

WEFTEC

Operations Challenge

2005 – 2008 Godwin

Maintenance Event

Introduction

The purpose of this event is to test the skills of a maintenance/operating team to respond to a lift station pumping outage. A Godwin Dri-Prime® model CD100M 4" diesel driven solids-handling trailer mounted pumpset 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 CD100M 4" pump in preparation for use at a lift station.

Premise

Pump 1 at a duplex lift station has shut down due to excessive amp draw. 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 Pump 1 to be removed and repaired. The Godwin Dri-Prime® pump will be connected to the lift station and will be operated via two float controls 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 CD100M 4" 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. Automatic float controls will be connected to the Godwin 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.

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, portable control panel, 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 hasp 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.
- Cords on the portable control panel may be coiled and re-hung on the hooks during the 5-minute period. 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 can 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.

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.
9. Replace secondary fuel filter on diesel engine.
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.
21. Reinstall venturi assembly.
22. Reattach air compressor outlet line.
23. Replace air compressor air filter.
24. Remove and inspect Non Return Valve (NRV) ball and seat.
25. Inspect volute and NRV drain valves; ensure both are in closed position.

Trailer Inspection

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

Vacuum pad test

30. Reconnect negative battery cable to battery.
31. Bleed air from fuel system.
32. Perform vacuum test on pump

Pump hookup at lift station

33. Lock out Pump 1 at lift station.
34. Lock out 4" gate valve at force main tie-in.
35. Position Dri-Prime® pump at lift station and lower rear jack stand.
36. Install discharge hose from pump to tie in point.
37. Install suction hose from pumpend to manhole.
38. Position automatic control floats.
39. Plug float control panel wire into portable pump control panel and test.
40. Remove lock bonnet on lift station discharge tie in point.
41. Place safety tape around manhole opening.
42. Communicate to team that task has been completed.
43. Return to designated start line and signal completion.

Operations Challenge Maintenance Event 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 that the negative terminal has been disconnected – safety procedure.
- 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.
- 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.
- Verbalize level as read on dipstick ("Crankcase full").

4. Drain oil from diesel engine.

- Place funnel under oil pan drain plug.
- Remove oil pan drain plug using 7/8" 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.
- Reinstall drain plug, hand-tight, then using 7/8" open-end wrench tighten ½ turn past hand tight.

5. Replace oil filter on diesel engine.

- 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).
- Screw new oil filter on to diesel engine hand tight only.
- Write hour meter and date of servicing with dry-erase marker on the end of the new oil filter.

- 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”....
 - 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.
 - Verbalize level as read on dipstick as “Crankcase full”.

- 8. Bleed water from primary fuel filter**
 - Loosen plastic wing nut on bottom of clear plastic primary fuel filter two full turns by hand.
 - Verbal 2 second to drain water into plastic quart container from bottom of primary fuel filter
 - Tighten plastic wing nut on bottom of fuel filter two full turns by hand.

- 9. Replace secondary fuel filter on diesel engine.**
 - 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.
 - Verify level of fuel in tank with the fuel gauging stick.
 - 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. Verbalize “No water in fuel”.
 - Wipe dye check from fuel-gauging stick with shop towel and store.
 - Correctly replace fuel fill cap hand tight.

- 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 for disposal.
 - Install new air filter properly and close housing.

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 that "Radiator full".
- Replace filler cap hand tight.

Pump Servicing

13. Check mechanical seal oil level on pumpend.

- Remove breather/fill cap on mechanical seal.
- Use engine oil dipstick to check level in seal cavity.
- Wipe dipstick with shop towel and replace in engine.
- Replace breather/ fill cap on seal cavity, tighten hand tight.

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).
- 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 reinstallation.

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 nuts on ejector housing studs.
- Lift ejector housing off pumpend.

18. Inspect and clean ejector housing screen.

- 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.

20. Reassemble ejector housing.

- Place ejector housing and screen back on pump housing.
- Install four 13mm nuts 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: Do not over tighten!

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.

24. Remove and inspect Non Return Valve (NRV) ball and seat.

- Unscrew four eyebolts on lid of NRV tank with 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.
- Inspect NRV ball seat in tank by shining the flashlight into the tank.
- Remove, inspect and reinstall gasket on top of NRV tank.
- Replace NRV tank lid.
- Screw on four eyebolts and tighten with pry bar ½ turn past hand tight using torque pattern.

