Tubing-Casing Patch Running Procedures

MAN-PAT-010 (R05)

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Introduction

Owen highly recommends the use of a casing scraper before patch installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

In instances where there is corrosion and/or holes in the casing, it is recommended to straddle the complete joint with the Casing Patch; with at least a 5 ft. (1.5 m) overlap on the couplings.

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in patches sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's, ID's and lengths of the equipment to be run. Prepare the work area for the operation and remove all unnecessary equipment. Prepare assembly, lifting and handling equipment and inspect ALL handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. Check that all of the explosive components are compatible with each other and with well temperatures.

4. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

5. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

6. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

7. Confirm that the patch Elements will not be set across a coupling or connection.

8. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment

1. Assemble the Casing/Tubing Patch as per Owen recommended assembly instructions.

Caution: ***Blue Thread Lock (medium) should be applied to all deployment rod connections, including Collet support!***

Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

2. Lower the Casing Patch into position in the well. In cases where, because of the working height of the rig or mast unit, it is not possible to pick up more than a 30ft (9m) patch with the setting tool installed, you can build up the required length of patch by assembling it in modular sections in a vertical position.

Note: *If the overall length of the section is quite long and is not deployed in a lubricator; lift nubbins, a dog collar safety clamp, swivel lift hook, rod support plate and elevators are required to lift and assemble the extensions vertically.*

3. Because the patch is supported through the center rod system, the center rod must be held at all times.

4. Assemble explosives components as per safety checklist. Lift the Multi-Stage Setting Tool (MSST) into position with the wireline. Next, attach the setting tool to the patch assembly by means of the Quick Change Nut. Screw the Setting Sleeve (item #16) firmly against the Top Swage. Do not over torque. Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.

Note: *It may be possible to pick up a short patch with the setting tool installed. The preferred method is to insert the complete assembled patch Bottom Hole Assembly (BHA) into the lubricator on*

the deck and then pick up the lubricator. If the patch BHA is being picked up unsupported, make sure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Top Swage. After the patch BHA is vertical then screw the Setting Sleeve firmly against the Top Swage and lock it in place with the Sleeve Lock Nut as described above.

5. Check and record hang weight.

6. Be careful while running the patch to the required depth. Avoid jarring stops when running the tool and don't spud or force the casing patch down the well. Do not exceed 100 ft./min. (30 m/min.) running speed.

7. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

8. Position patch on depth by either tagging a fixed position in the well or by the use of a Casing Collar Locater (CCL) log.

Note: *A shooting Gamma Ray tool may be required when isolating perforations.*

9. When at setting depth, (last motion up), record the up and down weight, initiate the firing sequence to detonate the power charge and then wait 10 minutes.

10. Pick up slowly to confirm the Collet is released. Once this is done, there should be a noticeable loss of BHA weight. Now, if overall length permits, pick up approximately 10 ft. (3 m).

Caution: ***Do not pull Collet assembly completely out of the patch!***

11. Run back in slowly and tag lightly to confirm patch placement. Pull out of hole (POOH) and lay down setting assembly.

Note: *The running tools retrieved will be the same over all length as the original running assembly.*

Warning: ***Bleed off pressure in the MSST prior to laying it down!***

12. If down hole conditions permit, pressure test Casing Patch to desired pressure, being careful not to exceed 80% of rating.

Running Procedures, Std Patch w/MSST-Tubing

Introduction

Owen highly recommends the use of a casing scraper before patch installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

In instances where there is corrosion and holes in the casing, it is recommended to straddle the complete joint with the Casing/Tubing Patch; with at least 5 ft. (1.5 m) overlap on the couplings.

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in patches sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the rig floor and pipe deck for the operation and remove all unnecessary equipment. Prepare elevators to handle the correct size equipment and inspect ALL handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. Check that all of the explosive components are compatible with each other and with well temperatures.

4. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

5. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

6. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

7. Confirm that the patch Elements will not be set across a coupling or connection.

8. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment

1. Assemble the Casing/Tubing Patch as per Owen recommended assembly instructions.

Caution: ***Blue Thread Lock (medium) should be applied to all deployment rod connections, including Collet Support!***

Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

2. Lower the Casing Patch into position in the well. In cases where, because of the working height of the rig or mast unit, it is not possible to pick up more than a 30 ft. (9 m) patch with the setting tool installed. It is possible to build the required length of patch by assembling it in modular sections in a vertical position.

