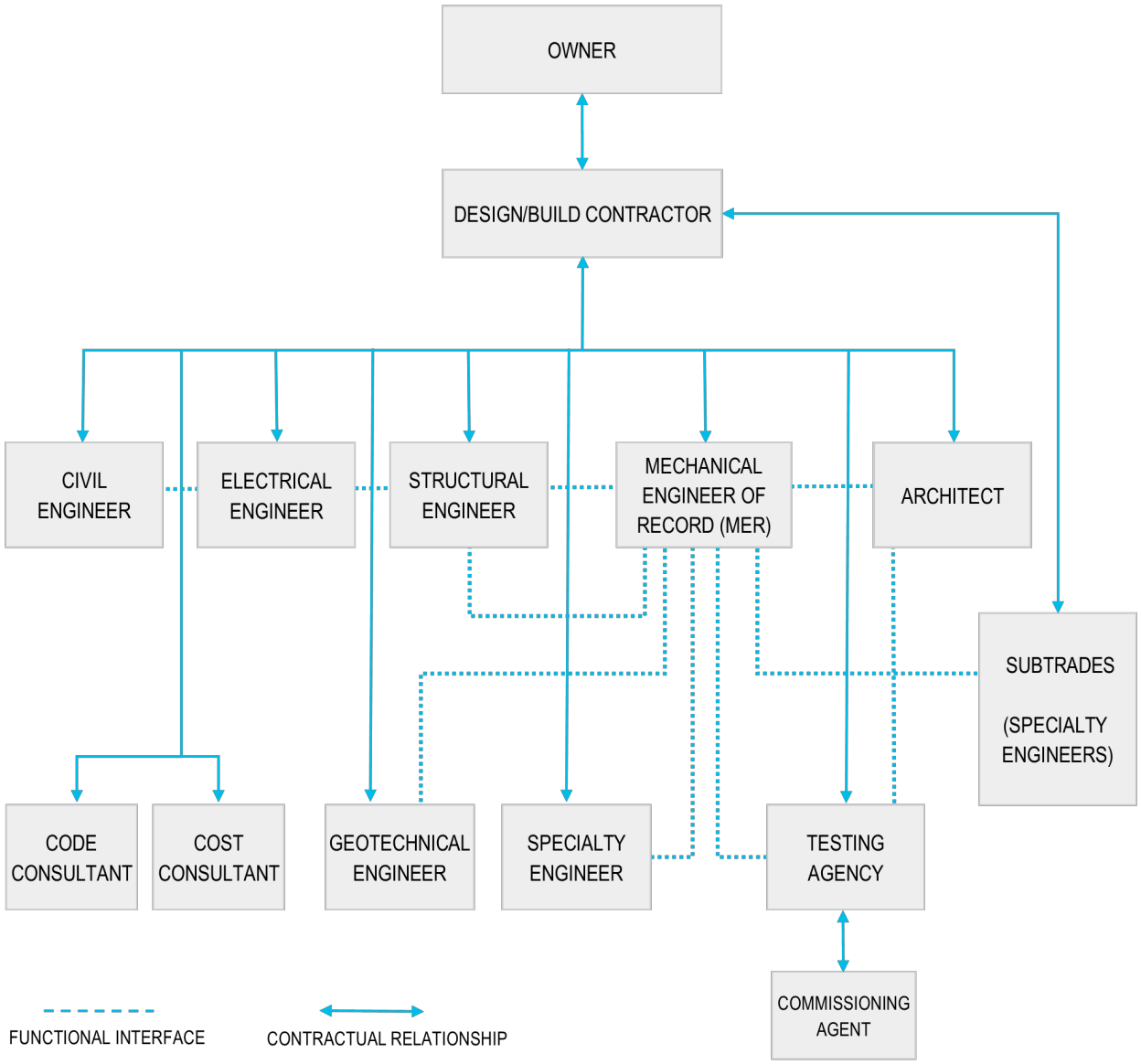
FIGURE A2: MECHANICAL ENGINEER OF RECORD (MER)/OWNER CONTRACT



NOTES:

1. The Specialty Engineer may be hired by the Owner, by the Mechanical Engineer of Record (MER), or by contractors.
2. The Coordinating Registered Professional must be responsible for coordination of the subconsultants even though they are hired by the Owner.
3. It must be noted that in some circumstances, the MER will be the Coordinating Registered Professional or will take the role of a Coordinating Registered Professional.

