Job Safety Analysis

Use These Forms Before You Begin Any Job to Alert You of Any Hazards That May Exist

Engine Removal and Installation

Customer Name:	**Job Location:**	**Unit #:**	**Job#:**

REQUIRED PERSONAL PROTECTION EQUIPMENT:	***MSDS(s) ASSOCIATED WITH THE JOB:***
Hard hat, ear plugs, safety glasses with side shields, gloves, steel toed boots, fall protection & all other required site specific personal protective equipment.	Chemicals normally used on the crane or stored on Service trucks

To improve readability and comprehension of this field document, we have detailed all common hazards and the recommendations for safe work at the beginning of this JSA. It is understood and assumed that any time during the assembly of this crane, any or all of these hazards may become relevant. This JSA is to be used in conjunction with the operator's manual. If there is ever a discrepancy between the two the operator's manual takes precedence.

Common Hazards	Safe Job Practices
• **Slips, Trips and Falls**	• Use of personal fall protection system is mandated when working where employees are exposed to falls greater than 4 feet. • To reduce the risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms. However, walkways and platforms can be slippery when wet and when oil or grease is spilled on them. ***Keep walkways and platforms clean and dry to prevent slipping on them.*** When non-skid material wears out, reapply it • Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto crane. • Do not use top of mast, boom, or jib as walkways (unless they have optional catwalks). • Use ***both hands*** and handrails, steps and ladders provided to climb onto and off crane. • Lift tools and other equipment which cannot be carried in pockets or tool belts onto and off crane with hand lines or hoists. • Boom and gantry are not intended as ladders. **DO NOT** attempt to climb lattice work of boom or gantry to get to maintenance points.
• **Crushing Injury Hazard**	• Barricade all accessible areas to crane so personnel cannot be struck or crushed when upper works is swung. • Do not climb on or off crane while upper works is being swung or crane is being traveled. • Signal operator that you need to climb on or off crane. • Operator: do not swing or travel while personnel are climbing on or off crane. Stop swing and travel motions. Apply swing brake and turn on Travel Brake. • Use of dedicated spotters and signal persons when flying objects with cranes. • Use of tag lines when a rotating load may become a hazard.
• **Struck By/ Caught Between/Pinch Point Hazards**	• Hard Hats and Safety Glasses shall be worn at all times during the assembly/disassembly of this crane. • Never handle wire rope with bare hands. Always wear heavy-duty gloves to prevent being cut by broken wires. • Use extreme care when handling coiled pendants. Stored energy can cause coiled pendants to uncoil quickly with considerable force. • Do not attempt to maintain or repair any part of crane while engine is running, unless absolutely necessary. • If engine must be run, keep your clothing and all parts of your body away from moving parts. ***Maintain constant verbal communication between person at controls and person performing maintenance or repair procedure.*** • Do not use your hands to check for air and hydraulic oil leaks • Relieve pressure before disconnecting air, coolant, and hydraulic lines and fittings. • Do not attempt to lift heavy components by hand. Use a hoist, jacks, or blocking to lift components.

• **Struck By/ Caught Between/Pinch Point Hazards**	• Store tools, oil cans, spare parts, and other necessary equipment in toolboxes. Do not allow these items to lie around loose in operator's cab or on walkways and stairs. • Use of dedicated spotters to direct and signal all vehicle traffic. • Before a crew member goes to a location that is out of view of the operator and is either in, on, or under the equipment, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member must inform the operator that he/she is going to that location. Where the operator knows that a crew member went to a location covered by the above sentence, the operator must not move any part of the equipment (or load) until the operator is informed in accordance with a prearranged system of communication that the crew member is in a safe position.	
• **Dropped Loads and equipment damage**	• Select a suitable location for Engine Stagging. It must be firm, level, and be free of obstructions. It should have enough open space to accommodate the crane, the length of boom, and - if required - movement of an assist crane or other equipment. If possible, secure the area to keep unauthorized personnel and vehicles away. • Sling Engine at an appropriate spot and around the engines so not to slip or move. Use softeners as needed. If the engine is slung incorrectly, it can fall or cause machine damage	
	• Inspect all rigging prior to the start of the day and before each use to ensure rigging is not damaged and capable of lifting the load safely. • Check load capacities of each piece of rigging to ensure proper use. • Look for tearing or cuts on the rigging • Ensure hooks and latches are in place and in good working order • Inspect softeners to make sure they will protect the rigging against sharp edges	