Note: *If the overall length of the section is quite long; lift nubbins, a dog collar, safety clamp, swivel lift hook, a rod support plate and elevators are needed to lift and assemble the extensions vertically.*

3. Because the patch is supported through the center rod system, the center rod must be held at all times.

4. Install the Top Element assembly onto the extensions as per the X-Span™ systems tech manual.

5. Lift the setting tool and firing head into position with the tubing elevators or Coil Tubing unit.

6. Attach the setting tool to the patch assembly by means of the Quick Change Nut. Screw the Setting Sleeve (item #16) firmly against the Top Swage. Do not over torque. Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.

Note: *It may be possible to pick up a short patch with the setting tool installed. The preferred method is to insert the complete assembled patch Bottom Hole Assembly (BHA) into the lubricator on the deck and then pick up the lubricator. If the patch BHA is being picked up unsupported, make sure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Top Swage. After the patch BHA is vertical then screw the Setting Sleeve firmly against the Top Swage and lock it in place with the Sleeve Lock Nut as described above.*

7. Check and record hang weight.

8. Make sure that all crossovers and new items are drifted to allow an Owen Ball (7/8 in) or drop bar to pass through and that there are no square shoulders inside any of them (an Owen Ball is used to activate hydraulic percussion firing tool).

9. All drill pipe/tubing is to be drifted prior to running in hole (RIH) and only one rabbit should be on the rig floor at one time.

10. Install wiper rubber to prevent debris access.

11. Apply pipe dope to pin end of threads only.

12. On highly deviated wells (greater than 30 degrees), run a spiral centralizer or stabilizer in the string ±30 ft. (10 m) above the setting tool.

13. If the patch is going to be positioned on depth with a wire line Gamma Ray and Casing Collar Locator (CCL) tool, install a radioactive marker sub, a pup joint or both, one joint above the centralizer. Accurate measurements from the top of the patch to the radioactive marker sub or short joint are required.

Caution: ***Make sure the electric line operator understands what is being done and knows the maximum distance allowed below the radioactive Collar or short joint. Because some logging tools have an extension or end cap that is smaller than the rest of the tools, make sure that the OD of the logging tools is compatible with tubular ID's. Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools. Confirm that the wireline tools OD are larger than No-Go!***

14. To prevent rotation while tripping pipe, make sure that the rotary is locked (do not turn the pipe when in a static position).

15. If you experience any heavy losses while running in the hole, close the string and pump down from the backside.

16. Be careful while running the patch to the required depth. Avoid jarring stops when running the tool and don't spud or force the casing patch down the well. Do not exceed 10,000 lbs of set down weight on the casing patch or exceed 100 ft./min. (30 m/min.) running speed when RIH. Cover the tubing while taking breaks, changing elevators etc….

17. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

18. Position patch on depth by either tagging a fixed position in the well, pipe tally, or by the use of a Gamma Ray and CCL log.

19. When at setting depth (last motion up), record the up and down weight, drop an Owen 7/8 in ball and pump down at a max rate of 1.50 bbls/min.

Caution: ***Slow down pump rate prior to ball seating!***

20. For a Hydraulic Firing Head, pressure the tubing to 2400 psi. The Shear Screws holding the Ball Seat will shear and hydrostatic pressure acting on the piston area will fire the detonator and ignite the setting tool.

Note: *Tubing pressure will drop and circulation will be established when Ball Seat shears.*

21. Make sure that all non-essential personnel are clear from pressure lines, the annulus is opened, the trip tank is gauged and monitored and that the pop off valves are set to required pressures.

22. After waiting 10 minutes for patch to set, slowly pick up to confirm Collet is released. Once this is done, there should be a noticeable loss of BHA weight. Now if overall length permits, pick up approximately 10 ft. (3 m).

Caution: ***Do not pull Collet assembly completely out of the patch!***

Warning: ***Never attempt to retrieve live tools with the firing bar still in the tubing!***

23. Run back in slowly and tag lightly to confirm patch placement. Pull out of hole (POOH) and lay down setting assembly.

Note: *The running tools retrieved will be the same over all length as the running assembly.*

Warning: ***Bleed off pressure in the Multi-Stage Setting Tools (MSST) prior to laying it down!***

24. If down hole conditions permit, pressure test Casing Patch to desired pressure, being careful not to exceed 80% of rating.