FIGURE A3: DESIGN/BUILD CONTRACT



NOTE:

1. The Specialty Engineer may be hired by the Owner, by the Mechanical Engineer of Record (MER), or by contractors.
2. The Coordinating Registered Professional (CRP) is responsible for coordinating the subconsultants, even when they were hired by the Owner

APPENDIX B: LETTERS OF ASSURANCE

B1 OVERVIEW

Letters of Assurance were introduced in 1990 in the Vancouver Building By-law (VBBL), and in 1992 in the *British Columbia Building Code* (*BCBC*).They continue to be referenced in the current editions of the VBBL and *BCBC*.

Letters of Assurance were developed after discussions among the City of Vancouver, the British Columbia (BC) Building and Safety Standards Branch, the Architectural Institute of British Columbia (AIBC), and Engineers and Geoscientists BC, and in close consultation with the Building Officials' Association of BC.

The purpose of Letters of Assurance is to assure the Authority Having Jurisdiction for a particular building project that:

- activities of the various Registered Professionals of Record (RPRs) are coordinated;
- design documents submitted to support the application for a building permit substantially comply with the *BCBC* or VBBL;
- building designs substantially comply with the requirements of the *BCBC* or VBBL; and
- the RPR undertakes the necessary Field Reviews to determine that building construction substantially complies with the *BCBC* or VBBL.

Where unanticipated conditions are observed, design professionals should provide recommendations and additional Field Reviews to achieve the design objectives. Design professionals are responsible for ensuring deficiencies identified in Field Reviews for which they are responsible are addressed adequately.

Where the requirements of the *BCBC* or VBBL are at variance with standard practice, there are provisions for "generally accepted design" or "established local practice" to satisfy the requirements, or any variance may be addressed by submitting an alternative solution to the Authority Having Jurisdiction for review and acceptance.

B2 SUMMARY OF SCHEDULES AND GUIDANCE DOCUMENTS

B2.1 SCHEDULE B

Schedule B, Assurance of Professional Design and Commitment for Field Review, is used to identify the various RPRs taking responsibility for designs, and confirms that the designs substantially comply with the *BCBC* or VBBL respecting safety, except for construction safety aspects.

Schedule B also provides a commitment that the RPRs will be responsible for Field Reviews required for the project.

B2.2 SCHEDULE C-B

Schedule C-B, Assurance of Professional Field Review and Compliance, is used to confirm that the necessary Field Reviews were completed by the RPR, and that the finished project substantially conforms to the design and the *BCBC* or VBBL.

B2.3 SCHEDULES S-B AND S-C

An RPR who is acting as the Mechanical Engineer of Record (MER) should only undertake design and Field Review for the items identified on the Letters of Assurance for a discipline, based on the MER's competence in the associated area of practice.

An RPR or an Owner may engage supplementary supporting engineering services for a particular mechanical component or subcomponent.

Where supporting engineering services are required, the relevant RPR should obtain appropriate assurances from the Supporting Registered Professional (SRP) providing the supporting design service and/or Field Review service. The SRP could be engaged by the RPR or the Owner, or by a contractor, Subcontractor, or supplier.

After receiving assurance from an SRP that a particular component or subcomponent substantially complies, in all material respects, with the applicable requirements of the *BCBC*, the RPR can complete and submit the Letter of Assurance for that discipline.

Schedule S-B, Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional, and Schedule S-C, Assurance of Professional Field Review and Compliance By Supporting Registered Professional are recommended for use by a Registered Professional acting as an SRP. These model schedules are available from the *Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).

