Introduction

The purpose of this event is to test the skills of a maintenance/operating team to respond to a severe weather condition resulting in a lift station pumping outage. A Godwin Dri-Prime® model NC80 4” x 3” diesel driven sewage-handling trailer mounted pumpset featuring the Flygt style “N” impeller (non-clog) will be used to respond to the need for an emergency back up pump at a lift station. The maintenance portion of the WEFTEC Operations Challenge is focused on the routine maintenance and operation of the Godwin NC80 4” x 3” pump in preparation for use at a lift station, transportation and installation at the lift station including programming for emergency use. NOTE: The NC80 pump discharge has been increased to 4” to maximize the flow potential of the NC80 pump.

Premise

An extreme weather event has created concern regarding the reliability of a critical duplex lift station. In addition, Pump 1 at the duplex lift station has shut down due to excessive vibration. Pump 2 is still operating properly, but the decision has been made to place the Godwin Dri-Prime® pump at the station as a back up to Pump 2, therefore allowing the Lift Station to operate during the extreme weather or in the event that Pump 1 is removed and repaired. The Godwin Dri-Prime® NC80 pump will be connected to the lift station and will be operated via a level transducer in the lift station inlet manhole in the event of a failure to pump 2.

Prior to positioning the Dri-Prime® pump at the station, routine maintenance must be performed on the NC80 4” x 3” pump to ensure proper operation while in service at the lift station.

The WEFTEC Operations Challenge will consist of performing routine maintenance on the Dri-Prime® pump, positioning it at the lift station and installing suction and discharge hoses from the pump to the lift station inlet manhole and flanged force main tie-in gate valve. A level controller will be connected to the Godwin NC80 Dri-Prime® pump to allow for unattended operation (starting and stopping).

Important

Reliable running of portable pumping equipment is the goal, so caution must be exercised to avoid damage to the pump, engine or any parts associated with the challenge. Deductions will be made for damage to pump, engine parts, hoses, fittings or any other equipment used in the challenge.

A skid will be provided containing the lift station inlet manhole opening, discharge tie in point and lift station control panel.
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

Introduction

During an initial 5-minute period, the team will have an opportunity to look over the unit and check the toolbox for its contents. The team will be allowed to pre-sort the tools and remove them from their individual pouch or tray, but the tools must stay in the toolbox until the event begins. Supplies, hoses, and fittings may be arranged within the designated start area. Team members may not touch the pump unit or lift station during this time. Lockout locks will be assigned to team members during this time period. The event begins with all team members behind a designated starting line. Once the event has begun, the toolbox, tray, and various spare parts may be moved to the pump area. The electrical controls of lift station Pump 1 must be tagged out before any team member may touch the discharge point of the station. Furthermore, the discharge tie in gate valve must be closed and locked via a bonnet and multiple lockout hasps prior to any team member touching the discharge tie in piping. All tools and supplies used must be stored prior to the completion of the event.

Other items to note are as follows:

- Appropriate safety attire such as steel toe boots, hardhats (bump caps are not acceptable) and safety glasses must be worn.
- Safety gloves must be worn (latex gloves are acceptable) at all times during the event.
- Mechanics’ gloves (example: leather) must be worn by any team member involved in the closure of quick disconnect fittings on suction and discharge hoses.
- Personal protective equipment must be worn at all times, if a glove is torn, or hard hat falls off, the team member must replace it immediately or severe penalty will be assessed.
- The torque wrench must be set to 40 foot-pounds during the initial 5-minute period.
- The transducer and cable will be preset on the floor next to the table. The air supply hose for the vacuum pad test may also be recoiled and replaced to original start position.
- Any reason to stop the event due to equipment failure could result in a restart from the beginning, as decided by the team Captain and Head Judge.
- If the Head Judge stops the event due to abuse or misuse of tools or equipment, time will continue to run. Depending on the severity of the situation, penalty time could be added on to the event time in addition to the time the team was stopped.
- Failure to perform any task will result in severe penalties.
- Failure to communicate tasks performed out loud as specified in the following task list will result in penalties. When directed to count seconds out loud, always use “one-one-thousand, two one-thousand, three one-thousand”, etc. Counting the number of times you are doing a task can be “one-two-three”, etc.
- Upon finishing the event, all team members are asked to remain outside of the challenge curtain area until the judges have finished scoring and evaluating the team’s performance. When finished, the Head Judge will review the event and scoring results with the Team Captain.
- Judges are asked to supply the team captain with their raw time in minutes and seconds. The event scorekeeper will do actual tabulation, conversion and reporting of the finished time.