Contingency #1 Mechanical Release: *The Patch sets but the shear ring doesn't release or shear and the running tools will not release from the patch.*

- On the tubing/drill pipe make clear marks at you're up and down weights and at your neutral point. You should be able to see the neutral point as the telescoping joint travels from the open to closed position or vice versa.
- Confirm the maximum pull allowed on the pulling unit, the running string and the down hole tools including the rods.
- While maintaining maximum pump pressure pull on the string to the shear ring value in the collet or to maximum pull allowed. Work the string up and down but always maintain at least a 10,000 lb. over pull and try to fatigue the shear ring into shearing and releasing the collet assembly and running tools from the patch.
- If it's possible to pump clean fluids down the well. Set down 5,000 to 10,000 lbs. weight on patch, pump 4 or 5 barrels of fluid through the patch at 2 to 3 lbs./minute. Work string up and down increasing weights to -15,000 to +15,000 pounds over string weight. If running tools fail to release continue to next step.
- Make a vertical mark on the running string so as the number of rotations can easily be counted.
- Note maximum torque that is allowed on the running string and the down hole tools including the rods.

Caution: ***The purpose of the over-pull is to keep the pistons in the MSST setting tool from turning and to transfer the torque to the rods. The over-pull will also put force on the collet fingers and help hold the collet support in place. When applying right hand rotations to the string and rod to the collet support should thread up on the bottom rod and after about 10 to 12 turns at the bottom rod the collet support should be threaded up the rod far enough to allow the collet to release from the profile in bottom swage.***

- Pick up on the string pull 10,000lbs over pull. Rotate the string slowly 5 turns to the right taking note of the torque required to turn the string. Release the torque, work string up and down always maintaining a positive over-pull (5,000 to 10,000 lbs.) on the patch and count the back turns. This confirms the amount of turns that you are getting down hole. You should only get about 1/2 to 1-1/2 turns back.
- Pick up on the string pull 10,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over-pull (5,000 to 10,000 lbs). Repeat this step 4 to 5 times.
- Pick up on the string and pull 15,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over-pull (10,000 to 40,000 lbs.). Repeat this step a few times and the collet should release from the profile in the bottom swage.

Caution: ***If the collet fails to release from the patch after all other attempt have been made it may be necessary to pull on the string hard enough to break the weak point and then to fish the running tools. If that is not an option then the tubing would have to be released from the setting tool and then a work string and fishing tools used to recover the running tools.***

Running Procedures, Std Patch w/HST Tubing

Introduction

Owen highly recommends the use of a casing scraper before patch installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

In instances where there is corrosion and holes in the casing, it is recommended to straddle the complete joint with the Casing/Tubing Patch; with at least 5 ft. (1.5 m) overlap on the couplings.

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in patches sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the rig floor and pipe deck for the operation and remove all unnecessary equipment. Prepare elevators to handle the correct size equipment and inspect ALL handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

4. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

5. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

6. Confirm that the patch Elements will not be set across a coupling or connection.

7. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment

1. Assemble the Casing/Tubing Patch as per Owen recommended assembly instructions in the X-Span™ Tech Manual.

Caution: ***Blue Thread Lock (medium) should be applied to all deployment rod connections, including Collet Support!***

Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

2. Lower the Casing Patch into position in the well. In most cases, because of the working height of the rig or mast unit, it is not possible to pick up more than a 30 ft. (9 m) patch with the setting tool installed. However, you can build up the required length of patch by assembling it in modular sections in a vertical position.

Note: *If the overall length of the section is quite long; lift nubbins, a dog collar safety clamp, swivel lift hook, rod support plate and elevators are needed to lift and assemble the extensions vertically.*

3. Because the patch is supported through the center rod system, the center rod must be held at all times.

4. Install the Top Element assembly onto the extensions as per the X-Span™ Tech Manual.

5. Lift the Hydraulic Setting Tool (HST) into position with the tubing elevators or Coil Tubing.

Note: *The HST should have a Screen Sub debris catcher installed.*

6. Attach the setting tool to the patch assembly by means of the Quick Change Nut. Screw the Setting Sleeve (item #16) firmly against the Top Swage. Do not over torque. Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.