B2.4 CODES, BYLAWS, AND GUIDANCE DOCUMENTS

More information on Letters of Assurance in the *BCBC* and VBBL is available from the following sources (see also Section 6.0 References and Related Documents):

- *BC Building Code*, Letters of Assurance (BCBC 2018)
- City of Vancouver Building By-law, Letters of Assurance (City of Vancouver 2019)
- *Guide to the Letters of Assurance in the BC Building Code* (Province of BC 2010)
- Bulletin K: BCBC – Letters of Assurance in the BC Building Code and Due Diligence (Engineers and Geoscientists BC 2010)
- *Joint Professional Practice Guidelines – Professional Design and Field Review by a Supporting Registered Professional* (AIBC and Engineers and Geoscientists BC 2020)

The following table summarizes the schedules referred to in this appendix and these guidelines.

Table B - 1: List of Assurance Documents Related to Mechanical Engineering Services

SCHEDULE	PURPOSE	SOURCE
Schedule B	Letter of Assurance Form: Assurance of Professional Design and Commitment for Field Review	*BCBC* or VBBL
Schedule C-B	Letter of Assurance Form: Assurance of Professional Field Review and Compliance	*BCBC* or VBBL
Schedule S-B	Intraprofessional Form: Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional	*Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* [a]
Schedule S-C	Intraprofessional Form: Assurance of Professional Field Review and Compliance By Supporting Registered Professional	*Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* [a]

Note:

[a] AIBC and Engineers and Geoscientists BC 2020

B3 ASSURANCE DOCUMENTS FOR MECHANICAL ENGINEERING PRACTICES

B3.1 SCHEDULE B

This section describes how items set out in Schedule B relate to mechanical engineering practices.

With respect to the items under the heading of "Mechanical," the purpose is to clearly identify the Registered Professional of Record who has the overall responsibility for these items, and thus is acting as the MER.

The MER is responsible for the design and Field Review of the mechanical system. Only the MER for the mechanical system should sign off for the mechanical items on Schedule B.

The following sections cover the relevant mechanical, plumbing, and fire suppression systems items within Schedule B.

B3.1.1 Mechanical

Note that the numbers 3.1 to 3.9 assigned to each item below directly correspond to the numbering in Schedule B under the "Mechanical" heading.

3.1 HVAC systems and devices, including high building requirements where applicable

The MER is responsible for all aspects of the building HVAC, including but not limited to heating, cooling, ventilation, and air conditioning systems. This includes designing, showing, and specifying the HVAC systems, components, required vestibules, and accessories for the building HVAC system, including provisions for controlling the movement of carbon monoxide to other occupancies of the building; and requirements for high buildings that include stack effect mitigation, zone pressure controls, and system balancing and Commissioning with methods and assessment of achieved performance.

3.2 Fire dampers at required fire separations

The MER is responsible for ensuring that the project documents specify and show the required fire dampers and smoke dampers at all building fire separations. Fire dampers and smoke dampers must be indicated on the drawings with sufficient details to allow for proper installation and testing, and they must be specified in the project Specifications. Coordination is required with the Electrical Engineer of Record (EER) to provide the associated detection for activation of smoke dampers.

3.3 Continuity of fire separations at HVAC penetrations

For the MER to sign off on this item, the MER needs to review listed firestop (shop drawings), and either:

- carry out reasonable Field Reviews (consistent with wording in Letters of Assurance) to provide assurance that the firestopping of penetrations by mechanical services at fire separations substantially complies with the *BCBC*, and that the material or listed product specified has been installed in accordance with the applicable code and/or standard; or
- rely on an SRP to carry out the above and submit Schedules S-B and S-C to the MER.

Note: While the MER may rely on an SRP to confirm that the penetrations have been satisfactorily completed, together with signed and sealed Schedules S-B and S-C, the MER may provide random Field Reviews of the firestopping to provide assurance that the fire stopping substantially complies with the approved documentation and applicable code and/or standards.

3.4 Functional testing of mechanically related fire emergency systems and devices

The MER is responsible for specifying the testing and verification methods that support assessment of compliance to requirements for the life-safety–related mechanical systems, such as fire suppression systems verification, smoke control system control and performance, stair pressurization controls and performance, and vestibule pressurization, in coordination with the building fire alarm system designed and administered by others (normally the EER). The MER should observe the testing to ensure that it is performed in a manner consistent with the intent of the specified methods and that the required system functions are achieved.