NOTE:
A 20-minute time limit has been imposed for the completion of all required tasks. If, at the 20-minute mark, teams have not progressed through task number 32, the event will be stopped and penalties will be assessed for all uncompleted tasks.
The following procedure and sequence addresses the energy isolation, testing, repairs, and connections that may be made in sequence during the process.

Pumpset energy isolation
- The negative battery terminal is removed from the battery thereby interrupting the direct current circuit from the battery to the engine starter. Verbiage in Step 1 states: “NOTE: The negative battery cable must be removed prior to performing any tasks on the pump or engine. This includes placing tools or supplies on the unit. You may perform trailer or lift station tasks prior to disconnection.”

Lift station energy isolation
A. Pump 1 is turned to the Off position and the breaker is turned to the Off position. A lock (or hasp and lock, if more than one team member locks out) is placed on the breaker switch. THIS ISOLATES ENERGY TO PUMP 1.
B. The force main gate valve is locked out using a red plastic lock collar. A lock (or hasp and lock, if more than one team member locks out) is placed on the red collar. THIS ISOLATES THE FORCE MAIN CONNECTOR VALVE OF THE LIFT STATION.
C. A team member must be locked out on BOTH LOCKOUTS IN PLACE (from here on referred to as “the station”), to do the following tasks:
   - Insert the suction hose & screen in the wet well
   - Connect discharge hose to force main female fitting
   - Position transducer in wet well
D. With the NC80 pump in place, a team member must be locked out on THE STATION, to do the following tasks:
   - Connect the suction hose to the pump – ONLY IF THE SUCTION HOSE IS ALREADY IN THE WET WELL. If the suction hose IS NOT inserted in the wet well, the team member DOES NOT need to be locked out on the station.
   - Connect the discharge hose to the NC80 pump – ONLY IF THE DISCHARGE HOSE IS ALREADY CONNECTED TO THE FORCE MAIN.
   - Connect the transducer to the PrimeGuard panel – ONLY IF THE TRANSDUCER IS ALREADY POSITIONED IN THE WET WELL.
E. A team member DOES NOT NEED TO BE LOCKED OUT ON THE STATION to do the following tasks:
   - Connect the suction hose to the pump – ONLY IF THE SUCTION HOSE AND SCREEN ARE NOT POSITIONED IN THE WET WELL.
   - Connect the discharge hose to the pump discharge fitting – ONLY IF THE DISCHARGE HOSE IS NOT ALREADY CONNECTED TO THE STATION.
   - Connect the transducer to the PrimeGuard panel ONLY IF THE TRANSDUCER IS NOT ALREADY POSITIONED IN THE WET WELL.
F. If a team member who is NOT LOCKED OUT ON THE STATION does any of the following tasks, it will be an infraction:
   - Position suction hose in wet well.
   - Connect discharge hose to force main
   - Position transducer in the wet well
   - Connects suction hose to pump, while suction hose & screen are positioned in the wet well
   - Connects discharge hose to the pump, while discharge hose is connected to the force main
   - Connects transducer to the PrimeGuard while the transducer is already positioned in the wet well.
G. When removing locks from the Pump Station control panel, the Supervisor’s lock is the ONLY lock to remain on the station. All other locks must be removed.
Operations Challenge
Maintenance Event - Required Task Summary

**Engine Servicing**
1. Disconnect and clean battery terminals.
2. Reconnect positive battery cable.
3. Check oil level in engine crankcase using dipstick.
4. Drain oil from diesel engine.
5. Replace oil filter on diesel engine.
6. Pump fresh oil into crankcase.
7. Re-check oil level in engine crankcase using dipstick.
8. Bleed water from primary fuel filter.
10. Verify fuel level in tank and dye test.
11. Replace air filter on diesel engine.
12. Visually check coolant level in radiator.

**Pump Servicing**
13. Check mechanical seal oil level on pumpend.
14. Grease pump bearing brackets (10 pumps).
15. Remove and inspect venturi assembly.
16. Remove braided air compressor outlet line.
17. Remove ejector housing on pumpend.
18. Inspect and clean ejector housing screen.
19. Check ejector ball in ejector housing.
20. Reassemble ejector housing.
22. Reattach air compressor outlet line.
23. Replace air compressor air filter.
24. Remove and inspect Non Return Valve (NRV) ball and seat.
25. Visually inspect condition of guide pin on front wearplate
26. Inspect volute and NRV drain valves; ensure both are in closed position.

**Trailer Inspection**
27. Inspect trailer hitch and safety chains.
28. Check wheel bearings and lug nuts.
29. Check air pressure in tires.
30. Check operation of jack stand.

