



Mobile Crane Inspection Guidelines for OSHA Compliance Officers

4.0 Inspecting A Mobile Crane

Since cranes impact such a large segment of work going on at any job site, crane inspections (to the OSHA Compliance Officer and Project Safety Managers) must include a survey, or walk around, of the entire operation that questions how the crane will be operating and how other crafts will be effected by working with and around the crane? Observation of crane operations prior to an inspection, or simply asking how cranes have or will be used, can indicate possible problem areas that may need a closer review during the inspection process.

4.1 Preinspection

Before the actual inspection, some general information about the crane operator's qualifications and the crane's certifications should be gathered, such as:

Operator Qualifications Observe the operator in action and when the opportunity permits ask a few question concerning the cranes capacity and restrictions imposed, either due to activity involved in or functional limitations.

Crane Records Ask for inspection and maintenance records and verify that the appropriate operator's manual and load charts are available for that particular crane in use.

4.2 Crane Setup

In your initial survey of crane operations, look for crane stability, physical obstructions to movement or operation, and proximity of electrical power lines, as well as the following:

- A. *Leveling* Has the crane operator set the crane up level and in a position for safe rotation and operation?
- B. *Outriggers* Are the outriggers, where applicable, extended and being used in accordance with manufacturer's recommendations?
- C. *Stability* The relationship of the load weight, angle of boom, and its radius (the distance from the cranes center of rotation to the center of load) to the center of gravity of the load. Also, the condition of crane loading where the load moment acting to overturn the crane is less than the moment of the crane available to resist overturning.
- D. *Structural Integrity* The crane's main frame, crawler, track and outrigger supports, boom sections, and attachments are all considered part of structural components of lifting. In addition, all wire ropes, including stationary supports, help determine lifting capacity and are part of the structural elements of crane operations.

4.3 Electrical Hazards

Working around or near electrical power lines is one of the most dangerous practices for crane operations. The OSHA requirements limit crane operations to a minimum clearance of 10 feet.

Cranes should not be used to handle materials or loads stored under electric power lines. In addition, operation of mobile cranes near de-energized electric power lines is not recommended until the following steps have been taken:

- The power company or owner of the power line has deenergized the lines.
- The lines are visibly grounded and appropriately marked at jobsite.
- Durable warning signs are installed at the operator's station and on the outside of the crane identifying the clearance requirements between the crane/load and electrical power lines.
- A qualified representative of the power company or owner of the electrical power line are on the job site to verify that the power lines have been de-energized or properly grounded.

4.4 Load Charts

Load Charts are the principle set of instructions and requirements for boom configurations and parts of line which

establish crane capacity for safe crane operations^{*}.

- *Availability* The crane operator must have in his/her possession the appropriate load charts related to the crane in use and for the loads being lifted.
- *Correct Use* The crane operator must show adequate understanding and proficient use of the load charts as related to the equipment in use and the loads being lifted.

4.5 Safe Operating Precautions

As stated above, cranes are carefully designed, tested, and manufactured for safe operations. When used properly they can provide safe reliable service to lift or move loads. Because cranes have the ability to lift heavy loads to great heights, they also have an increased potential for catastrophic accidents if safe operating practices are not followed.

Accidents can be avoided by careful job planning. The person in charge must have a clear understanding of the work to be performed and consider all potential dangers at the job site. A safety plan must be developed for the job and must be explained to all personnel involved in the lift.

Before operations begin for the day, a walkaround inspection needs to be conducted to ensure that the machine is in proper working condition. Only qualified and properly designated people shall operate the crane. Regular inspections are important, they provide a means of detecting potential hazards or conditions that could contribute to a sequence of events leading to an accident. Safe, reliable, and the economic operation of lifting equipment, cannot be ensured without regular safety inspections and thorough preventive maintenance programs. A thorough inspection program can forecast maintenance needs or potential equipment failures or malfunctions. The lack of such a program could result in serious deterioration of the equipment which might lead to excessive replacement, or repair charges, as well as an increased potential for accidents.

* See [General Load Charts and Operational Considerations, Appendix B](#).

