SAFE WORK PRACTICE **SWP-77**
December 11, 2018 **Pump Jack**

PURPOSE/APPLICATION

Pump jack maintenance is a task commonly undertaken by Strike personnel that poses several potential hazards. Of great significance are the large and heavy moving parts of the pump jack that have the capacity to inflict serious damage, injury or even death. Danger is heightened during installation, stroke change, counterbalance change, maintenance, well servicing and data readings. This safe work practice is intended to provide general guidelines and instruction for conducting pump jack maintenance.

PPE
- Strike minimum requirements
- Fall arrest

ADDITION RESOURCES
- Manufacturer/Owner Procedures

TRAINING

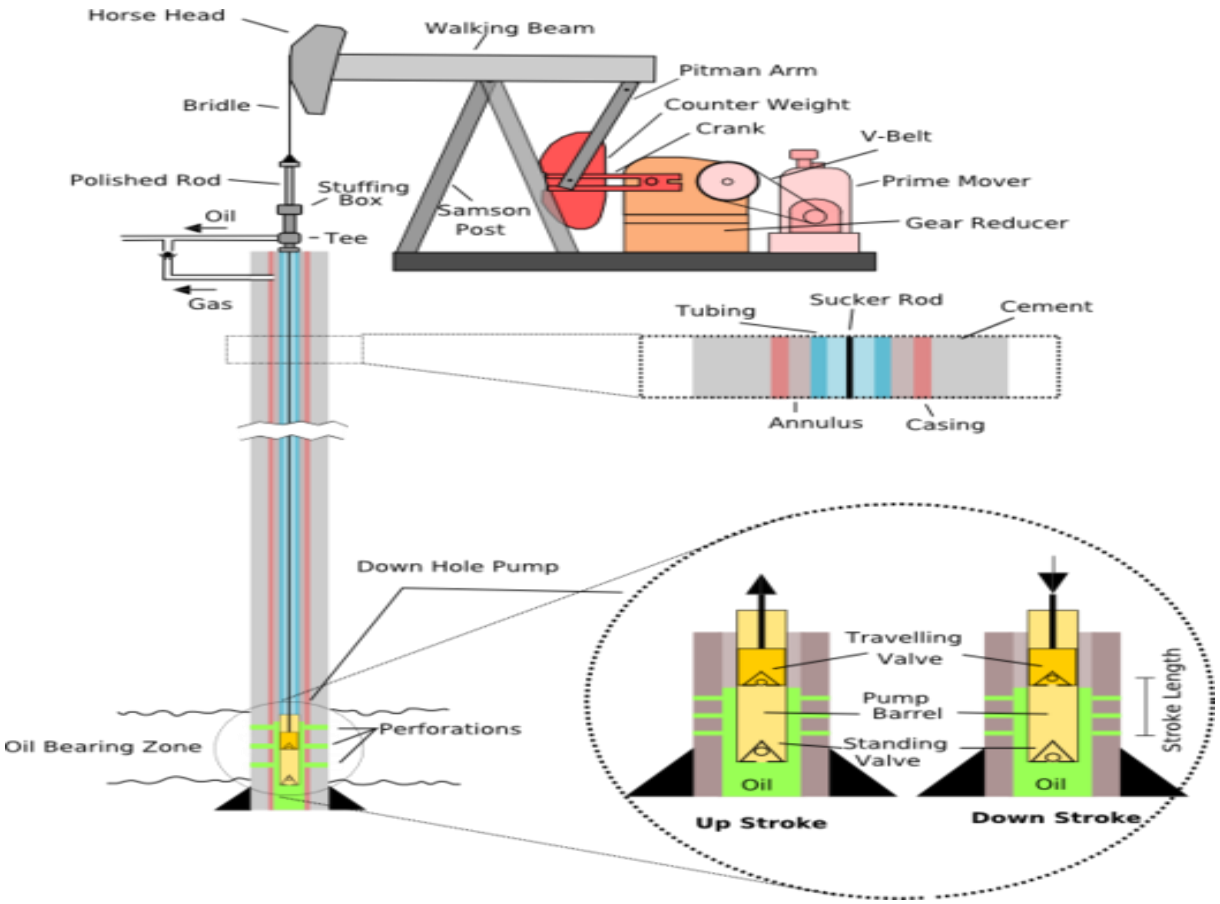
HAZARDS & CONCERNS
- Pressured systems
- Falling materials
- Property damage
- Inadequate knowledge
- Live well
- Rotating Equipment
- Line contacts
- Fall from heights
- Crush injuries
- Gas release (LEL, H_2S)
- High winds