Note: *It may be possible to pick up a short patch with the setting tool installed. If the patch Bottom Hole Assembly (BHA) is being picked up unsupported, ensure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Top Swage. After the patch BHA is vertical then screw the Setting Sleeve firmly against the Top Swage and lock it in place with the Sleeve Lock Nut as described above.*

7. Check and record hang weight.

8. Make sure that all crossovers and new items are drifted to allow an Owen Ball to pass through and that there are no square shoulders inside any of them (____" OD Ball to close circulation ports and activate the HST, ____" OD Ball to open Secondary Circulation Valve).

9. All drill pipe/tubing is to be drifted prior or while running in hole (RIH) and only one rabbit should be on the rig floor at one time.

10. If you are running a closed system, the drill pipe (DP) has to be filled by hand.

Note: *Closed circulation ports on the HST, prevent foreign debris from entering the string from annulus.*

11. Fill up string every stand with filtered fluid from surface using a fill up line. Flush the line before inserting nozzle into DP and make sure the nozzle is properly secured.

Caution: ***Keep the annulus topped up while RIH!***

12. Install wiper rubber to prevent debris access.

13. Apply pipe dope to pin end of threads only.

14. On highly deviated wells (greater than 30 degrees), run a spiral centralizer or stabilizer in the string ±30 ft. (10 m) above the setting tool.

15. If the patch is going to be positioned on depth with a wire line Gamma Ray and Casing Collar Locator (CCL) tool, install a radioactive (RA) marker sub, a pup joint or both, one joint above the centralizer. Accurate measurements from the top of the patch to the RA marker sub or short joint are required.

Caution: ***Make sure the electric line operator understands what is being done and knows the maximum distance allowed below the radioactive Collar or short joint. Because some logging tools have an extension or end cap that is smaller than the rest of the tools, make sure that the OD of the logging tools is compatible with tubular ID's. Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools. Confirm that the wireline tools OD are larger than No-Go!***

16. To prevent rotation while tripping pipe, make sure that the rotary is locked (do not turn the pipe when in a static position).

17. If you experience any heavy losses while running in the hole, close the string and pump down from the backside.

18. Be careful while running the patch to the required depth. Avoid jarring stops when running the tool and don't spud or force the casing patch down the well. Do not exceed 10,000 lbs of set down weight on the casing patch or exceed 100 ft./min. (30 m/min.) running speed when RIH. Cover the tubing while taking breaks, changing elevators etc….

19. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

20. Position patch on depth by either tagging a fixed position in the well, pipe tally or by the use of a Gamma Ray and CCL log.

21. When at setting depth (last motion up), record the up and down weight, drop an Owen ____" OD Setting Ball, flush lines and pump down (max rate 1.50 Bbls/min.).

Caution: ***Slow down pump rate prior to ball seating!***

22. Make sure that all non-essential personnel are clear from pressure lines, the annulus is opened, the trip tank is gauged and monitored and that the pop off valves are set to required pressures.

23. Pressure up on the tubing slowly to 1000 psi/6800 Kpa. The Shear Screws holding the Ball Seat will shear, closing the circulation ports and direct the pressure to the working pistons. Increase tubing pressure in 500 psi/3500 Kpa increments with a 2

minute wait period between each pressure increase. Then pressure the tubing to ____psi (tubing pressure will drop and circulation will be established with the annulus when patch is set and the Release Ring sheared).

Note: *Pressure required to initiate the setting process = ____psi.*

Note: *Estimated pressure required to set the patch = ____psi.*

24. Once pressure drops to zero, indicating shear and that the patch is set, pick up slowly to confirm Collet is released. Once this is done, there should be a noticeable loss of BHA weight. Now if overall length permits, pick up approximately 10 ft. (3 m).

Caution: ***Do not pull Collet assembly completely out of the patch!***

25. Run back in slowly and slack off 5000 -10,000 lbs to confirm patch placement. Pull out of hole (POOH) and lay down setting assembly.

Note: *The running tools retrieved will be the same over all length as the running assembly.*

26. If down hole conditions permit, pressure test Casing Patch to desired pressure, being careful not to exceed 80% of rating.

27. If the patch assembly fails to set see contingency plans below.

Contingency #1: *The Patch is set and the string is pulling wet.*

- Drop the ____" Ball. Pressure up to ____psi and shear the Ball Seat in the secondary circulating valve (top of the setting tool). Flow checks the well for 10 minutes. Circulate if necessary and continue POOH.

