



RP 3.0: INSPECTION AND CERTIFICATION OF MASTS

A Recommended Practice (RP) for the
Canadian Well Servicing Industry

CANADIAN ASSOCIATION OF OILWELL DRILLING CONTRACTORS
RECOMMENDED PRACTICE 3.0
INSPECTION AND CERTIFICATION OF MASTS (SR)

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INTRODUCTION

The Canadian Association of Oilwell Drilling Contractors (CAODC) Engineering & Technical (E&T) Committee has developed a Recommended Practice (RP) for masts. This document dated October 2016 supersedes all prior editions of this Recommended Practice.

The information contained herein is a recommendation only of certification schedules for masts currently utilized in the Canadian well servicing industry. An attempt has been made to establish some practical recommended operating practices for masts equipment in the Canadian well servicing industry.

The recommendations contained in this document should be considered in conjunction with the requirements of the original equipment manufacturers (OEM). Companies should operate and maintain the equipment within the operating limitations, such as load ratings, as designed by the OEM.

If the OEM stipulates increased levels of inspection or accelerated inspection/certification cycles, the contractors must follow the OEM guidelines unless granted approval to follow this CAODC Recommended Practice by a Professional Engineer (P. Eng).

CAODC has produced this Recommended Practice based on industry experience. However, this document should be considered in conjunction with all relevant legislation and the requirements of provincial regulatory authorities. This document should not be construed as a legal opinion, and users are advised to seek legal counsel to address their specific facts and circumstances.

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HISTORY

The Service Rig Safety & Technical (S&T) Committee set out to draft guidelines for improving the overall safety of masts with an emphasis on those operations where the mast is handled or repaired. During well servicing operations, it is evident that few problems occur and those that do are often related to a previous difficulty when handling the mast.

Factors which affect the condition of a mast include loads imposed on the mast, frequency of raising/lowering, mast design, method of transporting and handling, materials utilized, age of mast and types of wells serviced.

The Service Rig S&T Committee has drawn upon a number of resources in the formation of this Recommended Practice. Input was received from independent manufacturers, Professional Engineers, welders and operations personnel. The Service Rig S&T Committee wishes to thank all who were involved.

REVIEW PROCESS

CAODC Recommended Practices are reviewed and revised, reaffirmed, or withdrawn at least every three years. A one-time extension of up to two years may be added to this review cycle. Email any comments or items of concern to rpfeedback@caodc.ca.

RP REVISION SCHEDULE

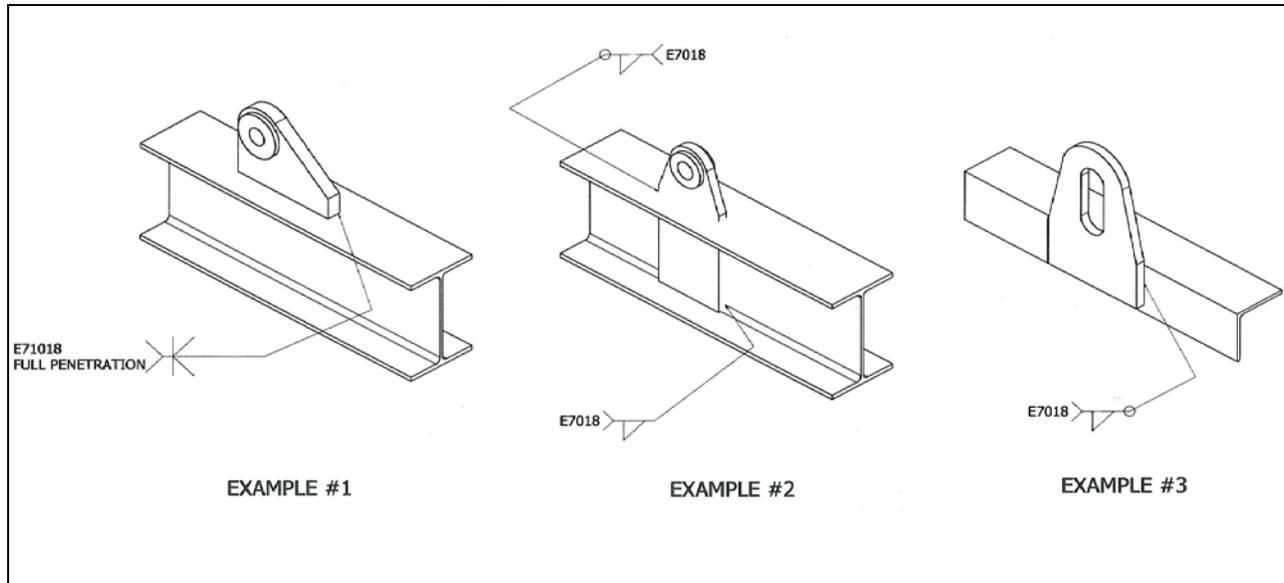
Revision Date	Revision Details
October 2014	Introduction revised to standardize all RP's.
October 2016	Content standardized for alignment and reformatted into new RP template.