Due to the wide variation of conditions under which a crane may operate, it is impossible for the manufacturer to determine inspection intervals appropriate for every situation. Inspection intervals recommended in manufacturer's publications represent minimum intervals for average operating conditions. More frequent inspection intervals should be required if use and site conditions are severe and warrant it. Inspections are also designed as maintenance checks and/or as a verification that proper repairs or modifications of equipment have been completed which, if not checked could affect capacities as well as personnel safety. Since the initial load rating for cranes was determined and set under ideal conditions, inspections are required by manufacturers to guarantee optimal operating efficiency and capacity as determined by the load charts.



Tower Crane Collapse
(Cleaning Up Debris)

The American National Standards Institute, ANSI B30.5, (1968), and OSHA both require inspections be divided into two categories: frequent and periodic. In addition to the performance of these regular inspections, equipment is required to be inspected and tested to ensure that it is capable of safe and reliable operation when initially set or placed in service and after any major repairs or any design modification.



Crawler Crane
Prepared for Inspection

4.6 Inspection Types

A. *Frequent Inspections* (daily to monthly intervals). Frequent inspections are usually performed at the start of each shift by the operator who walks around the crane looking for defects or problem areas. Components that have a direct bearing on the safety of the crane and whose status can change from day to day with use must be inspected daily, and when possible, observed during operation for any defects that could affect safe operation. To help determine when the crane is safe to operate, daily inspections should be made at the start of each shift. Frequent inspections should include, but are not limited to the following:

1. Check that all exposed moving parts are guarded. A removed guard may indicate that a mechanic is still working on part of the crane.
2. Visually inspect each component of the crane used in lifting, swinging, or lowering the load or boom for any defects that might result in unsafe operation.
3. Inspect all wire rope (including standing ropes), sheaves, drums rigging, hardware, and attachments. Remember, any hook that is deformed or cracked must be removed from service. Hooks with cracks, excessive throat openings of 15%, or hook twists of 10 degrees or more, must be removed from service.
4. Check for freedom of rotation of all swivels.
5. Visually inspect the boom and jib for straightness and any evidence of physical damage, such as cracking, bending, or any other deformation of the welds. Look for corrosion under any attachments that are connected to the chords and lacing. Watch carefully for cracking or flaking of paint. This may indicate fatigue of the metal which often precedes a failure. On lattice booms, look for bent lacing. If they are kinked or bent, the main chord can lose substantial support in that area. When lacing is bent, the ends also tend to draw together which pulls the main chords out of shape. This precaution is especially important on tubular booms where every component must be straight and free from any dents. Do not attempt to straighten these members by hammering or heating them and drawing them out. They must be cut out and replaced with lacing to the manufacturer's specifications, procedures, and approval.
6. Inspect tires for cuts, tears, breaks, and proper inflation.
7. Visually inspect the crane for fluid leaks, both air and hydraulic.
8. Visually check that the crane is properly lubricated. The fuel, lubricating oil, coolant and hydraulic oil reservoirs should be filled to proper levels.
9. Check that the crane is equipped with a fully charged fire extinguisher and that the operator knows how to use it.
10. Check all functional operating mechanisms such as: sheaves, drums, brakes, locking mechanisms, hooks, the boom, jib, hook rollers brackets, outrigger components, limit switches, safety devices, hydraulic cylinders, instruments, and lights.
11. Check the turntable connections for weld cracks and loose or missing bolts. If they are loose, there is a good chance that they have been stretched.
12. When checking the outriggers be sure that neither the beams nor the cylinders are distorted. Check that the welds are not cracked and that both the beams and cylinders extend and retract smoothly and hold the load. Check the condition of the floats, and check that they are securely attached.
13. Inspect and test all brakes and clutches for proper adjustment and operation.
14. Always inspect boom hoist lockout and other operator aids, such as anti-two-block devices (ATB) and load moment indicators (LMI), for proper operation and calibration.
15. While the engine is running, check all gauges and warning lights for proper readings and operate all controls to see that they are functioning properly.
16. Check for any broken or cracked glass that may affect the view of the operator.

B. *Periodic Inspections* (1 to 12 month intervals). The periodic inspection procedure is intended to determine the need for repair or replacement of components to keep the machine in proper operating condition. It includes those items listed

for daily inspections as well as, but not limited to, structural defects, excessive wear, and hydraulic or air leaks.