General Preparation

THE DO's:

DO Determine the scope of the work:
- What is our task?
- What tools and equipment do we require?

DO Ensure all personnel taking part in pump jack maintenance are adequately trained and competent.
DO Receive a work permit from the site owner, which will identify site specific hazards and mitigation requirements (i.e. atmospheric testing, vehicle entry requirements or smoking areas)
DO Complete a pre-job hazard assessment to be completed and reviewed with all on-site personnel
DO Complete an Emergency Response Plan (ERP) to be reviewed with all affected parties
DO Review of Job Plan On-Site for tailgate meeting
- Manufacturers service manuals and/or owners procedure for the equipment must be consulted
- Complete HIAC before after reviewing the job and area
- Ensure there is a lift plan (CF-S-42 form completed)
- Fall protection plan (CF-S-28 form completed)



THE DON'Ts

DON'T preforming any work on a pump, until all energy sources must be properly deenergized, locked and tagged out. Typical energy isolation procedures include the following:

1. Machine control centre shut-down and locked out
2. Lockout of the energy source by a qualified and competent worker (either electric or gas motor)
3. Locking the brake
4. Using the locking pawl if one is available on that type of equipment
5. Chaining the sheave
6. Using a rod clamp
7. Using the crane to support the weight of equipment when required

Note: Special types of equipment, such as a walking beam compressor, may require additional procedures to isolate the energy.

DON'T Yank on the hand brake to stop the unit, as this can cause damage to the gear box. Instead give the brake a slow even pull until it takes hold

DON'T **Rely on the brakes as your only source of isolation.**

- If weights move after ratchet style boomer is disengaged, get picker truck to lower weights or use alternate measures to ensure workers are not placed at risk.
- If pulleys cannot be secured, you may wrap chains around each weight arm and walking beam arm. Secure with a ratchet style boomer and lock out; lock and scissors on both sides.

Assembling and disassembling Pump Jacks

THE DO's:

- **DO** Review and follow the manufacturer/owner's procedures
- **DO** Use proper, clean tools that are in good condition and used in the correct manner
- **DO** Follow lock out tag out procedure to confirm zero energy isolation of all energy potential (i.e. stored energy in the counterweight/horsehead, electrical energy and all other identified)
- **DO** Stay alert and clear of the path of moving parts, including the crank swing area, counterweight area, or the horsehead area
- **DO** Exercise extreme caution when conducting pump jack maintenance in inclement weather.
- **DO** Plan all lifting activities and follow all safe work practices
- **DO** Use taglines when lifting and moving loads
- **DO** Use engineered lifting points making sure they are properly inspected and rated
- **DO** Use elevated work platforms when possible to complete work at heights
- **DO** Complete a thorough inspection of the pump jack and worksite before starting the equipment up.

THE DON'Ts

- **DON'T** Assume a stationary pump jack is not operational. Pump jacks may be equipped with automatic timers that can start up without warning
- **DON'T** Wear loose fitting PPE or jewelry, and ensure long hair is properly tied back
- **DON'T** Work on potentially live equipment without having personal LOTO in place
- **DON'T** Stand under the walking beam or horsehead during installation and removal, or under any moving parts or loads being lifted
- **DON'T** Perform pump jack maintenance during electrical storms
- **DON'T** Use eyelets or eyebolts as lifting points on pump jack horseheads unless the integrity can be verified
- **DON'T** Put Pump jack back into service without ensuring all parts and guards are replaced and working
- **DON'T** Remove locks, disengage brakes, open valves, etc. until it is verified no one is in danger and the work is complete
- **DON'T** Restart pump jack before doing a walk around to check that all tools and equipment have been cleaned up and are not in the way of moving parts

These procedures may vary depending on different styles of pump units (i.e. – Mark11). Manufacturer's service manuals and/or owner's procedures for the equipment must be consulted as part of the planning process. Manufacturer's and/or owner's procedures must be utilized to ensure the appropriate procedures are employed specific to the particular pump jack. Should there be a conflict between this safe work practice and the pump jack's manual and/or owner's procedures, default to the manual and/or owner's procedures as being the correct method for that particular pump jack.