1. SCOPE – LIFTING POINTS

Lifting points are the designated position at which the mast should be handled by a crane or gin pole truck and on a given class of mast, these lifting points may be can be found on several sections. Therefore, properly designed lifting points shall be a standard requirement for all masts. As such:

- Each lifting point must be designed to bear a given load;
- The lifting point on a mast must be clearly marked and personnel made aware of its importance;
- Lugs shall not be welded to the topside of the derrick as doing so may pull the girts inward causing permanent damage;
- For lifting points, lugs shall be marked on the main girts on the bottom of the derrick and strap slings used. Using lugs could be an alternate option, however they shall be welded on the topside of the bottom girts;
- The certifying party shall designate lifting points;
- Any new attachment points or lugs (such as tie lugs for wireline pulleys) installed on a mast after May 2003 must be identified with a capacity rating and certified by either a Professional Engineer or OEM Agent as described in [Section 5.1 - Personnel Qualifications](#);
- Application of loads to members within the mast structure not considered during manufacturing must be approved and certified by a Professional Engineer as described in [Section 5.1.4](#).

In many cases, slings may be used at a lifting point. The type of sling utilized is at the discretion of the contractor and certifying party. The figure below provides some typical lug designs which may be employed at the designated lifting points following mast inspection and certification. It is critical that, once lifting points or lugs are installed, all personnel become familiar with their locations and proper use.



Typical Mast Lifting Lugs – lifting lugs shown above are representative only. The certification of the mast requires that properly designed lifting lugs and/or lifting point be installed or designated prior to receiving final certification.

1.1 **MISCELLANEOUS ANCHOR POINTS**

Any equipment mounted within the mast structure must have a review of the attachment points to ensure the structure can accept the anticipated loads, and the anchor is rated for the load. Examples of such attachments include:

- Lights mounted within the mast and their cable securement points;
- Kelly hoses, their safety clamps, and the attachments to the mast via lug or sling around a mast member;
- Casing handling equipment that is not overhead equipment;
- Stabbing boards;
- Block hanging chains, slings, and lugs.

1.1.1 **ANCHOR POINT REVIEW**

Personnel qualified to review these attachment points are as follows:

- Professional Engineers as described in [Section 5.1.4](#); or
- OEM as described in [Section 5.1.5](#).

2. **INSPECTION TYPES**

To ensure that masts are properly maintained and serviceable, five levels of inspection are recommended:

2.1 **PRE/POST MOVE INSPECTION**

Mast transportation, handling training and vigilance are the most effective ways to ensure that damage does not occur to critical structures within the mast during a move.

A pre-move (loaded) and post-move (unloaded) visual inspection of the mast structure must be conducted by the Rig Manager and the trucking company representative to ensure damage has not occurred.

The pre-move safety meeting must include a discussion on the location of the correct lifting points as well as any other handling issues which may be unique to the individual mast structure being moved.

2.2 **LEVEL I INSPECTION**

A Level I inspection is a visual observation of the mast prior to, and/or during normal operation, and/or during routine maintenance.

2.2.1 **LEVEL I INSPECTION PERSONNEL**

Level I inspections are performed by the rig crew and should also be included as part of the daily rig walkaround carried out by the Driller or Rig Manager.

2.2.2 **LEVEL I INSPECTION DOCUMENTATION**

Level I inspections shall be recorded in the tour sheet.

2.3 **LEVEL II INSPECTION**

A Level II inspection is a Level I inspection that includes a more thorough inspection of, but not limited to, all load bearing components that includes checking for:

- Proper lubrication;
- Obvious external cracks;
- Damage and/or premature wear or deterioration;
- Missing parts or guards.

Note: *attention should be paid to sheaves for cracking and wear, tubing board and rod basket connections and any load bearing lug used in daily operation.*

2.3.1 LEVEL II INSPECTION PERSONNEL

Level II inspections should be carried out by the Driller or Rig Manager.

2.3.2 LEVEL II INSPECTION DOCUMENTATION

Level II inspections shall be recorded in the tour sheet.

2.4 LEVEL III INSPECTION

A Level III inspection requires rig equipment to be thoroughly checked in the field to determine serviceability. This may, at the owner's/inspector's discretion, include Non Destructive Testing (NDT) techniques, and may require some minor disassembly of guards.

Upon reaching the required number of operating days, as outlined in [Section 3 - Inspection Frequency](#), or if the mast is removed and replaced on the carrier, masts shall be Level III inspected. At a minimum, a thorough visual inspection of the following critical components is required to determine the condition of the mast:

- All load bearing components;
- Welds;
- Pickup points.