Inspection records of the inspected crane shall be maintained monthly on critical items in use, such as brakes, crane hooks, and ropes. These inspection records should include, the date of inspection, the signature of the person who performed the inspection, and the serial number, or other identifier. This inspection record should be kept readily available for review. The manufacturer's maintenance and inspection records, forms/checklist, or equivalent should be used.

1. Inspect the entire crane for structural damage. Be careful to check for distortion or cracks in main frame, outrigger assemblies, and structural attachments of the upperworks to the carrier.
2. Inspect all welded connections for cracks. Inspect the main chords and lacings and other structural items for paint flaking and cracking which may indicate potential failure, as well as for dents, bends, abrasions, and corrosion. Check hydraulic booms for bending, side sway, or droop.
3. Check for deformed, cracked, or corroded members in the load/stress bearing structure. Magnetic particle or other suitable crack detecting inspection should be performed at least once each year by an inspection agency retained by the owner. Inspection reports should be requested and retained in the crane file.
4. Inspect cracked or worn sheaves and drums.
5. Inspect for worn, cracked, or distorted parts such as: pins, bearings, shafts, gears, rollers, locking devices, hook roller brackets, removable outrigger attachments lugs, and welds.
6. Inspect for excessive wear on brake and clutch system parts, linings, pawls, and ratchets.
7. Inspect all indicators, including load and boom angle indicators, for proper operation and calibration.
8. Inspect all power plants for proper operation.
9. Inspect for excessive wear on drive sprockets and/or chain stretch.
10. Inspect for correct action of steering, braking, and locking devices.
11. Check that the counterweight is secure.
12. Check that the identification number is permanently and legibly marked on jibs, blocks, equalizer beams, and all other accessories.
13. Inspect all hydraulic and pneumatic hoses, fittings, and tubing. Any deterioration of any system component should cause the inspector to question whether further use would constitute a safety hazard. Conditions, such as the following, require replacement of the part in question:
 - a. Any evidence of oil or air leaks on the surfaces of flexible hoses or at the point at which the hose in question joins the metal end couplings.
 - b. Any abnormal deformation of the outer covering of hydraulic hose, including any enlargement, local or otherwise.
 - c. Any leakage at connections which cannot be eliminated by normal tightening.
 - d. Any evidence of abrasive wear that could have reduced the pressure retaining capabilities of the hose or tube effected. The cause of the rubbing or abrasion must be immediately eliminated.

4.7 Starting the Inspection

Since most crane inspections begin with a general walkaround and observation of the overall crane set up and operation, followed by a specific inspection of items or components, the following guidelines are presented in that order. The first section addresses the general items and operational considerations when inspecting any type of crane, followed by the specific inspection items for two specific types of cranes; Grove Rough Terrain 45 Ton (hydraulic) and Manitowoc 4100 150 Ton Crawler (lattice boom friction) cranes.

In general, the following should be considered when inspecting any crane:

1. Request for and review all inspection and maintenance documents for the crane being inspected, including the crane manufacturer's inspection and maintenance requirements.
2. Conduct a walkaround inspection, paying particular attention to mechanical systems leaks or damage (oil, hydraulic, air) and structural deficiencies.
3. Look at crane cab for properly marked controls, damaged instruments and for properly displayed and legible load charts.
4. Ask the operator, ground crew (riggers), and/or supervisors appropriate questions on load charts, rigging and load weight determinations, and capacities.
5. Request the operator to raise and lower the boom/load line, where practical, and inspect, from the cab position, the running line or rope of the main hoist drum and secondary line or jib line. Check brake action and its ability to stop.
6. If practical, request the operator to lower boom to look at the condition of booms sections, lacing, lifting components, anti-two-block devices, jib back stops, and the condition of the hook.
7. Check crane set up and stability of outriggers on hydraulics and/or the effectiveness of cribbing on crawlers. if possible, request that the crane be rotated to check all clearances and overall stability.

4.8 Specific Inspection Items and References

The following table identifies the specific inspection items for cranes as well as a brief description and purpose to help the inspector to have a better understanding of what and why the item is being inspected.