3.5 Maintenance manuals for mechanical systems

The MER is responsible for specifying the requirements to have the contractor collect equipment and systems information and create a mechanical systems operations and Maintenance Manual for the MER to review, for the use of the Owner and their facilities staff upon project turnover.

3.6 Structural capacity of mechanical components, including anchorage and seismic restraint

The MER is responsible for reviewing the weights of mechanical equipment and systems components, coordinating with the project structural engineer for adequate support provisions, and insuring that sufficient details and Specifications are provided to adequately support and anchor mechanical equipment and components to comply with *BCBC* seismic restraint requirements.

3.7 Review of all applicable shop drawings

All relevant project shop drawings must be reviewed and signed off by the mechanical contractor. The MER only reviews shop drawings for conformity to the design concept and for general arrangement. Unless a deviation in the shop drawings has been previously approved in writing by the MER, such a review by the

MER does not relieve the contractor from taking responsibility for any and all errors or omissions in the shop drawings, or from taking responsibility for meeting all the requirements contained in the Contract Documents, such as dimensions, weights, electrical requirements, and accessories. The MER must confirm the shop drawings have been reviewed; for example, by applying a review stamp that includes appropriate wording to indicate the type of review, and indicating that the shop drawings were reviewed for general conformance only to the design concept and for general arrangement. Where variations from the design intent are identified during the review of shop drawings, the variations must be documented and followed up. For more information, refer to the *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2015).

3.8 Mechanical systems, Part 10 – ASHRAE, NECB, or Energy Step Code requirements

The MER is responsible for designing and specifying mechanical systems equipment and components, including controls systems and sequences of operation, to meet or exceed the energy performance requirements of energy code requirements used for the building project.

3.9 Mechanical systems, testing, confirmation or both as per Part 10 requirements

The MER is responsible for specifying and assuring that the mechanical systems equipment and systems are installed, balanced, commissioned, and controlled to meet or exceed the requirements of the energy code used for the building project. The intention is that the RPR provides assurance regarding the design and Field Review requirements for testing, confirmation, or both, as per the requirements of the Part 10 compliance path chosen for the building (i.e., ASHRAE 90.1, *NECB*, or *BC Energy Step Code*).

B3.1.2 Plumbing

Note that the numbers 4.1 to 4.10 assigned to each item below directly correspond to the numbering in Schedule B under the “Plumbing” heading.

4.1 Roof drainage systems

This includes coordination with the architect and structural consultant for roof drain points, roof drain selection, rainwater leaders, storm drainage piping, overflow protection, and coordination with the architect for either scuppers or auxiliary overflow protection means. Local jurisdiction requirements for controlled flow roof drainage apply, where required.

4.2 Site and foundation drainage systems

The following professionals are responsible for signing off on the design and Field Reviews of item 4.2 in the “Plumbing” section of Schedule B.

- If an MER is engaged on the project, the MER is normally responsible for item 4.2.
  - For sites where below-grade portions of the building do not extend close to the property lines, a civil engineer should be engaged to address surficial site drainage. The MER must coordinate with the project civil engineer of record (CER) for surficial drainage and site services, to determine and confirm scope boundaries related to drainage and site services, which are typically a 1-metre offset from the building perimeter.

    - The MER must coordinate with the geotechnical engineer or record (GER) to ensure the MER's design is compatible with maximum design groundwater elevation, hydraulic conductivity, estimation of seepage, and/or dewatering approaches. With respect to geotechnical specialty items, the MER is required to coordinate with the GER and ensure the GER provides Schedule S-B, Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional.
- If a CER is engaged on the project, the CER is normally responsible for the "site service" aspects of item 4.2, as outlined above and according to the agreed project-specific scopes of work for the MER and the CER.
    - If the CER's design relies on geotechnical specialty items, such as determination of maximum design groundwater elevation, hydraulic conductivity, and estimation of seepage, the CER is required to coordinate with the GER and ensure the GER provides a Schedule S-B, Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional.
- The GER is responsible for aspects of item 4.2 in coordination with and depending on the engagement of other discipline RPRs, as noted above. If neither an MER nor a CER is engaged on the project:
    - the GER should work with the Coordinating Registered Professional (CRP), architect or Owner to determine if a project scope for site and foundation drainage is required and, if so, add it to the GER's scope of services; and
    - the GER must then determine if the GER is prepared and qualified to undertake this work or if a mechanical engineer, civil engineer, and/or a geotechnical Specialty Engineer should be engaged.