Any repairs required will be done as described in [Section 4 – Repairs, Maintenance and Documentation](#).

2.4.1 LEVEL III INSPECTION PERSONNEL

Personnel qualified to supervise and/or provide technical assistance for Level III inspections include:

- Inspection Personnel as described in [Section 5.1.1](#);
- Professional Engineer's as described in [Section 5.1.4](#).

2.4.2 LEVEL III INSPECTION DOCUMENTATION

Level III inspections must be documented in the CAODC Mast and Overhead Equipment Log Book, or suitable equivalent.

2.5 LEVEL IV INSPECTION AND CERTIFICATION

A Level IV inspection requires the equipment to be disassembled as required to do a complete inspection and may, at the owner's/inspector's discretion, include NDT of all critical load bearing components.

2.5.1 **MASTS**

Upon reaching the required number of operating days, as outlined in [Section 3 - Inspection Frequency](#), the entire mast shall be Level IV inspected. The following procedure is recommended for completing this inspection:

- Place mast, fully assembled, on pipe racks or other suitable supports;
- Clean mast as required to prepare for inspection.

Note: *actual inspection requirements will be at the discretion of the certifying party.*

All deficiencies and repairs required shall be done in accordance with [Section 4 – Repairs, Maintenance and Documentation](#).

2.5.2 **CROWN ASSEMBLY**

In conjunction with a Level IV mast inspection, the entire crown assembly shall also be Level IV inspected. The following procedure is recommended for completing this inspection:

- Sheaves must be removed from the crown shaft;
- Bearing races must be removed;
- Sheaves must be gauged using a sheave gauge;
- Tread thickness shall be evaluated and documented;
- Wall thickness shall be evaluated and documented;
- An NDT inspection for cracks must be performed.

Note: *application of loads to members within the mast structure, not considered in the original design, must be approved and certified by either a Professional Engineer or OEM Agent as described in [Section 5.1 - Personnel Qualifications](#).*

2.5.3 **LEVEL IV INSPECTION AND CERTIFICATION PERSONNEL**

Personnel qualified to perform a Level IV inspection shall possess adequate knowledge and experience and typically includes:

- Professional Engineer's as described in [Section 5.1.4](#);

- OEM Agent as described in [Section 5.1.6](#).

2.5.4 LEVEL IV INSPECTION AND CERTIFICATION DOCUMENTATION

A certification document will be provided by the certifying party and should include the following:

- Items outlined in CAODC Level III Inspection Form;
- Hook load ratings (daN) with maximum lines strung:
 - Guyed static hook load;
 - Freestanding static hook load – If applicable;
 - Matting requirements;
 - Line requirements (removal of tubing board lines);
- Clear height;
- Reference to turnbuckle inspection (if applicable);
- Escape line and fall arrest anchor point ratings;
- A diagram of lugs on the mast and a chart of the ratings applied with the intended use of each lug;
- Document author;
- Date and period of certification;
- Mast serial number (if available);
- Name of manufacturer (if available);
- Date of manufacture (if available);
- Results of the Level IV inspection;
- Location of repairs (if applicable).

Additionally, Level IV inspections must be documented in the CAODC Mast and Overhead Equipment Log Book, or suitable equivalent, and signed by the certifying party.

Note: certification would remain in effect for wells in progress which were spudded prior to the 24,000 hour period.

3. INSPECTION FREQUENCY

At a minimum, the inspection frequency for masts shall be conducted in accordance with the schedule below.

Note: should circumstances, OEM recommendations or individual experience dictate otherwise, CAODC member companies may conduct these inspections at greater frequencies.

DOCUMENTATION	DAILY	RAISE & LOWER	ANNUAL	MAST REMOVAL/ INSTALLATION	24,000 OP HRS
TOUR SHEET	I	II			
MAST AND OVERHEAD EQUIPMENT LOG BOOK			III	III	IV

Note: one operating day = 24 accumulated operating hours from spud to rig release.

4. REPAIRS, MAINTENANCE AND DOCUMENTATION

Occasionally repairs and/or maintenance following a Level III or IV inspection may be required to retain the operating integrity of the mast. Any damage that requires repair will be categorized as minor or major as follows:

4.1 MINOR DAMAGE

Minor damage is considered damage or distortion to secondary equipment and includes the following:

- Ladder damage;
- Cosmetic damage to diagonal girts and minor fan distortions;
- Cosmetic damage to the mast;
- Walk around platforms on masts used for personnel positioning;
- Tong hangers;
- Monkeyboards.

4.1.1 **MINOR DAMAGE REPAIR PERSONNEL**

Minor repairs may be completed by Operating Personnel (as described in [Section 5.1.2](#)) at the discretion of the Rig Manager or higher authority, and do not require re-inspection.

If there is any question as to whether the damage is minor or major, either a Professional Engineer or OEM Agent as described in [Section 5.1 - Personnel Qualifications](#) must be consulted.