PUMP UNIT – REMOVE WALKING BEAM

1. Arrange for a picker unit with a load rating adequate for the task to be performed.
2. Stop pump unit with the pitman arms at the horizontal-to-base position. Set the brake and test brake for tightness. Lockout all sources of power to the pump unit according to Safe Work Procedure – Lockout.
3. Clamp off the well by clamping on the polish rod at stuffing box. Ensure polish rod clamp is clean and rod is not worn.

4. Take weight off carrier bar by rotating weights such that weight transfers to top clamp.
5. Remove gate in carrier bar.
6. Push the carrier bar from polish rod and replace the gate.
7. Have the picker unit move into place and rig according to safe rigging practices.
8. Have picker unit snug line to take the weight for removing bolts.
9. Disconnect pitman latches from the crank pits.
10. Remove bolts that hold the saddle bearing on top of Samson post.
11. Lift off walking beam, tail assembly and pitmans. Non-essential personnel must stand clear of all line of fire zones.
12. Move the entire assembly to a designated safe work area.
13. If the pump unit is larger than 228's, a basket truck will be required to facilitate in the overhead work.

PUMP UNIT – INSTALL WALKING BEAM

1. Arrange for a picker unit with a load rating adequate for the task to be performed.
2. Attach center bearing, equalizer bearing assembly, pitmans and bridle to the walking beam.
3. Attach rigging according to safe rigging practices.
4. Lift entire assembly to the top of Samson post. Boss on the bottom of center bearing fits into hole in the top of Samson post. Stand clear of all line of fire zones.
5. Bolt center bearing to samson post – snug, not tight.
6. Attach pitman latches to crank pin housing but do not tighten. The lug on top of crank pin housing must fit into hole in the pitman arm.
7. Line up horsehead with polish rod.
8. Remove carrier bar gate.
9. Install carrier bar around polish rod and replace gate.
10. Tighten center bearing to Samson post.
11. Tighten end cap over equalizer bearing.
12. Tighten pitman latches.
13. Set upper polish rod clamp above carrier bar and tighten.
14. Release the brake and allow unit to take the weight of well.
15. Remove polish rod clamp at stuffing box.

PUMP UNIT – ADJUST BRAKE

1. Stop pump unit with the counter weights down.
2. Shut off and lockout all sources of power according to Safe Work Procedure – Lockout.
3. Adjust nut at brake shoes:
    a. until brake lever can be pulled back with moderate pressure to within three teeth of back travel;
    b. shoes should be just clear of brake drum when lever is in the off position (forward position).

PUMP UNIT – ADJUST COUNTER-BALANCE

1. Determine whether unit is balanced too light or too heavy by:
    a. listening to engine or electric motor;
    b. watching governor movement on engine;
    c. taking ammeter readings on electric motor.
2. If adjustment is required, shut off all sources of power and lockout same according to Safe Work Procedure – Lockout. Shut off engine if gas motor.

3. If prime mover works harder when weights are being raised, weights should be moved in.
4. If prime mover works harder when weights are going down, weights should be moved outward.
   NOTE: Stop unit with the counter weight horizontal.