**Vacuum pad test**
31. Reconnect negative battery cable to battery.
32. Reset Oil Life, etc. timers on PrimeGuard panel
33. Perform vacuum test on pump

**Pump hookup at lift station**
34. Lock out Pump 1 at lift station.
35. Lock out 4” gate valve at force main tie-in.
36. Position Dri-Prime® pump at lift station and lower rear jack stand.
37. Install discharge hose from pump to tie in point.
38. Install suction hose from pumpend to manhole.
39. Position level transducer in wet well.
40. Plug level transducer control panel wire into portable pump control panel and test.
41. Program PrimeGuard panel parameters.
42. Remove lock bonnet on lift station discharge tie in point.
43. Move key switch on PrimeGuard panel to AUTO position
44. Place safety tape around manhole opening.
45. Communicate to team that task has been completed.
46. Return to designated start line and signal completion.
**Operations Challenge**  
**Maintenance Event**  
**Process Description Breakdown**

**Engine Servicing**

1. **Disconnect and clean battery terminals.**
   - Use 7/16” wrenches to open battery box.
   - Use ½” wrench to disconnect negative battery terminal.
   - Communicate out loud “negative cable is disconnected.”
   - **NOTE:** The negative battery cable must be removed prior to performing any tasks on the pump or engine. This includes placing tools or supplies on the unit. You may perform trailer or lift station tasks prior to disconnection.
   - **NOTE:** Battery box cover may be swung on one loose bolt.
   - Battery cover will be connected using standard bolt with flat washer on bolt head side of the battery cover and a flat washer, lock nut and nut on the nut side of the battery cover. Nyloc nuts will NOT be used.
   - Use ½” wrench to disconnect positive battery terminal.
   - Use battery terminal/post cleaning brushes to clean terminals and posts, verbal 2 second count (“1-one thousand, 2-one thousand”) for brushing each terminal and each post.

2. **Reconnect positive battery cable.**
   - Use ½” wrench to connect positive battery cable.
   - Close battery box cover, do not install/tighten bolts.

3. **Check oil level in engine crankcase using dipstick.**
   - Pull dipstick and clean with shop towel.
   - Reinsert dipstick and pull to check level.
   - Communicate out loud level as read on dipstick (“Crankcase full”).
   - Wipe dipstick with shop towel and replace in engine.

4. **Drain oil from diesel engine.**
   - **NOTE:** ENGINE OIL FILTER MAY BE LOOSENED AND REMOVED WHILE OIL IS DRAINING FROM THE OIL PAN. THE FILTER IS LOCATED ABOVE THE OIL PAN THEREFORE THE WOULD BE LITTLE SPILLAGE WHEN REMOVING THE OIL FILTER.
   - Place funnel under oil pan drain plug.
   - Remove oil pan drain plug using 13/16” open-end wrench.
   - Open ball valve.
   - Drain waste oil into “Used oil” 5-gallon container with funnel (simulation, crankcase will be dry). Verbal 10 second count for draining.
   - Close ball valve.
5. **Replace oil filter on diesel engine.**
   - Reinstall drain plug, hand-tight, then using 13/16” open-end wrench tighten 1/4 turn past hand tight. **DO NOT OVERTIGHTEN.**
   - **Reinstall drain plug, hand-tight, then using 13/16” open-end wrench tighten 1/4 turn past hand tight.**
   - **Remove new filter to be installed from box.**
   - **Remove old oil filter by hand.**
   - **Place used oil filter in box of new filter to simulate proper disposal of used filter.**
   - **Lubricate o-ring on new oil filter (dip finger in “Used Oil” and run around o-ring on new oil filter). Communicate out loud “Oil filter o-ring lubricated.”**
   - **Screw new oil filter on to diesel engine hand tight only.**
   - **Write hour meter and date of servicing with marker on the end of the new oil filter.**
   - **NOTE: Engine hours will be on a piece of masking tape located above the display window of the PrimeGuard (engine hours on PrimeGuard read 0.0 because they are new engines)**

6. **Pump fresh oil into crankcase.**
   - **Remove plastic oil fill port cap from the top of the valve cover by hand.**
   - **Pump fresh oil into crankcase fill port for 10 pumps using Oil dispenser pump, count out loud “one-two-three”….**
   - **NOTE: A “full stroke” must be used when pumping oil into the engine. A “full stroke” means withdrawing the plunger of the oil pump to its maximum point and then plunging it back down completely. **DO NOT DAMAGE OIL PUMP.**
   - **Screw plastic fill port cap on diesel engine hand tight.**