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• **Designate Stagging / Work area Area**	• Select a good location to stage the new engine and to place the old one after removal • Ensure ground conditions are firm, level and uniformly supportive. • Select an area large enough and free of any underground or overhead obstructions or hazards to accommodate the crane, assist crane, and the movement of trailers. • Maintenance area should not interfere or pose a hazard to other onsite personnel. Area should be clearly marked and barricaded. • There should be at least 2 feet of clearance between the counterweights and nearest obstacle of the assist crane. • Ground support as specified in the erection drawings is complete and in compliance with the stated requirements.
• **Assist Crane Requirements (If used)**	• The assist crane shall be sized in accordance with site restrictions and manufacturers specifications. • Site conditions and matting must be suitable for maximum loading of the assist crane. • Assist crane will assembled in accordance with manufacturer's instructions.
• **Rigging Failure**	• Rigging shall be inspected per applicable OSHA/ASME standards, at a minimum, daily and prior to use. Examples of unserviceable rigging would be bird caging, kinks, and broken wires.
• **Electrical Shock Hazard**	• Ensure adequate clearance from power lines is continuously maintained per ASME B30.5.
• **Operational Test Loads (if required)**	• Test loads shall not exceed 100% of the manufacturers load rating. Any request to load test a crane above the manufacturers load rating must be approved by a Regional Vice President. • Test loads shall never exceed 110% of manufacturers load rating. • Test loads must be freely suspended. Testing using static loads is prohibited. • All rigging must be inspected and approved prior to load testing. • The weight and radius of the load test shall be determined by: - Manufacturers load chart. - Site Conditions. - Winch line pull, (i.e., the test load must be lifted while staying within the line pull capacity of the drum being utilized).

Note: At no time will a trainee, apprentice, or an oiler operate any crane during the assembly, reconfiguration, and/or disassembly process or while the crane is in bypass.

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BASIC JOB STEPS	POTENTIAL HAZARDS	SAFE JOB PRACTICES
• **Park the crane on a level ground,** ○ *Return the shift lever to "N"* ○ *Place Chocks on rear wheels* ○ *Make sure outrigger cylinders are fully retracted and connection pins are fully pulled out* ○ *Remove aux hook block if stowed* ○ *Check that lock pins are inserted, and all hoses / cables are stowed*	**See Common Hazards Above** **Crushing hazards, Pinch Points** **Damage to equipment, Caught between** **Moving Equipment** ***NOTE*** *Make sure that the area has been barricaded. Set up area completely for new engine to be placed prior to moving on the next step. Work with Site contact to provide a spotter if necessary due toa congested work area and moving equipment prior to removal.*	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures. Monitor levels. Ensure cribbing and base is level. Use of designated spotter to direct truck drivers.*** ***Gloves to be worn for all hands-on work,*** ***Constant communication.***
• **Disconnect existing Engine** ○ *Attach the rigging to the engine to avoid any unnecessary movement of the engine.* ○ *Remove all hoses, wired connections and bolts securing the engine to the engine compartment* ○ *Make sure rigging is properly secured with weight on the rigging but not enough to lift* ○ *Stop work. Make sure all attachments and connections to the engine are removed* ○ *Remove engine form compartment*	**See Common Hazards Above** **Crushing hazards, Pinch Points, Hydraulic leaks** **Damage to equipment, caught between, Spills** **Moving Equipment** ***NOTE*** *Double check the engine attachments to the frame and body. Ensure all hoses and wiring is secured away form the engine before lifting. Clear the area of any non-essential workers not involved in the lift.*	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.*** ***Use of designated spotter to direct truck drivers*** Arrange for containment and/or spill prevention. Release all pressure on system before connection of hydraulic lines. ***Monitor levels. Ensure cribbing and base is level.***
• **Rig up and Lift Engine** ○ Sling the engine properly so the rigging will not move or slip If the engine is slung wrong, it can fall or cause machine damage. ○ Extend outriggers fully and set-up machine horizontally. For engine lift ○ Check the area to make sure there are no obstruction or persons in the lift radius. ○ Assign one signal person ○ Double check location where engine will be placed after removal ○ Conduct pre lift discussion and lift engine out of compartment ○ Set engine in designated area for stagging.	**See Common Hazards Above** **Tipping Hazard, crushing hazards,** **Pinch Points, Hydraulic leaks,** **Damage to equipment,** **caught between, Moving Equipment,** **Fire Hazard, Falling objects,** **Hydraulic Oil Spills** **NOTE** Make sure that all hose and fuel connections are still securely covered to avoid any leaks after the engine is removed.	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.*** ***Monitor levels. Ensure cribbing and base is level. Use of designated spotter to direct truck drivers.*** ***Gloves to be worn for all hands-on work, Constant communication.***