Table 4.8A Inspection Items and Description	
ITEM	DESCRIPTION / PURPOSE

(1) Manufacturer's operating and Maintenance Manuals	Manufacturer's operating and maintenance manuals shall accompany all mobile hoisting equipment. These manuals set forth specific inspection, operation and maintenance criteria for each mobile crane and lifting capacity.
(2) Guarding	All exposed moving parts such as gears, chains, reciprocating or rotating parts are guarded or isolated.
(3) Swing Clearance Protection	Materials for guarding rear swing area.
(4) High-Voltage Warning Sign	High-voltage warning signs displaying restrictions and requirements should be installed at the operator's station and at strategic locations on the crane.
(5) Boom Stops	Shock absorbing or hydraulic type boom stops are installed in a manner to resist boom overturning.
(6) Jib Boom Stops	Jib stops are restraints to resist overturning.
(7) Boom Angle Indicator	A boom angle indicator readable for the operator station is installed accurately to indicate boom angle.
(8) Boom Hoist Disconnect, Automatic Boom Hoist Shutoff	A boom hoist disconnect safety shutoff or hydraulic relief automatically stops the boom hoist when the boom reaches a predetermined high angle.
(9) Two-Blocking Device	Cranes with telescoping booms should be equipped with a two-blocking damage prevention feature that has been tested on-site in accordance with manufacturers requirements. All cranes hydraulic and fixed boom used to hoist personnel must be equipped with two-blocking devices on all hoistlines intended to be used in the operation. The anti-two blocking device has automatic capabilities for controlling functions that may cause a two-blocking condition.
(10) Power Controlled Lowering	Cranes for use to hoist personnel must be equipped for power controlled lowering operation on all hoistlines. Check clutch, chains, and sprockets for wear.
(11) Leveling Indicating Device	A device or procedure for leveling the crane must be provided.
(12) Sheaves	Sheave grooves shall be smooth and free from surface defects, cracks, or worn places that could cause rope damage. Flanges must not be broken, cracked, or chipped. The bottom of the sheave groove must form a close fitting saddle for the rope being used. Lower load blocks must be equipped with close fitting guards. Almost every wire rope installation has one or more sheaves ranging from traveling blocks with complicated reeving patterns to equalizing sheaves where only minimum rope movement is noticed.

<p>(13) Main Hoist and Auxiliary Drums System</p>	<p>Drum crushing is a rope condition sometimes observed which indicates deterioration of the rope. Spooling is that characteristic of a rope which affects how it wraps onto and off a drum. Spooling is affected by the care and skill with which the first larger of wraps is applied on the drum. Manufacturer's criteria during inspection usually specify:</p> <ul style="list-style-type: none"> • Minimum number of wraps to remain on the drum. • Condition of drum grooves • Condition of flanges at the end of drum. • Rope end attachment. • Spooling characteristics of rope. • Rope condition.
<p>(14) Main Boom, Jib Boom, Boom Extension</p>	<p>Boom jibs, or extensions, must not be cracked or corroded. Bolts and rivets must be tight. Certification that repaired boom members meet manufacturers original design standard shall be documented. Non-certified repaired members shall not be used until recertified.</p>
<p>(15) Load Hooks and Hook Blocks</p>	<p>Hooks and blocks must be permanently labeled with rated capacity. Hooks and blocks are counterweighted to the weight of the overhaul line from highest hook position. Hooks must not have cracks or throat openings more than 15% of normal or twisted off center more than 10° from the longitudinal axis. All hooks used to hoist personnel must be equipped with effective positive safety catches especially on hydraulic cranes.</p>
<p>(16) Hydraulic Hoses Fittings and Tubing</p>	<p>Flexible hoses must be sound and show no signs of leaking at the surface or its junction with the metal and couplings. Hoses must not show blistering or abnormal deformation to the outer covering and no leaks at threaded or clamped joints that cannot be eliminated by normal tightening or recommended procedures. There should be no evidence of excessive abrasion or scrubbing on the outer surfaces of hoses, rigid tubing, or hydraulic fittings.</p>
<p>(17) Outriggers</p>	<p>Outrigger number, locations, types and type of control are in accordance with manufacturer's specifications. Outriggers are designed and operated to relieve all weight from wheels or tracks within the boundaries of the outriggers. If not, the manufacturer's specifications and operating procedures must be clearly defined. Outriggers must be visible to the operator or a signal person during extension or setting.</p>
<p>(18) Load Rating Chart</p>	<p>A durable rating chart(s) with legible letters and figures must be attached to the crane in a location accessible to the operator while at the controls. The rating charts shall contain the following:</p> <ul style="list-style-type: none"> • A full and complete range of manufacturer's crane loading ratings at all stated operating radii. • Optional equipment on the crane such as outriggers and extra counterweight which effect ratings. • A work area chart for which capacities are listed in the load rating chart, i.e. over side, over rear, over front.