7. **Re-check oil level in engine crankcase using dipstick.**
   - **Pull dipstick and clean with shop towel.**
   - **Reinsert dipstick and pull to check level.**
   - **Communicate out loud level as read on dipstick as “Crankcase full.”**
   - **Wipe dipstick with shop towel and replace in engine.**
   - **NOTE: if dipstick will immediately be used to check seal housing oil, it does not need to be returned to the engine until after the seal housing oil has been checked.**

8. **Bleed water from primary fuel filter**
   - **NOTE: THIS STEP MUST BE DONE BEFORE THE FUEL FILTER IS REPLACED. FUEL SPILL WILL OCCUR IF THE PRIMARY FILTER IS NOT DRAINED PRIOR TO REMOVING THE FUEL FILTER.**
   - **Loosen plastic wing nut on bottom of clear plastic primary fuel filter two full turns by hand.**
   - **Must do FOUR 180 degree turns of the wing nut to simulate two 360 degree turns.**
   - **Verbalize 2 second count to drain water into plastic quart container from bottom of primary fuel filter.**
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

- Tighten plastic wing nut on bottom of fuel filter two full
  turns by hand. Do FOUR 180 degree turns to simulate two
  360 degree turns.
- Communicate “fuel filter drained”.

   - Remove new fuel filter from box.
   - By hand, remove old fuel filter and place in new filter box to
     simulate proper disposal.
   - Install new fuel filter and tighten hand tight.

10. Verify fuel level in tank and dye test.
    - Remove fuel fill cap on tank by hand.
    - Insert fuel gauging stick into fuel tank.
    - Verify level of fuel in tank with the fuel gauging stick.
    - Remove fuel gauging stick and wipe.
    - Place dye check (simulated, container is empty) on end of
      fuel gauging stick.
    - Dip fuel-gauging stick into tank with dye solution to detect
      water in fuel. Communicate out loud “No water in fuel”.
    - Wipe dye check from fuel-gauging stick with shop towel
      and store.
    - Correctly replace fuel fill cap hand tight so that locking tabs
      are aligned.

11. Replace air filter on diesel engine.
    - Remove new air filter from box.
    - Open clips on plastic filter housing.
    - Remove old air filter and place “used” filter in new filter box
      to simulate proper disposal.
    - Install new air filter properly and close housing with drain
      pointing to 6 PM on the clock dial.
    - NOTE: Drain position between 5 PM and 7 PM is
      acceptable.

12. Visually check coolant level in radiator
    - Warning: Do not remove radiator cap if engine is running
      or warm.
    - Remove filler cap.
    - Visually inspect that coolant level is at the bottom of the
      filler neck.
    - Communicate out loud “Radiator full”.
    - Replace filler cap hand tight.
    - Cap must be securely tightened to withstand pressure
      when engine is running. Failure to tighten the radiator cap
      will be an infraction.

12a. Discarding used filters (air, oil, fuel)
    - The used filters in the boxes may be put in the 5-gal. bucket of waste oil and
      returned to the table.
Pump Servicing

13. Check mechanical seal oil level on pumpend.
   - Remove breather/fill cap on mechanical seal.
   - Remove engine oil dipstick and wipe with shop towel.
   - Insert dipstick into mechanical seal housing.
   - Use engine oil dipstick to check level in seal cavity.
   - Remove dipstick, verify oil level, Communicate out loud “oil level OK”.
   - Wipe dipstick with shop towel and replace in engine.
   - Replace breather/ fill cap on seal cavity, tighten hand tight.
   - DO NOT CROSS THREAD PLASTIC FILL PLUG

14. Grease pump bearing brackets (10 pumps).
   - Clean grease fitting on bearing bracket with shop towel.
   - Clean grease gun zircon adapter with shop towel.
   - Attach grease gun to pumpend bearing bracket grease fitting.
   - Fill bearing bracket with grease (10 pumps, count out loud).
   - NOTE: One “full pump” means full travel of the handle on the up stroke and down stroke of the grease gun pump handle.
   - Wipe excess grease from grease relief fitting.
   - Wipe excess grease from grease gun fitting.

15. Remove and inspect venturi assembly.
   - Loosen shoulder bolt using 17mm socket.
   - Use small pry bar to remove venturi.
   - Inspect inlet top to venturi for carbon fouling. Communicate out loud “No carbon fouling”.
   - Inspect venturi o-rings for wear or cuts. Communicate out loud “O-rings OK”.
   - Set venturi aside on trailer deck until reassembly in step 21.
   - NOTE: Penalty will result if venturi is reinstalled prior to ejector housing removal and reinstallaation.