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Crane Assembly

BASIC JOB STEPS	POTENTIAL HAZARDS	SAFE JOB PRACTICES
• **Prep Engine for Installation** ○ *Pre all connection and wiring ports and connections for easy hook up after install* ○ *Clean area of any tripping hazards and store any secure any loose items.* ○ *Make sure that there are no hoses or connections that can be caught or hung-up during installation*	**See Common Hazards Above** **Crushing hazards, Pinch Points, Hydraulic leaks Damage to equipment, caught between, Spills Moving Equipment** **NOTE** Make sure that any item protruding out form the engine is secured back to avoid any hang ups during installation	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.*** ***Monitor levels. Ensure cribbing and base is level. Use*** ***of designated spotter to direct truck drivers.*** ***Gloves to be worn for all hands-on work, Constant communication.***
• **Rig up and Lift Engine** ○ Sling the engine properly so the rigging will not move or slip If the engine is slung wrong, it can fall or cause machine damage. ○ Extend outriggers fully and set-up machine horizontally. For engine lift ○ Check the area to make sure there are no obstruction or persons in the lift radius. ○ Assign one signal person ○ Double check location where engine will be placed after removal ○ Conduct pre lift discussion and lift engine out of compartment ○ Set engine in designated area for stagging.	**See Common Hazards Above** **Tipping Hazard, crushing hazards, Pinch Points, Hydraulic leaks, Damage to equipment, caught between, Moving Equipment, Fire Hazard, Falling objects, Hydraulic Oil Spills** **NOTE** Make sure that all hose and fuel connections are still securely covered to avoid any leaks after the engine is removed. Make sure Engine compartment is clear for installation	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.*** **The outrigger unit is not mounted correctly if the outrigger connection pin lock warning lamp is on. Check the status of the connection pins and the lock support for the outrigger mounting/dismounting cylinder, according to the mounting/dismounting procedure.**
• **Install Engine** ○ *Leave Rigging secured after installation until bolting to ensure no unnecessary movement on the engine occurs until secured.* ○ *After bolts are secured removing rigging and begin final installation*	**See Common Hazards Above** **Tipping Hazard, crushing hazards, Pinch Points, Hydraulic leaks, Damage to equipment, caught between, Moving Equipment, Fire Hazard, Falling objects, Hydraulic Oil Spills**	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.***

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• **Complete Engine installation** ○ *Secure all hoses and Electrical wiring* ○ *Extend the Cylinders fully using the remote controller* ○ *Check that the pin holes on the left and right of the slewing table are aligned with the pin holes on the cylinders.* ○ *Insert the left and right counterweight cylinder connection pins and turn the pins to fix them.*	**See Common Hazards Above** **Tipping Hazard, crushing hazards, Pinch Points, Hydraulic leaks, Damage to equipment, caught between, Moving Equipment, Fire Hazard, Falling objects, Hydraulic Oil Spills**	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.*** ***Adjust slings so inserts lift level.***
• **Place Standard Weight in Carrier** ○ Place the standard weight so that the markings on the standard weight are aligned with the holding supports. ○ Place the extra weight on the standard weight ○ Fix the Standard and extra weights with the connection pins ○ Slew the boom rearward until the counterweight/boom mount/dismount position indicator lights up. ○ Stop the engine and connect the remote controller. ○ Connect all hoses **NOTE: Do not let the extra weight touch the counterweight cylinder.**	**See Common Hazards Above** **Tipping Hazard, crushing hazards, Pinch Points, Hydraulic leaks, Damage to equipment, caught between, Moving Equipment, Fire Hazard, Falling objects, Hydraulic Oil Spills** **NOTE: Do not lift the counterweights while the extra weights are placed on the standard weight. The extra weights can fall, leading to a serious accident. Lift the standard weight only.**	***See Safe Job Practices Above*** ***Refer to operator's manual for detailed procedures.***

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Additional Comments (include any additional observations or comments on this job task below)
All personnel shall review the job safety analysis prior to work activity and sign below. Perimeter of work area shall have yellow caution or red warning tape installed to prevent any unnecessary jobsite personnel being exposed to these hazards.

PRINT	**SIGNATURE**

Assembly/Disassembly Director: _____ **Date:** _____