Contingency #2: *The Patch fails to set.*

- Inform the Owen Office and Company man.

- If the patch fails to set and shear off, increase DP pressure in 1000 psi/6800 Kpa increments up to the maximum allowed pressure. Hold pressure for 2-3 minutes between each increment. Hold and maintain pressure at maximum pressure for 30 minutes. Next, bleed off pressure rapidly to surge tool, by the use of the bleed off line. Pressure up the drill pipe quickly to maximum allowed pressure, hold 1 minute and bleed off rapidly.
- Repeat 4 or 5 times. Slack off 5000 -10,000 lbs on patch. If patch is holding weight, try to pick up 5,000 lbs over-pull, if it is holding, re-apply maximum pressure and maintain. Pick up to set patch and shear patch Shear Ring by using both hydraulic and mechanical forces. POOH
- If the patch cannot be set the string may have to be pulled out of the hole wet.

Caution: ***Do not attempt to open the Circulating Valve if not at the required setting depth!***

Contingency #3: *Mechanical Release: The Patch sets but the shear ring doesn't shear and the running tools fail to release from the patch.*

Caution: ***Do not attempt this until all previous contingency plans have been attempted.***

- On the tubing/drill pipe make clear marks at you're up and down weights and at your neutral point. You should be able to clearly see the neutral point as the weight indicator will remain the same as the HST setting tool pistons will have a small amount of stroke.
- Confirm the maximum pull allowed on the pulling unit, the running string and the down hole tools including the rods.
- While maintaining maximum pump pressure pull on the string to the shear ring value in the collet or to maximum pull allowed. Work the string up and down but always maintain at least a 10,000 lb. over pull and try to fatigue the shear ring into shearing and releasing the collet assembly and running tools from the patch.
- Watch for a drop in pressure and fluid returns while working the running string up and down.
- If it's possible to pump clean fluids down the well. Set down 5000 to 10,000 lbs. weight on patch, pump 4 or 5 barrels of fluid through the patch at 2 to 3 lbs./minute. Work string up and down increasing weights to -15,000 to +15,000 pounds over string weight. If running tools fail to release continue to next step.

- Make a vertical mark on the running string so as the number of rotations can easily be counted.
- Note maximum torque that is allowed on the running string and the down hole tools including the rods.

Caution: ***The purpose of the over-pull is to keep the pistons in the HST setting tool from turning and to transfer the torque to the rods. The over-pull will also put force on the collet fingers and help hold the collet support in place. When applying right hand rotations to the string and rod to the collet support should thread up on the bottom rod and after about 10 to 12 turns at the bottom rod the collet support should be threaded up the rod far enough to allow the collet to release from the profile in bottom swage.***

- Pick up on the string and pull 10,000 lbs. over-pull. Rotate the string slowly 5 turns to the right taking note of the torque required to turn the string. Release the torque, work string up and down always maintaining a positive over-pull (5,000 to 10,000 lbs.) on the patch and count the back turns. This confirms the amount of turns that you are getting down hole. You should only get about 1/2 to 1-1/2 turns back.
- Pick up on the string pull 10,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over- pull (5,000 to 10,000 lbs) Repeat this step 4 to 5 times.
- Pick up on the string and pull 15,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over-pull (10,000 to 40,000 lbs.). Repeat this step a few times and the collet should release from the profile in the bottom swage.

Caution: ***If the collet fails to release from the patch after all other attempt have been made it may be necessary to pull on the string hard enough to break the weak point and then to fish the running tools. If that is not an option then the tubing would have to be released from the setting tool and then a work string and fishing tools used to recover the running tools.***

Running Procedures, SST Non-Washdown

Introduction

Owen highly recommends the use of a casing scraper before Screen Suspension Tool (SST) installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in the SST sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the rig floor and pipe deck for the operation and remove all unnecessary equipment. Prepare elevators to handle the correct size equipment and inspect ALL pipe handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

4. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

5. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

6. Confirm that the SST Hanger Element will not be set across a coupling or connection.

7. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment

1. Pre-assemble the SST as per the Owen recommended assembly instructions in the tech manual.

> **Caution:** ***Blue Thread Lock (medium) must be applied to all deployment rod connections, including Collet Support!***