PUMP UNIT – REPLACE COUNTER WEIGHT

1. Arrange for picker unit with a load rating adequate for the task to be performed.
2. Shut off motor and lockout power supply at main switch. Refer to Safe Work Procedure - Lockout.
3. Apply the brake and test brake for proper adjustment. Stop unit with pitman arms in the horizontal and the weight to be replaced in the upward position.
4. Loosen pinion set screw.
5. Attach picker unit lines. Take up slack on winch line.
6. Remove all nuts from counter weight bolts.
7. Lift off counter weight following Safe Work Practice – Lifting and Hoisting.
8. Remove pinion screw from counter weight.
9. Put pinion screw into new counter weight.
10. Set new counter weight onto crank, over counter weight bolts and pinion.
11. Move weight to proper position using pinion wrench.
12. Tighten nuts on counter weight bolts using hammer wrench.
13. Tighten pinion set screw.
14. Check for proper balance (See Pump Unit – Adjust Counter-Balance Procedure above).
15. Remove lockouts and tags.

PUMP UNIT – CHANGE PITMAN ARMS

1. Stop motor with the cranks in lower position. Apply brake and test for proper brake tension.
2. Lockout all sources of power at main switch as per Safe Work Procedure – Lockout.
3. Tie down horsehead with a come-a-long or other suitable means.
4. Clamp off weight of rod string with cranks in lower position.
5. Put clamp at stuffing box. Check that clamp is clean and rod is not worn.
6. Undo pitman latches.
7. Loosen bolts at end of equalizer.
8. Remove cotter key in one end of pin holding top of pitman arm.
9. Support weight of pitman arm using attached winch line.
10. Drive out pin through top of pitman arm.
11. Remove old pitman arm, being certain winch line is properly secured. Be sure to follow proper lifting procedures at all times.
12. Place new pitman arm into place.
13. Push pin through top of pitman arm.
14. Insert cotter pin.
15. Tighten bolts at ends of equalizer.
16. Secure pitman latches around crank pins. Be certain that lug on top of crank pin fits up into the hole in pitman arm.
17. Tighten pitman latches securely and set lock nuts.
18. Remove come-a-long from horsehead.
19. Take weight of rod string off the clamp. Remove clamp.
20. Release brake.

21. Remove all lockouts and tags.

PUMP UNIT – SHIMMING HORSE'S HEAD

1. Stop pump unit with the weights at the two o'clock position.
2. Clamp off rod string. Ensure that clamp and rod are in good condition.
3. Take rod weight off pumping unit. Weights should now be in the twelve o'clock position.
4. Stop motor and lockout all power sources at main switch as per Safe Work Procedure – Lockout.
5. Apply brake. Make certain that brake is properly adjusted.
6. Loosen, but do not remove, the four bolts holding the horsehead bracket to the walking beam.
7. Raise the horsehead bracket.
8. Shim up bracket as required so that the bridle will run straight down tracks on the horsehead.
9. Back off the set screws to lower bracket.
10. Tighten the four bolts holding the bracket to the beam.
11. Release brake and allow unit to take the weight of the well.
12. Remove polish rod clamp.
13. Remove lockouts and tags.

PUMP UNIT – CHANGING STROKE LENGTH

1. Stop pump unit with cranks at an angle of about 45 degrees above horizontal. Check brake for adjustment.
2. Clamp off rod string. Ensure clamp and rod are clean.
3. Turn unit until cranks are in the four o'clock position. Crank pins can be driven out easier and reduces the chance of hitting the gear box with hammer.
4. Shut off and lockout all power sources.
5. Attach chain hoist to crosspiece of bottom of horsehead and chain to wellhead. Tighten chain hoist up snug.
6. Remove cotter keys in crank pins.
7. Back off nuts on crank pins using hammer wrench
8. Screw drive nut onto crank pin. Drive nut must be tight.
9. Knock out crank pins using sledge hammer. May also be removed using grease pressure.
10. Clean new pin holes thoroughly using wire brush, solvent and emery paper. Wipe holes dry.
11. Apply very thin film of light oil inside holes. Do not use grease.
12. Insert pins firmly into new holes. Move walking beam up or down with chain hoist at front to facilitate line up.
13. Replace nuts on crank pins. Tighten nuts firmly using hammer wrench.
14. Replace cotter keys in crank pins. DO NOT BACK OFF NUT IN ORDER TO INSERT COTTER PIN.
15. Apply rust preventative in old holes.
16. Remove chain hoist from horsehead.
17. Ease off brake and allow unit to take weight off the rods.
18. Slide polish rod clamp up under rod rotator and tighten securely.
19. Remove all lockouts and tags.
20. Respace pump before leaving well site.