	<ul style="list-style-type: none"> Weights of auxiliary equipment, i.e. load block, jibs, boom extensions. A clearly distinguishable list of ratings based on structural, hydraulic or other factors rather than stability. A list of no-load work areas. A description of hoistline reeving requirements on the chart or in operator's manual.
(19) Wire Rope	<p>Main hoist and auxiliary wire rope inspection should include examining for</p> <ul style="list-style-type: none"> Broken wires. Excess wear. External damage from crushing, kinking, cutting or corrosion.
(20) Cab	<p>Contains all crane function controls in addition to mechanical boom angle indicators, electric wipers, dash lights, warning lights and buzzers, fire extinguishers, seat belts, horn, and clear unbroken glass.</p>
(21) Braking Systems	<p>Truck cranes and self-propelled cranes mounted on rubber-tired chassis or frames must be equipped with a service brake system, secondary stopping emergency brake system and a parking brake system. Unless the owner/operator can show written evidence that such systems were not required by the standards or regulations in force at the date of manufacture and are not available from the manufacturer. The braking systems must have been inspected and tested and found to be in conformance with applicable requirements.</p> <p>Crawler cranes are provided with brakes or other locking devices that effectively hold the machine stationary on level grade during the working cycle. The braking system must be capable of stopping and holding the machine on the maximum grade recommended for travel. The brakes or locks are arranged to engage or remain engaged in the event of loss of operating pressure or power.</p>
(22) Turntable/Crane Body	<p>Make sure that the rotation point of a crane gears and rollers are free of damage, wear and properly adjusted and the components are securely locked and free of cracks or damage. The swing locking mechanism must be functional (pawl, pin) and operated in the cab.</p>
(23) Counterweight	<p>The counterweight must be approved and installed according to manufacturer's specifications with attachment points secured.</p>

Table 4.8B shows the items that need to be examined for the Grove Rough Terrain 45 Ton Hydraulic Crane and their corresponding applicable OSHA 29 CFR 1926 and ANSI B30.5 Standards.

Table 4.8B Rough Terrain 45 Ton Hydraulic Crane		
STANDARD (29 CFR 1926.550)	INSPECTION ITEMS	ANSI B 30.5

	<p>Outriggers</p> <ol style="list-style-type: none"> 1. Lubrication 2. Structural Condition 3. Pressure Hoses/Connections 	<p>5-1.9.9 5-2.1.3 5-2.1.2</p>
	<p>Turntable/Crane Body</p> <ol style="list-style-type: none"> 1. Ensure Level/Stability 2. Wear/Gear/Teeth/Rollers 3. Cracks 4. Bolts/Ensure Securely Attached 	<p>5-1.1 & 5-1.2</p>
	<p>Counter Weight</p> <ol style="list-style-type: none"> 1. Proper Size 2. Attachment Connection/Bolts 	<p>5-3.4.2</p>
<p>1926.550(a)(8) 1926.550(a)(13)(ii) & (iii) ----- 1926.550(a)(4) ----- -----</p>	<p>Engine Housing</p> <ol style="list-style-type: none"> 1. Cleanliness/No Rags/Trash 2. Gear/Machinery Guards 3. Clear Access/Walkways 4. Brakes/Clutch Adjustments 5. Hand Signal Illustration 6. Swing Break 	<p>5-1.9.6 5-1.8.2 & 3 ----- 5-2 (Fig.16) 5-1.4</p>
<p>1926.550(a)(12) ----- ----- 1926.550(a)(14)(i) 1926.550(a)(2) 1926.550(a)(13) & 1926.550(a)(13)(iii)</p>	<p>Cab</p> <ol style="list-style-type: none"> 1. Glass/Visibility 2. Instruments and Controls 3. Functioning Horn (Warning signal) 4. Fire Extinguisher 5. Appropriate Load Charts and Warning Signs 6. Proper and Adequate Access (Steps/Walkway) 	<p>----- 5-5.1.6.1.1 ----- 5-3.4.9 5-5.1.1.3 5-1.8.2 & 3</p>
	<p>Drum</p> <ol style="list-style-type: none"> 1. Proper Size and Spooling of Hoistlines 2. Drum Sides/Shields for cracks 3. Dogs/Pawls/Locking Devices 4. Drum Rotation vs. Control Motion 	<p>5-1.3.1 & 2</p>