16. Remove braided air compressor outlet line.
   - Use 1-5/16” open-end wrench as a hold back to retain compressed air inlet fitting on priming housing while using a 1-1/16” open-end wrench to loosen and remove compressed air line.
   - Inspect hose end outlet of braided compressed air outlet hose for carbon fouling. Communicate out loud “No carbon fouling”.
   - Leave compressed air line detached.

17. Remove ejector housing on pumpend.
   - Loosen and remove four 13mm machine bolts, washer and lock washer on ejector housing.
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

18. Inspect and clean ejector housing screen.
   - Lift ejector housing off pumpend.
   - Remove screen from ejector housing.
   - Clean screen with wire brush to remove debris (4 strokes each side of screen, count out loud).

19. Check ejector ball in ejector housing
   - Inspect ejector ball for free movement housing to ensure the ball is not stuck.
   - Gently shake housing and listen for free movement of the ball.
   - Communicate “Ball is free”.

20. Reassemble ejector housing.
   - Place ejector housing and screen back on pump housing.
   - Install four 13mm machine bolts, washers and lock washers and tighten with socket wrench using a torque pattern.

21. Reinstall venturi assembly
   - Insert venturi into ejector housing, with hose clamp on the side, clear of the volute.
   - Tighten 17mm shoulder bolt to retain venturi.
   - NOTE: Make sure venturi is fully inserted and do not over tighten venturi shoulder bolt!

22. Reattach air compressor outlet line.
   - Use 1-5/16” and 1-1/16” wrenches to tighten compressed air line on ejector housing.
   - NOTE: Brass fittings: do not over-tighten. May cause rounding of hex nut.

23. Replace air compressor air filter.
   - Remove new filter from box
   - Remove clips on pumpend air compressor filter housing.
   - Remove old air compressor inlet filter
   - Install new filter, install lid and clamps.
   - Place “old” filter in box to simulate proper disposal.

24. Remove and inspect Non Return Valve (NRV) ball and seat.
   - Unscrew four eyebolts on lid of NRV lid with small pry bar.
   - Use dead blow hammer to break seal on lid.
   - NOTE: Do not strike lid too hard: cast iron may crack.
   - Remove Non Return Valve (NRV) ball and inspect for damage.
   - Roll NRV ball on flat floor surface to check for out-of-round.
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

- Inspect NRV ball seat in tank by shining the flashlight into the valve opening.
- Communicate “Ball OK. Seat OK.”
- Remove, inspect and reinstall o-ring on top of NRV lid.
- Communicate “O-ring OK.”
- Replace NRV lid.
- Screw on four eyebolt and washers and tighten with pry bar ½ turn past hand tight using torque pattern.

25. Visually inspect condition of guide pin on front wearplate
   - Shine flashlight in suction of NC80 pump
   - Communicate out loud “Guide pin OK”

26. Inspect volute and NRV drain valves; ensure both are in closed position.
   - Open and close drain valve on volute to ensure proper operation. Communicate out loud “Drain valve OK.”
   - Open and close drain valve on NRV tank to ensure proper operation. Communicate out loud “NRV valve OK.”

Trailer Inspection

27. Inspect trailer hitch and safety chains.
   - Inspect safety chains for damage or wear, Communicate out loud “chains OK”.
   - Snap spring clips on safety chains to check for proper operation.
   - Grab and shake trailer hitch to ensure that it is tight. Verballize “Hitch OK.”

28. Check wheel bearings and lug nuts.
   - Remove plastic cap from bearing buddy.
   - Clean grease fitting on wheel bearings with shop towel.
   - Clean grease gun zircon adapter with shop towel.
   - Pump 5 pumps of grease into each wheel grease fitting (count out loud).
   - NOTE: One “full pump” means full travel of the handle on the up stroke and down stroke of the grease gun pump handle.
   - Clean grease fitting on wheel bearings with shop towel.
   - Replace plastic cap on wheel bearings.
   - Clean grease gun zircon adapter with shop towel.
   - Tighten 13/16” lug nuts on both wheels to 40 foot-pounds using a torque pattern.
   - Lift grease gun upward to safely remove it from the grease fitting.

29. Check air pressure in tires.
   - Use tire pressure gauge to check tire pressure, Communicate out loud, “Tire pressure OK.” for each tire.
   - Gauge stick MUST GO OUT (actual test of tire pressure).
30. Check operation of rear jack stand.
   - Clean grease fitting on rear jack stand using shop towel.  
     Note: the rear stand is the one without the wheel.
   - Clean grease gun zircon adapter with shop towel.
   - Attach grease gun to wheel bearing grease fitting
   - Grease rear jack stand with three pumps; count out loud.
   - Clean grease fitting on rear jack stand.
   - Clean grease gun zircon adapter.
   - Swing rear jack stand into vertical position.
   - Rotate crank down 5 times to assure proper operation.
   - Rotate crank up 5 times to retract rear jack stand.
   - Swing rear jack stand into horizontal position for towing.