The following responsibilities must be fulfilled by the professionals responsible for signing off on the design and Field Reviews of item 4.2 in the "Plumbing" section of Schedule B, as described above.

- The term "site and foundation drainage systems" refers to the arrangement of site grading and buried (subsoil) pipes, trenches, and other engineered systems that intercept surface and subsurface (both groundwater and interflow) water flow and direct it away from a building and its below-grade envelope system. In the *BCBC* Letters of Assurance, this item is pertinent to buildings, and ensures the codified requirements to direct water flow away from buildings are met. Site grading aspects that affect buildings are covered under Item 1.8 of the architectural discipline of Schedule B. The design of site grading performed under Item 1.8 should be coordinated with the site drainage work performed under item 4.2 (and described below), as the site grading design details may affect the design of the site and foundation drainage systems.
- Although engineering input to the design of site-grading and other systems to manage surface and subsurface water that do not affect buildings may add value to a project, this is a separate issue and does not require declaration of professional responsibility for item 4.2.
- Within a nominal 1-metre offset from the perimeter of the building, item 4.2 is normally undertaken by mechanical engineers and is related to the design and Field Reviews of on-site stormwater and groundwater management features. Typical design features may include foundation and perimeter drainage pipes, interior catch basins and sediment sumps, weep holes, pumps, alarm floats, back-up generators, triggering elevations, and connections to a site drainage system or municipal infrastructure. If appropriate to the site and project, this typical offset distance may be adapted in coordination between the project's mechanical, civil, and geotechnical professionals.

– Outside of the nominal 1-metre offset from the perimeter of the building, item 4.2 as relates to site service aspects are normally undertaken by a civil engineer. According to the *Guide to the Letters of Assurance in the BC Building Code* (Province of BC 2010), this may include, but is not limited to:
    - stormwater piping, including on-site stormwater system features such as sumps, catch basins, inspection chambers, pipes, detention tanks (including proprietary), swales, drains, dry wells (including rock pits, infiltration trenches, fields, galleries, or proprietary stormwater management facilities), pumps, alarm floats, back-up generators, and triggering elevations;
    - drainage for site retaining walls;
    - sanitary piping, including on-site sanitary systems such as septic fields;
    - domestic water piping;
    - fire suppression water piping; and
    - fire hydrants on private property.
– For sites where infiltration of rainwater will be managed as part of a development's drainage systems, the approach must be coordinated with the GER for site-specific geotechnical considerations. Site-specific geotechnical considerations should be based on knowledge of the governing groundwater regime (including possible seasonal and tidal effects) and the receiving geology (including hydraulic conductivities and stability of sloping sites), the stability of proximate structures including retaining walls, climate change impacts, and the maximum design groundwater elevation. Potential hydraulic connections from subsurface infiltration features to the building envelope should be considered in, and managed by, the design, such as through the use of seepage collars.

Not included in item 4.2 are:

– dewatering (temporary or permanent);
– design of "tanking" or waterproofing;
– selection of or design of building envelope elements below the maximum design groundwater elevation; or
– proprietary stormwater management facilities.

Likewise, providing maximum design groundwater elevations, hydraulic conductivities, and/or seepage analyses to other members of the project design team who may be designing pumped or other systems (including groundwater cut-off) to maintain groundwater at design levels and pressures is covered in the scope of the GER, under Geotechnical – Permanent item 8.6, Permanent Dewatering.

Evaluation of potential off-site impacts due to rainwater infiltration, drainage discharge, and temporary/permanent dewatering (including lowering or raising of proximate groundwater elevations), including impacts due to seasonal and climate change effects, is out of scope for this line item but is encompassed by item 8.6 of Schedule B.

