Construction Industry Code of Practice: Safe Use of Tower Cranes

Residential Construction Council of Ontario

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Preface

A commitment to health and safety and continuous improvement are key pillars of the construction industry. As a result, the MTABA (Metropolitan Toronto Apartment Builders Association), in co-operation with the Ontario Formwork Association (OFA), struck a committee to review current industry tower crane practices.

This document will act as a best practice guide for builders and trade contractors, identifying and mitigating potential safety hazards associated with the erection, operation and dismantling of tower cranes. The information in this publication represents the consensus of constructors and formwork contractors who relied on the advice of the residential construction industry, including but not limited to engineers, suppliers and health and safety professionals.

The purpose of this Code of Practice is to assist constructors and construction project managers regarding requirements for the safe use of tower cranes and the mandatory related documentation. The contents are not intended to replace regulatory requirements or the applicable codes and standards but will assist constructors and employers in meeting the test of due diligence set out in Section 25 (2)(h) of the Occupational Health and Safety Act (OHSA).

RESCON would like to acknowledge the contribution of the Metropolitan Toronto Apartment Builders Association (MTABA) board of directors and members, the Ontario Formwork Association (OFA), and the Concrete Forming Association of Ontario (CFAO) for the critical role they played in creating this document.

We would also like to recognize the leadership of the RESCON Crane Safety Committee, RESCON Health and Safety Committee, Jim Wilkinson, and others who continuously dedicate time and energy to promote crane safety.

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Introduction

The following Code of Practice describes the requirements for the safe use of tower cranes on construction projects. It includes such topics as pre-erection inspections and reviews, the initial erection on the project, and safe operating practices, including climbing and dismantling procedures.

It also includes the documentation requirements, including engineering inspections at the pre-and post-erection stages, before placing the crane into service.

Legislative requirements regarding tower cranes are set out in the Regulations for Construction Projects O.Reg 213/91. Detailed safe practices are also contained in CSA Standard Z248-17 *"Code for Tower Cranes.*"

Scope and Purpose

The main purpose of this Code of Practice for tower cranes is to provide guidance to developers, builders (constructors under the OHSA), and formwork contractors regarding the drawings, reports and related documentation required to be kept and retained by the constructor of construction projects.

The primary scope applies to tower cranes; however, the general practices and procedures for hoisting and rigging set out in this document may also apply to other hoisting equipment on the project.

The Code of Practice describes the mechanical, electrical and structural inspections required prior to erecting a tower crane on a project, the methodologies and safe practices used to erect the crane, and the required inspections prior to putting the crane into service. All relevant documents to be retained by the constructor and the formwork contractor are identified.

Additional clarification is provided regarding engineering oversight and the role of professional engineers. In addition to specific inspections such as non-destructive testing (NDT) of structural components, an overall engineering review will now be required to ensure that all of the mechanical components, the electrical and electronic systems, and the structural and site preparation issues have been properly addressed.

It should be noted that this Code of Practice requires a significant expansion of the existing role of the professional engineer in the design, inspection and oversight of tower cranes on construction projects.

References and Publications

The following standards and publications are referenced in this Code of Practice:

- Regulations for Construction Projects O.Reg.213/91
- PEO practice standard "Review of Tower Cranes" (Linked here)
- CSA Standard Z248-17 "Code for Tower Cranes"
- Manufacturer guidelines

NOTE :

Tower cranes erected on construction projects must meet the design and construction requirements set out in CSA Standard Z248-17, "Code for Tower Cranes," and the manufacturer's guidelines. Tower cranes shall be erected, climbed, dismantled, maintained, and operated in accordance with Clause 5 to 8 of CSA Standard Z248-17 and all applicable manufacturer's guidelines.

Sections 5 to 8 address the crane's installation, inspection, testing, maintenance, and operation. Section 4 sets out crane design requirements; however, for cranes manufactured prior to 2017 that do not meet the electrical control circuit performance requirements, alternate safety procedures by the crane owner are required to be prepared.

1 Project Planning and Site Assessment

The conditions at a project site are key factors in the safe operation of tower cranes. Accordingly, it is crucial that a comprehensive project hazard assessment and review be carried out prior to the mobilization of the tower crane components at the project. The review and assessment must be conducted by the formwork contractor in consultation with the constructor of the project.

The assessment should involve a review of the applicable structural drawings and specifications to determine the general type of tower crane to be used and its location and configuration that best addresses the anticipated hazards and the required hoisting functions.