Vacuum Pad Test and PrimeGuard programming

31. Reconnect negative battery cable.
   - Use ½” wrench to connect negative battery cable.
   - Communicate out loud that the negative terminal has been reconnected.
   - Use 7/16” wrench to close battery box.
   - bolts for the battery cover must have the head on the top of the cover and threads below the cover when replacing and tightening the battery cable box bolts.
   - Note: This step must be completed prior to performing the vacuum pad test.

32. Reset Oil Life, etc. timers on PrimeGuard panel
   - Turn key on PrimeGuard to MAN (manual) position
   - Enter password
     - Touch left and right arrows simultaneously
     - Touch right arrow to move blinking cursor to the third column.
     - Touch Up arrow to advance number to 4
     - Touch Right arrow to move cursor to fourth column
     - Touch Up arrow to advance number to 4
     - Touch Enter
     - Touch Exit
     - Touch Next button four times to advance to Oil Life Timers screen
     - Touch Enter
     - Reset Maintenance timers “Yes” (enter) or “No” (exit): touch Enter to reset timers
     - Touch Exit button to return to Four Quadrant screen
     - Communicate out loud “Maintenance timers reset”.
   - NOTE: To stop the display light from blinking, touch the ACK ALARM button repeatedly (this is optional).

33. Perform vacuum pad test on pump
• Use compressed air line and attach it to the spring loaded air chuck connection on pump air compressor.
• Open, then close volute drain valve to ensure it is in closed position.
• Prior to starting engine, Communicate out loud “starting engine”.
• On PrimeGuard control panel of diesel engine, make sure key switch is in the MAN (manual) position.
• Touch the green Start button to start engine (simulation) count out loud for four seconds (simulating engine start up to idle speed).
• Rotate the throttle control knob counterclockwise four 90 degree turns to simulate raising the rpm to 1800.
• Install vacuum pad on pump suction. Hold pad on suction for 10-second count (count out loud).
• Rotate the throttle control knob clockwise four 90 degree turns to simulate returning engine speed to idle.
• Touch Stop button.
• Turn key switch on PrimeGuard panel to “Off” position.
• Remove compressor airline from air chuck fitting on the air compressor.
• With hands off, start a 5-second count (out loud) allowing the residual vacuum to hold the pad on the pump suction.
• Communicate out loud “Vacuum test good.”
• Open volute drain valve to relieve the vacuum.

Pump hookup at lift station
NOTE: SEE REVISED LO/TO PROCEDURE ON PAGE 3
34. Lock out and tag out Pump 1
• On lift station control panel, turn Pump 1 switch to “Off” position.
• The Safety Supervisor must put the breaker of Pump 1 in the Off position and install lock and tag on breaker switch. NOTE: If only one team member is locking out, the hasp is optional. If more than one team member locks out, the hasp must be used.
• The Safety Supervisor must write the date and their initials on the tag with the dry erase marker.
• Check Pump 1 start switch for operation by turning to “Hand” to ensure that power has been locked out. Return the switch to the “Off” position.
• Communicate “Pump 1 locked out.”

35. Lock out 4” gate valve on force main
• Check that the 4” discharge gate valve on lift station is closed, by opening one full turn & closing valve.
• Place red plastic lock out bonnet on 4” gate valve hand wheel.
• The Safety Supervisor must lock out valve with hasp, lock and tag.
• The Safety Supervisor must write their initials and date on the tag.
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

• After the Safety Supervisor’s lock has been installed, all team members who are installing hoses or transducer, or working on lift station hook-up must place their locks on the hasp.

36. Position pump at lift station and use rear jack stand to level pump.
• All engine, trailer, and pump maintenance tasks must be completed prior to moving the pump into place for hookup at the lift station.
• Remove 4 wheel chocks from under trailer tires.
• Remove all tools and supplies from pump for “towing” to lift station.
• Use at least two team members to move pump close enough to lift station to make the hose connections.
• Wheel chocks may not be placed on the pump during transit.
• Replace 4 wheel chocks under trailer tires. May be done after discharge hose is connected.
• Use the rear jack stand to level pump for optimal fuel and oil distribution.
• Set and check level with small torpedo level by placing the level on the gas tank by the rear jack stand (facing front to rear) to watch for level while adjusting.