4.2 **MAJOR DAMAGE**

Major damage is considered geometrical distortion or structural damage to A-legs, main legs, raising assembly, crown assembly or any other load bearing components and includes the following:

- Repairs to:
 - Main legs of the mast requiring welding or replacement;
 - A-Legs requiring welding or replacement;
 - Crown that are not cosmetic (i.e. replacement or repair of members);
 - Bridle line attachments and load path points;
 - Section pinning points
 - Freestanding beans and outrigger structures;
- Repair to or replacement of strongbacks on the mast;
- Weld repairs to:
 - Locking assemblies on telescopic masts;
 - Monkeyboard, excluding fingers and diving board;
 - Fall arrest points and escape line frames.

All major damage must be repaired and upon completion, requires a Level IV inspection specific to the equipment that was repaired. Repairs may be completed in a field environment providing they can be performed adequately and are accessible for NDT inspection.

Note: *all major repairs shall be done following an OEM Agent or a Professional Engineer procedure. The certifying party would supply the repair facility with an engineering procedure and so note on the repair documentation.*

4.2.1 MAJOR DAMAGE REPAIR PERSONNEL

Repairs to major damage may only be completed by a Professional Engineer or OEM Agent as described in [Section 5.1 - Personnel Qualifications](#).

4.3 REPAIR AND MAINTENANCE DOCUMENTATION

All repairs and maintenance performed shall be documented in the CAODC Mast and Overhead Equipment Log Book, or suitable alternative, and include the following information:

- Date repairs and/or maintenance was conducted;
- Description of repairs and/or maintenance that was completed;
- For minor repairs:
 - Operating Personnel as described in [Section 5.1.2](#) that performed the repair and/or maintenance;
- For major repairs:
 - Certifying party of the repair, including signature.

4.3.1 MAJOR REPAIR DOCUMENTATION (RECERTIFICATION)

The certifying party will provide a certification document for the equipment requiring major repairs.

Any repair certification issued is for the repair of actual damage and is intended to maintain Level IV certification. It does not extend the Level IV certification requirements unless a complete Level IV inspection is conducted in accordance with [Section 2.5 - Level IV Inspection and Certification](#).

5. PERSONNEL QUALIFICATION, TRAINING AND DOCUMENTATION

5.1 PERSONNEL QUALIFICATIONS

Proper training of personnel continues to be one of the most critical considerations in the care of a mast. This does not only include the rig personnel but also the truckers that are handling these masts and the welders repairing them. Most mast damage occurs during moving and handling, thus

trained and alert personnel are the best method of eliminating handling damage to masts.

5.1.1 INSPECTION PERSONNEL

Typical Inspection Personnel are considered to be senior operations personnel designated by the company that have:

- Knowledge of working principles of the equipment referenced in this RP;
- Mechanical competency in the disassembly of the equipment type and model;
- Experience and knowledge in service rig maintenance.

Examples of senior operations personnel include: Field Superintendents, Technologists, Rig-up Superintendents, Shop Foremen, and Operations Managers.

5.1.2 OPERATING PERSONNEL

Typical Operating Personnel are considered to be members of the rig crew that have:

- Knowledge of working principles of the equipment referenced in this RP;
- Experience and knowledge in service rig maintenance.

5.1.3 NDT TECHNICIANS

At a minimum, NDT Technicians are required to have Level II, Canadian Government Standards Board (CGSB) certification or other approved certification at the discretion of the owner/inspector.

5.1.4 PROFESSIONAL ENGINEERS

Professional Engineer's shall have:

- Previous experience and training in structural and/or mechanical analysis;
- A practical working knowledge of equipment referenced in this RP;
- Previous experience and training in the repair of the equipment referenced in this RP;

- Experience with general quality control standards;
- Professional status in Canada.

5.1.5 ORIGINAL EQUIPMENT MANUFACTURERS (OEM)

The company who built the original piece of equipment under inspection.

5.1.6 ORIGINAL EQUIPMENT MANUFACTURER AGENT

A designate of the OEM that has a practical working knowledge of the specific equipment under inspection.

5.1.7 WELDERS

Welders must hold a valid Journeyman Welder certificate and have experience in service rig maintenance.

5.2 PERSONNEL TRAINING

To satisfy provincial regulations and ensure that equipment will operate in the manner for which it was designed, Inspection and Operating Personnel (as described in [Section 5 - Personnel Qualification, Training and Documentation](#)) shall be adequately trained to conduct inspections (including visual) in accordance with this Recommended Practice. At a minimum, training should outline the inspection criteria for all critical components outlined in this Recommended Practice.

5.3 PERSONNEL DOCUMENTATION

Companies shall have a process in place that documents and retains all training administered to company personnel referenced in this Recommended Practice and should include:

- Date training took place;
- Who was in attendance.