Potential hazards, including but not limited to overhead restrictions and power lines, interference with other cranes or building structures, soil and ground support conditions, suitability of structural attachment locations, and building height and geometry, must be assessed and noted in an assessment report.

The assessment must identify any proposed specialized equipment, such as custom-designed components or lifting devices.

An assessment report should be prepared, which includes at a minimum:

- Preliminary engineering drawings.
- General crane layout showing maximum lifting capacity and reach.
- Assessment of anticipated loads and locations.
- Preliminary erection, climbing, and dismantling procedures.
- Potential interference with other cranes or structures.
  (Note that as-built drawings for existing structures may not be accurate and must be verified)

The assessment documents may take the form of meeting notes or minutes between the formwork contractor/crane owner but must address the topics above and the decisions and action items. Documents must be kept by the constructor and the formwork contractor.

2 Pre-Erection Requirements and Documents

2.1 Documents and records are to be reviewed by a Professional Engineer

Once the preliminary planning, site investigations, and assessment are finalized, the tower crane, including all of the structural, mechanical, and electrical components and assemblies, must be reviewed by a professional engineer prior to transport to the project. The following is a list of documents and information that must be provided to the engineer by the contractor or tower crane owner to assist the engineer in performing the review:

2.1.1 Wind Studies

Reports regarding wind studies that are completed by the constructor and related to the project are to be provided to the forming contractor and crane engineer.

2.1.2 Operation Manual

The operation or user manual for the crane must contain the general configurations and load charts, settings for limit switches, rigging and reeving, and the general setup and dismantling procedures, and should be referenced in the site-specific engineering drawings. The manual must be reviewed by the crane engineer to ensure it is complete and applicable to the crane to be erected. A copy of the manual must be kept with each tower crane.

2.1.3 Owners Crane Log - Inspection and Maintenance Reports

Copies of the owner's crane log, as referenced in clause 6.2.2 CSA Standard Z248-17 "Code for Tower Cranes," must be provided to the engineer for review. The log must include the most recent annual and periodic inspection reports.

The owner's crane log must contain the complete history of inspections, maintenance, and repairs for the individual crane unit up to but not including erection at the current project. The date of part replacements, including fasteners pins and wire rope installation, must be included in the owner's log.

2.1.4 Preliminary Site Installation Drawings

If the preliminary (or approved for construction) site-specific drawings have been completed, they should be made available to the engineer who is conducting the pre-erection review.

2.2 Inspections and Reports

The following is a list of the various inspections and maintenance items that must be carried out (normally in the crane owner's yard or shop) and the related written reports that must be provided to the constructor of the project.

The reports must be signed by the qualified technician or certified electrician who performed the inspections, tests, or repairs. All of the reports must be provided to the engineer for review. (See pre-erection engineering review report below.)

2.2.1 Non-Destructive Examination and Testing

The structural elements and components of the crane, including the welded structural connections, pins, and fasteners, must undergo non-destructive examination and testing under the direction of a professional engineer. The non-destructive tests and examinations must be carried out prior to the transport of the tower crane to the project.

Secondary structural elements and connections must undergo visual examination and be tested if deemed appropriate by the engineer. These include access ladders and platforms, operator cabin, hook block, and equipment attachments.

The inspection should be repeated at regular intervals while the crane is on the project, each interval must not exceed 6 months.

Note: Non-destructive test methods must meet the requirements set out in the Regulations for Construction Projects O.Reg.213/91.

2.2.2 Slewing Ring Fasteners

The condition of the slewing ring fasteners must be assessed by a professional engineer. This includes non-destructive examination, conducting non-destructive testing (such as ultrasonic test methods where appropriate), and verifying the installation of the proper fasteners and the preload torque according to the manufacturers' specifications as identified in the operation manual. Fasteners must be suitably "witness" marked to indicate that they have been inspected or tested. Ultrasonic testing of the slewing ring fasteners must be repeated at 18-month intervals while the crane is at the project.

2.2.3 Mechanical Hoisting and Operational Components

All mechanical components including but not limited to hydraulic systems, hoist and slewing brakes, rope sheaves, and slip ring must be inspected by a qualified technician.

2.2.4 Electrical Supply and Control Systems.

Electrical and electronic controls and components must be inspected by a qualified electrician or mechanic. The control circuits must meet the requirements of clause 4.21 CSA Z248-17 Code for Tower Cranes.