37. Install discharge hose from pump to force main.
• Install catch pan under discharge tie in point.
• Remove 4” male quick disconnect cap from discharge tie in point check valve.
• Inspect condition of o-ring on female inlet side of check valve quick disconnect fitting, Communicate out loud “o-ring OK”.
• Attach discharge hose to check valve quick disconnect fitting.
• Check condition of o-ring on female quick disconnect adapter on discharge hose, Communicate out loud “o-ring OK”.
• Attach 90° quick disconnect elbow to pump discharge quick disconnect fitting.
• Attach discharge hose to 90° quick disconnect elbow.
• Open & close NRV drain valve to check that it is in closed position.
• The drip pan under the lift station discharge connection must be returned to the table at the end of the run. The male quick disconnect cap may be put in the drip pan and transported back to the table.

38. Install suction hose from pumpend to manhole.
• Check condition of o-ring on suction of pumpend prior to attaching suction hose, Communicate out loud “o-ring OK”.
• Install suction hose to pumpend with quick disconnect fitting.
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

- Check that volute drain valve is closed. Communicate out loud “Drain valve closed.”
- Check condition of o-ring on suction hose prior to attaching suction screen. Communicate out loud “Suction screen o-ring OK.”
- Connect suction screen to suction hose.
- Lower suction hose with suction screen into manhole.

- Position automatic level control in manhole at bottom of wet well, bottom of the transducer to be between 4” – 8” of base of wet well.
- Secure transducer in position with tie wraps on the bar at the top of manhole.

40. Plug level transducer control panel wire into portable pump control panel and test.
- Plug level transducer control panel wire into the bottom of the PrimeGuard Control panel on the portable pumpset.
- NOTE: person connecting the transducer to the panel DOES NOT NEED TO BE LOCKED OUT AS LONG AS THE PRIMEGUARD PANEL IS STILL IN MANUAL MODE. If the panel is already in AUTO (automatic) mode, the person connecting the transducer must be locked out.

41. Program PrimeGuard panel LEVEL TRANSDUCER parameters.
- Turn key switch is in MAN (manual) position.
- Enter password
  - Touch left and right arrows simultaneously
  - Touch right arrow to move blinking cursor to the third column.
  - Touch Up arrow to advance number to 4
  - Touch Right arrow to move cursor to fourth column
  - Touch Up arrow to advance number to 4
  - Touch Enter
  - Touch Exit

Program Level transmitter start and stop settings
- Touch Right arrow to navigate to Operations Parameters screen
- Touch DOWN arrow to scroll backwards to “19 – OPERATION MODE”
- Touch ENTER to edit “19 - OPERATION MODE”. Field beneath will start blinking.
- Touch DOWN arrow to display “MANUAL/AUTO NO WARNING” (fig. 1)
- Touch ENTER to set parameter. Blinking will stop.

Change setting to Level control
- Touch RIGHT arrow to scroll to “PUMP CONTROL PARAMETERS”
MAINTENANCE CHALLENGE PROCESS: 2014 - 2017

- Touch Up or Down arrow to navigate to 1 – Start Stop Type parameter.
- Touch the Enter button to edit the parameter.
- Touch the Up arrow to change selection to Level.
- Touch Enter button to lock in parameter selection.
- Touch Down arrow to until 8 – START LEVEL is displayed.
- **NOTE:** Start level will be preset to 0 ft. during preset
- Touch Enter to edit the parameter.
- Touch the Up or Down arrow to set the start level at 5 ft.
- Touch Enter button to lock in parameter setting.
- Touch Down arrow one time to display 9 – STOP LEVEL.
- **NOTE:** Stop level will be preset to 0 ft. during preset
- Touch Enter button to edit the parameter.
- Touch Up or Down arrow to set stop level 1 ft.
- Touch Enter button to lock in parameter setting.

42. Remove lock bonnet on lift station discharge tie in point
- Team members whose locks are on the valve bonnet must remove their locks prior to the Safety Supervisor removing their lock from the hasp on the bonnet.
- Remove bonnet from gate valve on discharge point of lift station. May be done by any team member.
- Open gate valve.

43. Turn key switch on PrimeGuard to AUTO
- Turn key switch on PrimeGuard panel to the AUTO position and rotate engine throttle 4 times counter-clockwise to set operating speed of engine. Communicate out loud four turns.
- Communicate out loud “Pump is programmed and in Automatic mode”.

44. Place safety tape around manhole opening.
- Drop stakes into pockets on skid.
- Place yellow safety tape around four corners of lift station to secure area during the lift station bypass.
- Ensure that tape is sufficiently tight so that it will not fall.

45. Communicate to team that task has been completed.
- Return all tools to toolbox.
- Return all supplies and discards to proper area.