4.3 Plumbing systems and devices

This includes all of the building plumbing fixtures, and domestic hot and cold water distribution, including non-potable water, where used. This includes all of the sanitary drainage and venting system design, and where rainwater harvesting and non-potable water systems are being used.

4.4 Continuity of fire separations at plumbing penetrations

The MER is responsible for showing sufficient details and specification of installation requirements to ascertain that pipe firestopping and smoke barriers are shown and specified on the Contract Documents for piping and mechanical systems penetrations (e.g., controls cabling and conduits).

4.5 Functional testing of plumbing related fire emergency systems and devices

The MER is responsible for specifying the testing and verification methods that support assessment of compliance to requirements for life-safety–related plumbing systems, such as water connections for fire suppression systems verification, in coordination with the building fire alarm system designed and administered by others (normally the EER). The MER should observe the testing to ensure that it is performed in a manner consistent with the intent of the specified methods, and that the required system functions are achieved.

4.6 Maintenance manuals for plumbing systems

The MER is responsible for specifying the requirements to have the contractor collect equipment and systems information and create a plumbing systems operations and Maintenance Manual for the MER to review, for the use of the Owner and their facilities staff upon project turnover.

4.7 Structural capacity of plumbing components, including anchorage and seismic restraint

The MER is responsible for reviewing weights of plumbing equipment and systems components, coordinating with the project structural engineer for adequate support provisions, and ensuring that sufficient details and Specifications are provided to adequately support and anchor plumbing equipment and components to comply with *BCBC* seismic restraint requirements.

4.8 Review of all applicable shop drawings

All relevant project shop drawings must be reviewed and signed off by the plumbing contractor. The MER only reviews shop drawings for conformity to the design concept and for general arrangement. Unless a deviation in the shop drawings has been previously approved in writing by the MER, such a review by the MER does not relieve the contractor from taking responsibility for any and all errors or omissions in the shop drawings or from taking responsibility for meeting all the requirements contained in the Contract Documents, such as dimensions, weights, electrical requirements, and accessories. The MER must confirm that the shop drawings have been reviewed by applying a review stamp that includes appropriate wording to indicate the type of review, and indicating that the shop drawings were reviewed for general conformance only to the design concept and for general arrangement. Where variations from the design intent are identified during the review of shop drawings, variations must be documented and followed up. For more information, refer to the *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2015).

4.9 Plumbing systems, Part 10 – ASHRAE, NECB or Energy Step Code requirements

The MER is responsible for designing and specifying plumbing systems equipment and components, including controls systems and sequences of operation, to meet or exceed the energy performance requirements of the required energy code requirements used for the building project (e.g., service water heating systems, domestic hot water heat maintenance systems, pumping systems).

4.10 Plumbing systems, testing, confirmation or both as per Part 10 requirements

The MER is responsible for specifying and assuring that the plumbing systems equipment and systems are installed, balanced, commissioned, and controlled to meet or exceed the requirements of the energy code used for the building project. The intention is that the RPR provides assurance regarding the design and Field Review requirements for testing, confirmation, or both, as per the requirements of the Part 10 compliance path chosen for the building (e.g., ASHRAE 90.1, *NECB*, or *BC Energy Step Code*).

B3.1.3 Fire Suppression Systems

Refer to the *Professional Practice Guidelines – Fire Protection Engineering Services for Building Projects* (Engineers and Geoscientists BC 2013) for detailed explanation of the professional responsibilities regarding line items for the fire suppression discipline noted on the Schedule B Letters of Assurance.

With regards to this discipline, in cases where the design and Field Review work is undertaken by multiple professionals including the MER, fire protection engineers, and SRPs, the professional responsibilities must be coordinated and applied in a manner consistent with the scenarios described in *BCBC*, Division C, Section A-2.2.7.3, Item 3.2.4.