2.2.5 Wire Ropes

All wire ropes for the main hoist, main boom hoist for luffing boom cranes, and trolley cables should be newly installed prior to mobilization at the project or installed at the project prior to putting the crane into service or operation.

Wire ropes must be visually examined to verify that they meet the manufacturers' specifications and criteria set out in the Regulations for Construction Projects.

2.2.6 Secondary Structural Components and Connections

Secondary structural elements and connections must undergo visual examination and be tested if deemed appropriate by the engineer. These include, but are not limited to, access ladders and platforms, operator cabin, hook block, and any attached equipment.

2.3 Site Preparation and Engineering Drawings

Following the site planning process and decisions, site-specific engineering drawings must be prepared by a professional engineer. This engineer may not be the same engineer carrying out the NDT in the yard, but the scope and responsibilities must be clearly indicated on the drawings.

2.3.1 Information to be Included on the Drawings

- Clarification of scope and intent
- Foundation pad, shoring, bracing
- Reaction forces (based on manufacturers' spec as well as site-specific conditions)
- Erection, dismantling, and climbing procedures
  (These may be on separate drawings and may not be available for the initial erection on the project)

2.3.2 Out-of-service onditions

Out-of-service wind conditions shall consider the crane's geographic location and the microclimate conditions on the project in accordance with clause 4.1 of CSA Z248.

2.3.3 Related Inspection Reports

In addition to the site layout drawings, the following inspection reports must be provided to the constructor:

- Geotechnical inspection report for the foundation pad.
- Field inspection reports for foundation – concrete tests – rebar inspections.
- Inspection of embedded anchors or grounding components.

2.3.4 Review by the Structural Engineer of Record

The structural engineer of record for the building must verify that the reaction loads and forces on the building are acceptable. A geotechnical report will be provided to the contractor regarding the design of the concrete base pad. Acceptance of the crane installation by the engineer of record can be verified by a separate letter or approval stamp on the engineering drawing.

2.4 Pre-Erection Engineering Review Report

Before transporting the crane components to the project, a professional engineer must prepare a pre-erection review report.

The following is a summary of the reports and documents that must be reviewed by the professional engineer and clearly identified in the engineering pre-erection review report:

1. The user manual, owner log, and maintenance records.
2. The NDT report.
3. Inspection report for the secondary structural connections.
4. Inspection report for the structural fasteners, bolts, and pins.

5. Slewing ring fasteners and condition report.
6. Electrical controls and equipment inspection report
7. Mechanical components inspection report.
8. Counterweight ballast inspection (including weight and labelling)
9. Inspection report and drawings for the test blocks.

For a complete list of items to be reviewed, refer to PEO practice standard "Review of Tower Cranes." (Linked here)

3 Installation Plan and Erection Procedures

3.1 Installation Plan and Erection Procedures

Erection, dismantling, or climbing instructions and procedures shall be established before installation operations commence. (See CSA Z248 clause 5 "erection, dismantling and climbing.")

A written installation plan must be prepared by the erecting contractor in consultation with the constructor (based on the manufacturer's and engineer's specifications and must include the following information:

- Site-specific project conditions and details related to the erection, climbing, or dismantling operations
- Identification of erectors, their qualifications, and training documents.
- Identification of the competent worker who will be performing the final inspection.
- Recording the weights of the components installed to verify that the components are in accordance with the operation manual and engineering drawings.

The installation plan should be reviewed by the professional engineer who will be performing the post-erection engineering review. The installation plan and related documents must be provided to the constructor prior to mobilization at the project.

3.2 Climbing Procedures

In addition to the installation, dismantling, and climbing procedures normally included in the users' manual, written procedures must be prepared that address specific site conditions at the project.

Note: Some manufacturers may not have detailed climbing procedures, in which case the contractor must provide site-specific engineered instructions and procedures.

Shoring for the tower crane must be designed by a professional engineer and inspected by a competent worker (designated by the engineer) after the crane has been climbed to the new position.

3.3 Dismantling Procedures

Project-specific drawings describing the crane removal method are required to be prepared by a professional engineer. The drawings must be approved by the engineer of record for the building if the crane removal involves a stiff leg derrick or other similar hoisting device attached to the building. The engineer must also review written dismantling procedures.

3.4 Emergency Preparedness Plan

There must be an emergency plan setting out specific actions to be taken in the event of an emergency that could endanger the workers on the project and the general public surrounding the project.