25. Inspect volute and NRV drain valves; ensure both are in closed position.

- Open and close drain valve on volute to ensure proper operation.
- Open and close drain valve on NRV tank to ensure proper operation.

Trailer Inspection

26. 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.

27. 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).
- 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.

28. Check air pressure in tires.

- Use tire pressure gauge to check tire pressure, communicate out loud, “Tire pressure set to 50 p.s.i.” for each tire.

29. 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.
- 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

30. Reconnect negative battery cable.

- Use ½" wrench to connect negative battery cable.
- Communicate out loud that the negative terminal has been reconnected.
- Close battery box cover.
- Note: This step must be completed prior to bleeding the air from the fuel system and performing the vacuum pad test.
- Use 7/16" wrenches to tighten the cover.

31. Bleed air from fuel system

- Turn key switch to "on" position for a 2 second count to bleed air from fuel system.

32. Perform vacuum test on pump

- Use compressed air line supplied and attach it to the spring loaded air chuck connection on pump air compressor.
- On control panel of diesel engine, depress low oil pressure shutdown override and turn key switch to start engine (simulation) hold button for 5-second count (count out loud).
- Raise RPM to 1800 by rotating throttle 90° counter-clockwise 4 times (count out loud)
- Open, then close volute drain valve to ensure it is in closed position.
- Install vacuum pad on pump suction. Hold pad on suction for 10-second count (count out loud).
- Lower RPM to idle by turning throttle 90° clockwise 4 times (count out loud) and turn key switch to "Off" position.
- Remove compressor airline from air chuck fitting on the pump air compressor.
- With hands off, start a 5-second count (out loud) allowing the residual vacuum to hold the pad on the pump suction.
- Open volute drain valve to relieve the vacuum.

Pump hookup at lift station

33. Lock out and tag out Pump 1

- On lift station control panel, turn Pump 1 switch to “Off” position.
- The Safety Supervisor must turn off breaker and install hasp, lock and tag on Pump 1 breaker switch.
- 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 to team members that Pump 1 has been successfully locked out – safety procedure.

34. Lock out 4” gate valve at lift station

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

35. 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.
- 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.

36. Install discharge hose from pump to tie in point.

- 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.

37. 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.
- Check that volute drain valve is closed, by opening and closing.
- Check condition of o-ring on suction hose prior to attaching suction screen communicate out loud "o-ring OK".
- Connect suction screen to suction hose.
- Lower suction hose with suction screen into manhole within 6 inches of bottom.

38. Position automatic control floats.

- Using at least two team members, move the portable control panel to marked position to hook up floats and controls.
- Position automatic control floats in manhole with low level float (red) at bottom of wet well, within 4 inches, but not touching the bottom.
- Position high level float (yellow) approximately 3 feet above bottom of wet well, with the float and weight inside the manhole near the top.
- Secure floats in position with tie wraps on the bar at the top of manhole.

39. Plug float control panel wire into portable pump control panel and test.

- Plug float control panel wire into control panel and tighten screw connection.
- Make sure pump control key is in the “Off” position so that the portable pump control panel can operate the pump automatically.
- Place switch on portable control panel to “Test” position.
- Test run engine (simulation) for 5 seconds (count out loud).
- While in “Test”, to simulate correct pumping speed of 1500 – 1700 RPM, set the throttle by rotating 90 degrees counterclockwise 3 times, counting out loud.
- Move switch on portable control panel to “Auto” position.

40. 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.

41. 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.

42. Communicate to team that task has been completed.

- Return all tools to toolbox.
- Return all supplies and discards to proper area.

43. 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

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

Equipment

Godwin CD100M Dri-Prime® pump, trailer mounted, diesel drive
 Automatic Control Panel with two floats
 4" x 8' Suction hose with fittings
 4" Suction Screen
 4" x 3' Discharge hose with fittings
 4" flanged check valve with bolts and nuts
 Lift Station Skid (see illustration)
 Vacuum pad with vacuum gauge
 Wheel chocks (4)