46. Return to designated start line and signal completion.
- All team members must be beyond the starting point line before team captain can call an end to the event.
## Provided Tools and Equipment List

*(subject to change)*

### Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toolbox</td>
<td>Battery post/terminal brush</td>
</tr>
<tr>
<td>Toolbox lock</td>
<td>Tire pressure gauge</td>
</tr>
<tr>
<td>½” Drive Torque Wrench</td>
<td>Grease gun with fitting</td>
</tr>
<tr>
<td>½ “ Drive socket wrench set SAE 3/8” through 1-½”</td>
<td>Funnel</td>
</tr>
<tr>
<td>Combination wrench set 7/16” through 1- ¼ “</td>
<td>5-gallon container</td>
</tr>
<tr>
<td>7/16” combination wrench</td>
<td>Catch pan</td>
</tr>
<tr>
<td>8” pliers dikes (side cutter)</td>
<td>Plastic Quart container</td>
</tr>
<tr>
<td>13mm socket wrench, ½” drive</td>
<td>Shop Towels (2)</td>
</tr>
<tr>
<td>17mm socket wrench, ½” drive</td>
<td>Lock-out hasps (2)</td>
</tr>
<tr>
<td>Small pry bar</td>
<td>Lock-out tags</td>
</tr>
<tr>
<td>Dead blow hammer</td>
<td>Tie wraps (12” long)</td>
</tr>
<tr>
<td>Flashlight</td>
<td>4” Gate valve lock bonnet</td>
</tr>
<tr>
<td>Small torpedo level</td>
<td>Yellow safety barrier tape</td>
</tr>
<tr>
<td>Wire Brush</td>
<td>Fuel dye check (simulated)</td>
</tr>
<tr>
<td>1- 5/16” combination wrench</td>
<td>Dry Erase Markers (2)</td>
</tr>
<tr>
<td>½” drive ratchet, 3” extension, &amp; breaker bar</td>
<td>One set of nut drivers, standard</td>
</tr>
</tbody>
</table>

### Equipment

- Godwin NC80 Dri-Prime® pump, trailer mounted, diesel drive
- PrimeGuard controller and level transducer
- 4” x 8’ Suction hose with fittings
- 4” One Piece Suction Screen
- 4” x 4’ Discharge hose with fittings
- Lift Station Skid
- Vacuum pad with vacuum gauge
- Wheel chocks (4)
Pre-competition information:

General notes:
- All tools start on table and return to table (including keys)
- All tools in tool box start in tool box and return to tool box
- Any damage to equipment will be severely penalized
- Team captain will sign at the end of the conference and 45 minute challenge window will begin.
- Who is safety supervisor? That team member uses the red lock.
- Set torque wrench during pre-set and show Head Judge

<table>
<thead>
<tr>
<th>Step</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cables maybe loose on the terminals. Do two $90^\circ$ turns to loosen and tighten cables when removing/reinstalling.</td>
</tr>
<tr>
<td>2</td>
<td>There are flat washers on top and bottom of battery cover bolts</td>
</tr>
<tr>
<td>4</td>
<td>Do not overtighten oil drain plug on engine</td>
</tr>
<tr>
<td>6</td>
<td>Full stroke of oil pump when filling (min. 12”) DO NOT OVEREXTEND</td>
</tr>
<tr>
<td>8</td>
<td>Four $180^\circ$ turns (2 full turns) to loosen and tighten drain on fuel filter</td>
</tr>
<tr>
<td>12</td>
<td>Fuel cap on trailer must be reinstalled correctly</td>
</tr>
<tr>
<td>13</td>
<td>Do not cross-thread plastic mechanical seal plug</td>
</tr>
<tr>
<td>14</td>
<td>Full stroke of grease gun when greasing bearings</td>
</tr>
<tr>
<td>21</td>
<td>Make sure venturi is completely seated before tightening shoulder bolt</td>
</tr>
<tr>
<td>25</td>
<td>Flashlight may not light but use anyway to shine in pump suction checking guide pin</td>
</tr>
<tr>
<td>28</td>
<td>Lift grease gun up to safely remove it from bearing getting greased</td>
</tr>
<tr>
<td>29</td>
<td>Check tire pressure: remove cap, check pressure, GAUGE STICK MUST GO OUT</td>
</tr>
<tr>
<td>36</td>
<td>Wheel chocks must not be on the pump when in transit</td>
</tr>
</tbody>
</table>

HEAD JUDGE:
Ask which team member will be programming the PrimeGuard. Take him/her to the panel and adjust Key Sensitivity to “Normal” or “High” as per team member’s wish and show the sensitivity setting. Ask the team member to acknowledge to setting.