PUMP UNIT – ALIGN HORSE'S HEAD

1. Clamp off with weight off rods. Put clamp at stuffing box. Be certain that clamp and rod are clean and in good condition.
2. Turn cranks slightly to take the strain off unit.
3. Shut off power and lockout all power sources at main switch.
4. Apply brake and check for proper adjustment.
5. Loosen bolts at bottom of center bearing. Do not remove.
6. Loosen bolts holding cap over equalizer. Do not remove.
7. Loosen pitman latches. Do not remove.
8. Place bar between pitman arms and cranks. Swing horsehead so that the polish rod is centered on the horsehead. Check pitman arms for plumb.
9. Tighten all bolts and latches.
10. Loosen bolts holding walking beam on top of saddle.
11. Operate adjusting screws at saddle to move beam forward or backward.
12. Adjust beam so bridle lines are even with polish rod.
13. Tighten walking beam to saddle.
14. Slack off adjusting screws ONE turn. Set lock-nuts on adjusting screws.
15. Release brake and allow unit to take the weight of the rods.
16. Slide polish rod clamp under bridle and tighten securely.
17. Remove lockouts and tags.

PUMP UNIT – CHANGING BELTS

1. Shut down unit and lock out power sources at main switch.
2. Remove belt guard. Set it at a safe distance from unit so it will not be tripped over.
3. Slacken off tightening device. Loosen bolts at base of cross mounts, also the long tension tightening bolts, if any.
4. Remove belts.
5. Check grooves in sheave for undue wear, damage, etc. Check belts that they are a matched set.
6. Replace the belts.
7. Tighten belts – approximately ¼" per foot of up and down slack to be left in belts. Be certain sheaves line up.
8. Install belt guards. After belts and guards are installed, recheck all bolts for tightness and guard for clearance.
9. Restart unit.

PUMP UNIT – LEVELING (PORTABLE CONCRETE BASE)

1. Have gravel and timbers on lease.
2. Have a picker truck on site that is large enough to safely handle pump unit and/or base.
3. Place rod clamp on polish rod just above stuffing box.
4. Remove carrier bar from polish rod.
5. Prepare pump unit to be removed from base:
    a. Lockout main power sources;
    b. Remove all tie-down bolts and anchors;
    c. Remove electric motor and set away from work area.
6. Remove pump unit from base with picker unit and set on timbers away from work area.
7. Remove pump base and set on timbers away from work area.

8. Repair and level gravel pad. Make sure to excavate all soft areas of gravel mat and immediate top soil. Fill with dry gravel (install retainer boards if gravel pad is more than 6" thick).
9. Install cement base:
    a. Check level;
    b. Check distance from wellhead;
    c. Check alignment with wellhead.
10. Install pumping unit and motor:
    a. Install 1"x6" hardwood stripping under complete base frame of unit;
    b. Install tie-downs;
    c. Check alignment with polish rod and wellhead;
    d. Check level of pump unit.
11. Install carrier bar on polish rod.
12. Slide polish rod clamp up under rod rotator and tighten securely.
13. tart unit in operation:
    a. Check vertical alignment of polish rod with bridle;
    b. Check vertical alignment of polish rod with stuffing box;
    c. Check unit tie-downs.

PUMP UNIT – CHANGING AND ALIGNING MOTORS

1. Shut down unit and lockout power sources at main switch.
2. Remove belt guards and belts.
3. Remove tie-down bolts on the motor.
4. Lift motor off using gin poles on crew truck or picker unit.
5. Secure the motor to truck and move it away from pump unit.
6. Pick up new motor with winch truck and set on the base; install hold-down bolts.
7. Line up the sheave on the motor to the sheave on the pump unit. Use a string or chalk lines for line up.
8. Replace belts and belt guards (See Pump Unit – Changing Belts Procedure above).
9. Startup unit.