<p>----- ----- ----- ----- ----- ----- ----- 1926.550(b)</p>	<p>Boom Sections (Boom sections correspond with crane model)</p> <ol style="list-style-type: none"> 1. 2. 3. Boom Stops 4. 5. Hoist Line Guides/Sheaves 6. 7. 8. Jib Attachment/ Backstops/Belly Slings 	<p>5-2.1.3</p>
	<p>Sheave System</p> <ol style="list-style-type: none"> 1. Ensure Hoist Line and Sheave Size Match 2. Worn 3. Lubrication/Move Freely 	<p>5-1.7.4</p>
	<p>Load/Auxiliary Hook and Block System</p> <ol style="list-style-type: none"> 1. Sheaves Function Smoothly 2. Hook Rotates Freely/Lubricated 3. Proper Becket 4. Properly Reeved 	<p>5-1-7.1-6</p>
<p>1926.550(a)(7) 1926.550(a)(7)(v) ----- -----</p>	<p>Wire Rope/Hoist Line</p> <ol style="list-style-type: none"> 1. Overall Condition 2. End Connections 3. Lubrication 4. Clips 	<p>5-1.7.6 ----- -----</p>
<p>----- ----- 1926.550(a)(9) 1926.550(a)(15)</p>	<p>Safety Devices</p> <ol style="list-style-type: none"> 1. Anti-Two Block Devices 2. Boom Backstop Devices 3. Swing Radius Warning Devices 4. Job or Site Specific Devices/system (near electric power/personnel hoisting platforms) 	<p>5-1.1.9 5-2 (Fig. 17)</p>
<p>Additional References: 1926.550(a)(1) ---- Crane used in accordance with manufactures specification. 1926.550(a)(5) ---- Inspection: Competent Person. 1926.550(a)(6) ---- Annual Inspection Record. 1926.550(a)(16) ---- No modifications without written approval of manufacturer.</p>		

Table 4.8C shows the items that need to be examined for the Manitowoc 4100 150 Ton Lattice Boom Crawler Crane and their corresponding applicable OSHA 1926 and ANSI B30.5 Standards.

Table 4.8C 150 Ton Lattice Boom Crawler Crane		
STANDARD (29 CFR 1926.550)	INSPECTION ITEMS	ANSI B 30.5
	<p>Track Crawler System</p> <ol style="list-style-type: none"> 1. Lubrication 2. Connection Bolts 3. Drive Chain (slack & wear) 	<p>5-1.9.9 5-2.1.3 5-2.1.2</p>

	<p>Sheave System</p> <ol style="list-style-type: none"> 1. Ensure Hoistline and Sheave Size Match 2. Worn 3. Lubrication/Move freely 	5-1.7.4
	<p>Load/Auxiliary Hook and Block System</p> <ol style="list-style-type: none"> 1. Sheaves Function Smoothly 2. Hook Rotates Freely/Lubricated 3. Proper Becket 4. Properly Reeved 	5-1-7.1-6
<p>1926.550(a)(7) 1926.550(a)(7)(v) ----- -----</p>	<p>Wire Rope/Hoist Line</p> <ol style="list-style-type: none"> 1. Overall Condition 2. End Connections 3. Lubrication 4. Clips 	<p>5-1.7.6 ----- -----</p>
<p>----- ----- 1926.550(a)(9) 1926.550(a)(15)</p>	<p>Safety Devices</p> <ol style="list-style-type: none"> 1. Anti-Two Block Devices 2. Boom Backstop Devices 3. Swing Radius Warning Devices 4. Job or Site Specific Devices/System/Program for work near electric power and use of personnel hoisting platforms) 	<p>5-1.1.9 5-2 (Fig. 17)</p>
<p>Additional references: 1926.550(a)(1) ---- Crane used in accordance with manufactures specification. 1926.550(a)(5) ---- Inspection: Competent Person. 1926.550(a)(6) ---- Annual Inspection Record. 1926.550(a)(16) ---- No modifications without written approval from manufacturers.</p>		

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