4 Post-Erection Inspections and Engineering Review

Before being put into operation after the tower crane has been erected, a number of functional and operational tests must be performed to verify the crane's structural, mechanical, and electrical integrity. All tests and inspections must be documented in a report prepared by the erector and reviewed by the engineer.

4.1 Operational Tests and Load Tests

Operational tests and load tests must be carried out according to CSA Z248 clause 6.3.3. The test blocks used for the tests must be designed by a professional engineer to meet the requirements of the CSA standard and the operation manual for the crane. The weight of the test block must be identified and labelled on the test block. The design drawing for the test block must be included with the written installation procedures. The test block must be kept at the project and not be used for any other purpose while on the project.

4.2 Inspection Report by the Erector

Before being put into operation after the tower crane has been erected, a number of functional and operational tests must be performed to verify the crane's structural, mechanical, and electrical integrity. All of the tests and inspections must be documented in a report prepared by the erector.

Note: The erector must be a competent worker as defined in the Regulations for Construction Projects O.Reg. 213/91

The inspection report by the erector must include a description of items inspected, including the details of the operational and functional tests. The report must be dated and include the name, position, and signature of the person doing the inspection. The inspection must include functional or operational tests, load tests, examination of ropes and reeving and electrical grounding.

(See section 4.3 below for a list of items to be tested and inspected under the post-erection engineering review report.)

The inspection report prepared by the erector must include but is not limited to the following:

- Detailed description of the functional tests, load tests and test blocks
- Description of the control settings and limit devices
- A list of items and components inspected
- Description of test blocks used to set limits and location on the project

4.3 Engineering Inspection and Review Report

The tower crane installation must be reviewed and inspected by a professional engineer prior to being placed into service or operation. In addition to the structural components of the crane, the engineering review must include the mechanical and electrical components of the crane as well as the power supply as referenced in Clause 5.4 of CSA Z248. The report must be kept at the project.

The final review, inspection and engineering report must be in general conformance with the CSA Standard Z248 "Tower Cranes", the PEO Standard for the review of Tower Cranes (linked here) and in compliance with the requirements set out in the Regulations for Construction Projects.

The following is a summary of the items and information that must be addressed and documented in the engineering post-erection review report:

4.3.1 General Information

- contact information for the review engineer who prepared the report;

- identification and contact information for others contributing to the report;
- specific identification of drawings, photographs, documents, manuals and other material referenced in the report;
- copies of all reports and documents obtained from others or third-parties;
- list of defects discovered during review and a followup report confirming that the defects have been satisfactorily addressed;
- verification that the components are the same ones examined during the pre-erection inspection.

4.3.2 Tower Crane Configuration

An erection report prepared by the erector must be reviewed by the engineer to verify that the installed configuration and counterweights conform to the manufacturers' specifications and the design drawings prepared by a professional engineer.

4.3.3 Tower Bolts

The erector must provide a report to the engineer confirming that the tower bolts have been preloaded as specified by the manufacturer.

4.3.4 Wire Ropes and Reeving

Wire ropes and end connections must be inspected in accordance with CSA Standard Z248-17 "Code for Tower Cranes".

4.3.5 Tower Crane Components

Accessible structural components previously examined by NDT during the pre-erection inspection must be visually inspected to confirm that they have not been damaged during transport or erection.

Verification by visual examination that the following components have been properly installed:
(a) all accessible parts of the crane structure;
(b) ladders, landings, guardrails and access walkways;
(c) pins and pin retainers;
(d) bolt head and nut locking means, if specified by the manufacturer;
(e) counterweights; and
(f) tower crane supports (anchors, shoring, bracing, external ties)

4.3.6 Foundation

Verification that the foundation pad, rail bed, or other supports have been designed and inspected by a professional engineer. Drawings and inspection reports should be attached to the report.

4.3.7 Electrical Grounding

Verification of a written report indicating that a qualified electrician has carried out a grounding continuity test for both the tower and power supply grounding systems in accordance with the Electrical Safety Code.

4.3.8 Electrical Inspection

Verification of a written report by a qualified electrician or technician indicating that the electrical system from the demarcation point or generator to the electrical equipment on the crane has been inspected for damage or violations of the Electrical Safety Code and for compliance with the manufacturer's specifications.

The electrical inspection must include an assessment of the condition of the electronic components and control systems. This may have been done as part of the pre-erection inspections.