B3.1.4 Schedule B and Part 10 (Energy Step Code) Aspects of the BCBC

Regardless of what energy code (e.g., *National Energy Code for Buildings* [*NECB*]) and standard (e.g., ASHRAE 90.1, *BC Energy Step Code*) is used in the project, for Part 3 new construction projects, the MER should sign off on Schedule B, items 3.8 and 3.9 of the Letters of Assurance relating to conformance with the Part 10 (Energy) aspects of the *BCBC*.

- In projects where no building energy modelling is required, the MER can sign off on the following items:
  - Item 3.8, by confirming that the mechanical requirements within Section 6 of ASHRAE 90.1, or Part 5 of the *NECB* have been met.
  - Item 3.9, by confirming the applicable requirements have been met, and/or by specifying the testing requirements in the energy code or standard applicable to the building, and where testing applies, by confirming that the testing will be carried out.
- In projects where building energy modelling is required, the MER can sign off on the following items:
  - Item 3.8, by confirming that the mechanical discipline's inputs to the energy model have been provided per Sections 6 and 10 (including mandatory requirements) of ASHRAE 90.1, or per *NECB* Part 8 with relevant prescriptive requirements under *NECB* Part 5 (applies to both *NECB* and the *BC Energy Step Code*), and after confirming the design's compliance as it pertains to the model.
  - Item 3.9, by confirming the applicable requirements have been met, and/or by specifying the testing requirements in the energy code or standard applicable to the building, and where testing applies, by confirming that the testing will be carried out and any changes to the mechanical design that could affect the energy model will be communicated to the coordinator, as defined in the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services* (AIBC and Engineers and Geoscientists BC 2018).

B3.2 ADDITIONAL NOTES FOR BUILDING ENERGY MODELLING PROJECTS

In projects in which whole building energy modelling is required under Part 10 (Energy) of the *BCBC*, the following applies:

- If the MER is also assuming the role of the qualified modeller or energy modelling supervisor (EMS) the MER must adhere to the professional practice requirements of these roles, as defined in the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services* (AIBC and Engineers and Geoscientists BC 2018), in addition to the provision of Schedules B and C-B.
- If the MER is not assuming the role of the qualified modeller or EMS, the MER must review the pertinent sections of the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services*, and provide inputs to the energy model through the CRP as it pertains to the scope of their project.
- Through the coordinator (as defined in the *Joint Professional Practice Guidelines – Whole Building Energy Modelling Services*), the MER must provide relevant inputs to the qualified modeller or EMS within the design process, in order to confirm compliance with the energy performance objectives of the energy codes or standard (e.g., *BC Energy Step Code*). This includes providing information on building design and systems that impact building energy consumption applicable to their scope of work.
- The MER can sign off on items 3.8 and 3.9 of Schedule B regarding compliance with the Part 10 (Energy) aspects of the code after providing model inputs to the qualified modeller or EMS, and after receiving confirmation the building design meets the applicable whole building energy performance objectives. The coordinator must be involved in key communications concerning sign-off and performance objectives,
- Based on Field Reviews, the MER should also confirm that the inputs specific to the mechanical discipline provided to the energy modeller have been accepted based on the as-constructed condition. This should occur prior to the issuance of Schedule C-B.

Note: Except for existing buildings and projects involving Commissioning or measurement and verification, the energy modelling exercise is only relevant to the completed design at the time of occupancy and does not deal with energy usage once the building is operational.

B3.3 REQUIREMENTS FOR CHANGING AN MER PART WAY THROUGH A PROJECT

For more information about the allocation of responsibilities, refer to the *Guide to the Letters of Assurance in the B.C. Building Code*, Section 7 titled "Dealing with Changes In Registered Professionals of Record After a Building Permit Is Issued" (Province of BC 2018).

B3.4 SCHEDULES S-B AND S-C

An RPR or Owner may engage supplementary supporting engineering services for a particular mechanical component or subcomponent.

Where supporting engineering services are required, the relevant RPR should obtain appropriate assurances from the SRP providing the supporting design service and/or Field Review service.

As described above, refer to *Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2017) for the model Schedules S-B and S-C that are recommended for use by a Registered Professional acting as an SRP.

See also the list of Defined Terms at the front of these guidelines for the definition of SRP.

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