PUMP UNIT – CHANGING ROD ROTATOR

1. Shut off pump unit at bottom of stroke.
2. Set brake on firmly.
3. Install rod clamp above stuffing box.
4. Ease off brake to allow weight of rod string to rest on clamp.
5. Reset brake firmly and lockout power source.
6. Position bucket or man lift equipment.
7. Remove pony rod.
8. Remove carrier bar and polish rod clamp.
9. Remove and replace rod rotator. Ensure that rod rotator has oil.
10. Install carrier bar in place and install rod liner clamp.
11. Install pony rod.
12. Remove manlift equipment.
13. Remove power lockout source.
14. Ease off brake to allow rod string weight onto rod clamp. Reset brake firmly.
15. Remove rod clamp on stuffing box.

16. Clean up wellhead.
17. Ease off brake and start up well.

PUMP UNIT – CHANGING ROD LINER

1. Whenever possible the Client/Operator will shut down/start up pumping unit.
2. When positioning the pumping unit crank arms with two people, one person must remain on either side of pump unit with sight directly facing the weights straight on in order to relay message at which position the weights are cocked. This method to be used whenever rotation is completed on pumping unit.
3. When the unit is to be shut down the brake must be tested with the weights at a number of positions, to ensure the reliability. (i.e. Shut in at 10:00 or 2:00 depending on rotation, then ending with the weights at 12 noon). NOTE: if the brake does not function properly repairs must be made before any work continues).
4. Position weights once again at 10 o'clock and firmly apply the brake.
5. Ensure well is killed by bleeding off into a tanker using the bonding method.
6. If applicable, install stuffing box protector over stuffing box and install rod clamp/stool above rod liner. You may require a tape measure to measure position of top rod clamp and rod liner position prior to commencing procedure.
7. Loosen rod liner packing gland and slide liner down to desired level and re-tighten.
8. Ease off brake and bump pumping unit to 12 o'clock at which point rod string should be resting on rod/stool clamp.
9. Top rod clamp and bottom rod clamp may need to be moved several times in order to rest rod string on bottom.
10. Once rods are on bottom, weights should be positioned at 12 o'clock (tail section at its highest point) and brake applied firmly.
11. Electrical – control panel to be locked/tagged out.
12. Different control measures can be used to secure pumping units in a safety position.
    a. Option #1 – if applicable chain/sling horses head to 'A' leg frame for secondary safety.
    b. Option #2 – Use a picker to assist changing a rod liner.
    c. Option #3 – Chain pumping unit's fly wheel down to pumping unit's base/frame. This can only be completed by a component senior person, making sure that their body is always in the safe zone between the weights. If at all possible, chain should be passed through flywheel without putting ones hands in between the flywheel spokes. (If option #3 is eliminated then step 10 will change to weights being set at 6 o'clock and bridal carrier being disconnect prior).
13. Proceed to remove pony rod (if applicable).
14. Remove bridal carrier bar and polish rod clamps (top and bottom).
15. Remove rod rotator (if applicable).
16. Remove damaged rod liner and install new liner (try not to rotate rods, due to possible tubing pump in hole).
17. Install rod rotator (if applicable).
18. Install carrier bar in place, install rod liner clamp and clamp above bridal carrier.
19. Install pony rod.
20. Remove equipment from wellhead area (eg. Truck, manlift systems, etc.).
21. Remove lock/tag from electrical panel box.
22. Ease off brake to allow rod string weight onto rod clamp.

23. As a general rule set rods off tap on a vertical well at approximately 46-61cm (18-24") off tap and on tubing pumps 58.5-107cm (23-42") off. (Check with client to confirm clearance at all times).
24. Clean up wellhead and parts/or materials.
25. Turn electrical disconnect switch to auto position.
26. Monitor pumping unit for normal operation and correct cable length to rod rotator (if applicable).
27. Notify client, pumping unit is on line and now leaving location.

REFERENCES / ADDITIONAL INFORMATION

CF-S-42 Strike Lift Plan for

Developed by:	1.	Rhys Cooper	2.		Date:	May 2017
Approved by:	1.	Corporate HSE Committee	2.		Date:	December 11, 2018