4.3.9 Operational Tests

Verification of the operational tests and written reports confirming the following:

- all control levers operate the appropriate function, return to neutral position when released, and are properly identified;
- calibration of the load moment system (load indicator, angle indicator, height indicator, radius indicator) has been completed;
- visually check control wiring and electronic components; and,
- witness functional tests for all control components.

4.3.10 Condition of Mechanical Components

Verification that a written report prepared by a qualified technician describing the condition of the mechanical components that were examined or tested under normal operating conditions. The components should include motors, gears, brakes, sheaves, and bearings.

4.3.11 Load Test

Verification of the load test results and a copy of a report by the person performing the test, indicating the procedures used to carry out the tests.

4.3.12 Test Blocks

Verification that the test blocks have been designed by a professional engineer and the weights are identified in accordance with manufacturers' specifications.

4.3.13 Brake Systems

Verification that all brake systems have been inspected and tested to confirm compliance with manufacturers' specifications.

5 Tower Crane Operation

5.1 On-site Inspections

Daily, weekly, monthly, and annual inspections must be carried out in accordance with CSA Standard Z248-17 clause 6.4 "Inspections."

5.2 Rope Inspections

Wire ropes used for hoisting, trollies, or pendants must be inspected every week and recorded in the logbook as set out in section 170 O.Reg.213/91. The section is provided below for reference.

> ***170.*** *(1) All cable used by a crane or similar hoisting device shall be visually inspected by a competent worker at least once a week when the crane or similar hoisting device is being used. O. Reg. 213/91, s. 170 (1).*
>
> *(2) The worker performing an inspection shall record the condition of the rope or cable inspected in the logbook for the crane or similar hoisting device. O. Reg. 213/91, s. 170 (2).*

Wire rope inspection and maintenance procedures must be performed in accordance with CSA Standard Z248-17 clause 6.5. All rope inspections, maintenance, and replacements must be noted in the operator's log.

5.3 Operation Manual and Operator's Crane Log

A copy of the operation manual for each tower crane must be kept on the equipment (usually in a weatherproof pouch or compartment in the operator's cab) as well as the operator's log. The following information must be recorded in the operator's crane log:

- Daily inspections and checks by operator – entries should be completed after daily inspection prior to operation.
- On-site inspections, maintenance, and repairs by third-party mechanics and engineers.

5.4 Emergency Rescue Using a Tower Crane

The use of a tower crane in emergency rescues is something that must be considered by the employer/constructor. Best practices for this consideration include compliance with the Occupational Health and Safety Act (OHSA) and consultation with the forming contractor, Joint Health and Safety Committee and other emergency rescue professionals. Topics to include, but are not limited to roles and responsibilities, equipment (stretchers) and other rescue

devices, training (tool box talks and communication with other safety processionals – fire, ambulance, police, etc.)

5.5 Out-of-Service Configuration

When the crane is taken out of service, it shall be done in accordance with the crane manufacturer's instructions or as approved by an engineer.

In the case of luffing boom cranes or similar tower cranes, the manufacturer's instructions or an engineer's instructions regarding the jib's angle for out-of-service purposes shall be observed.

5.6 Multiple Crane Sites

If two or more tower cranes will be sited on the same project and will have overlapping swing radii or hoist zones, a written plan and communication procedures to prevent interference or potential collision between any parts of the tower cranes must be prepared in consultation with the constructor.

The plan and procedures must address potential hazards from the interference of crane components, hoist lines, loads, and other devices such as concrete pumping equipment.

Note: A sign clearly identifying the tower crane by letter or number must be attached to the crane in a clearly visible location. The tower cranes must be operated in accordance with CSA Standard Z248-17 clause 8.10.2.

5.7 Containers and Slings

Containers, boxes, concrete buckets, and similar devices or objects to be hoisted must have documentation verifying that the equipment meets the requirements of section 172 O.Reg.213/91. The documentation must be kept at the project. An excerpt of the regulation is provided below for information purposes.

> ***172.*** *(1) A container, sling or similar device for rigging or hoisting an object, including its fittings and attachments,*
>
> *(a) shall be suitable for its intended use;*
>
> *(b) shall be suitable for and capable of supporting the object being rigged or hoisted;*
>
> *(c) shall be so arranged as to prevent the object or any part of the object from slipping or falling;*
>
> *(d) shall be capable of supporting at least five times the maximum load to which it may be subjected; and*
>
> *(e) shall be capable of supporting at least ten times the load to which it may be subjected if it is to be used to support a person. O. Reg. 213/91, s. 172 (1).*
>
> *(2) A sling or similar device made of web-type fabric or nylon shall be labelled to indicate its load rating capacity. O. Reg. 213/91, s. 172 (2).*

(3) No sling or similar device for rigging or hoisting made of web-type fabric or nylon shall be used if it may be cut. O. Reg. 213/91, s. 172 (3).

5.8 Load Test Blocks

The load test block must be kept at the project in a location within reach of the tower crane and not used for any other purpose.

5.9 Weather Conditions

A wind velocity measuring device shall be provided at each tower crane site and mounted close to the top. The device should also have the ability to set alarms when a pre-set speed is reached.

6 Checklist of Documents

As a guide for the constructor of the project and the project management team, a checklist of documents that are required to be retained at the project has been provided in Appendix A. The checklist has been organized with recommended timing milestones in the tower crane installation process, starting from the early planning stages to the final placing of the crane into service. The checklist can also be used as a transmittal for the documents.

- Site preparation and planning
- Pre-erection (prior to transport from equipment yard to project)
- Post- erection of tower crane structure
- Prior to commissioning or putting into service

Appendix "A"

Construction Industry Code of Practice
Safe Use of Tower Cranes

Checklist of documents to be retained by the constructor

Construction Industry Code of Practice
Safe Use of Tower Cranes

Checklist of documents to be retained by the constructor

As a guide for the project management team, the following is a checklist of the required documents to be retained by the constructor of the project. The documents should be in both digital and print form and made readily available to a Ministry inspector if requested. The checklist has been organized with recommended timing milestones in the tower crane installation process starting from the early planning stages to the final placing of the crane into service. The checklist can also be used as a transmittal form for the documents.

Item or Document	**Comments** (If subcontractor is using this form as a transmittal form check each item to indicate that documents are attached)	Document Attached ✓
1 Project Planning and Site Assessment		
Preliminary engineering drawings. General crane layout showing maximum lifting capacity and reach Assessment of anticipated loads and locations Anticipated wind conditions. Preliminary erection, climbing, and dismantling procedures Potential interference with other cranes or structures Foundation pad and soil reports		
2 Pre-Erection Requirements and Documents		
2.1 Documents and records to be reviewed by a Professional Engineer		
2.1.1 Wind studies for the completed buildings		
2.1.2 Operation Manual		
2.1.3 Owners Crane Log - Inspection and Maintenance Reports		
2.1.4 Preliminary Site Installation Drawings		
2.2 Inspections and Reports		
2.2.1 Non-Destructive Examination and Testing		
2.2.2 Slewing Ring Fasteners		
2.2.3 Mechanical hoisting and operational components		
2.2.4 Electrical supply and control systems		

Item or Document	Comments (If subcontractor is using this form as a transmittal form check each item to indicate that documents are attached)	Document Attached ✓
2.2.5 Wire Ropes		
2.2.6 Secondary structural components and connections		
2.3 Site Preparation and Engineering Drawings		
2.3.1 Information to be included on the drawings		
2.3.2 Out of service conditions		
2.3.3 Related inspection reports		
2.3.4 Review by structural engineer of record		
2.4 Pre-Erection Engineering Review Report (See list of items to be addressed in the engineering review report)		
3 Installation Plan and Erection Procedures		
3.1 Installation plan and erection procedures		
3.2 Climbing procedures		
3.3 Dismantling procedures		
3.4 Rescue plan		
3.5 Emergency preparedness plan		
4 Post-Erection Inspections and Engineering Review		
4.1 Operational Tests and Load Tests		
4.2 Inspection Report by the Erector		
4.3 Engineering inspection and review report (See list of items that must be addressed in the engineering review report.)		
5 Tower Crane Operation		
5.1 On-site Inspections		

Item or Document	**Comments** (If subcontractor is using this form as a transmittal form check each item to indicate that documents are attached)	Document Attached ✓
5.2 Rope Inspections		
5.3 Operation Manual and Operator's Crane Log		
5.4 Emergency Rescue using a Tower Crane		
5.5 Out-of-Service Configuration		
5.6 Multiple Crane Sites		
5.7 Containers and Slings		
5.8 Load Test Blocks		
5.9 Weather Conditions		
5.10 Operator and Rigger Training		