> **Note:** *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

2. Make up Bottom Hole Assembly (BHA) below SST.

3. Check and record hang weight.

4. Change elevators to pick up Hydraulic Setting Tool (HST).

5. Make up SST liner hanger tool and customer crossover to the lower BHA.

6. Lift the HST into position with the tubing elevators. A handling sub is required for the HST.

> **Note:** *The Hydraulic Setting Tool should have a Screen Sub debris catcher installed.*

7. Attach the setting tool to the SST assembly by means of the Quick Change Nut. Screw the Setting Sleeve firmly against the Swage. Do not over torque. Tighten the Sleeve Lock Nut against the Setting Sleeve.

> **Note:** *It may be possible to pick up a short assembly with the setting tool installed. If the SST BHA is being picked up unsupported, make sure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Swage. After the SST BHA is vertical then screw the Setting Sleeve firmly against the Swage and lock it in place with the Sleeve Lock Nut as described above.*

8. Make sure all crossovers and new items are drifted to allow Owen Ball to pass through and that there are no square shoulders inside any of them (____" OD Ball to close circulation ports and activate the HST, ____" OD Ball to open circulation valve).

9. Check and record hang weight.

10. All drill pipe/tubing is to be drifted prior or while running in hole (RIH) and only one rabbit should be on the rig floor at one time.

11. If you are running a closed system, the drill pipe (DP) has to be filled by hand.

Note: *Closed circulation ports on the HST, prevent foreign debris from entering the string from annulus.*

12. Fill up string every stand with filtered fluid from surface using a fill up line. Flush the line before inserting nozzle into DP and make sure the nozzle is properly secured.

Caution: ***Keep the annulus topped up while RIH!***

13. Install wiper rubber to prevent debris access.

14. Apply pipe dope to pin end of threads only.

15. Install 1 joint of drill pipe and RIH.

16. Install stabilizer and/or centralizer. On highly deviated wells (greater than 30 degrees), run a spiral centralizer in the string ±30 ft. (10 m) above the setting tool.

17. If the SST is going to be positioned on depth with a wire line Gamma Ray and Casing Collar Locator (CCL) tool, install a radioactive marker sub, a pup joint or both one joint above the centralizer. Accurate measurements are required from the top of the SST to the radioactive marker sub or short joint.

Caution: ***Make sure the electric line operator understands what is being done and knows the maximum distance allowed below the radioactive Collar or short joint! Because some logging tools have an extension or end cap that is smaller than the rest of the tools, make sure that the OD of the logging tools is compatible with tubular ID's! Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools. Confirm that the wireline tools OD are larger than No-Go!***

18. Prepare slips, elevators and tubing tongs to handle work string drill pipe and install wiper rubber to prevent debris access.

19. To prevent rotation while tripping pipe, make sure that the rotary is locked (do not turn the pipe when in a static position).

20. If you experience any heavy losses while running in the hole, close the string and pump down from the backside.

21. Be careful while running the SST assembly to the required depth. Avoid jarring stops when running the tool and don't spud or force the SST down the well. Do not exceed _____ lbs of set down weight on the SST running into the well or 100 ft./min. (30 m/min.) running speed. Cover the tubing while taking breaks, changing elevators etc….

22. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

23. Position SST on depth by either tagging a fixed position in the well, pipe tally or by the use of a Gamma Ray and CCL log.

24. When at setting depth (last motion up), record up and down weight, run in 5 m (16 ft.) below setting depth. Pick up 10 ft. (3 m) and set slips. Record up and down weight.

Note: *This will enable the Hanger to be spaced out and set while SST is in pick-up weight.*

25. Drop an Owen ____" OD Setting Ball, flush lines and pump down (max rate 1.50 Bbls/min.).

Caution: ***Slow down pump rate prior to ball seating!***

26. Make sure that all non-essential personnel are clear from pressure lines, the annulus is opened, the trip tank is gauged and monitored and that the pop off valves are set to required pressures or are isolated.

27. Pressure up on the tubing slowly to 1000 psi (6800 Kpa). The Shear Screws holding the Ball Seat will shear, closing the circulation ports and direct the pressure to the Working Pistons. Increase tubing pressure in 500 psi (3500 Kpa) increments with a 2 minute wait period between each pressure increase. Pressure the tubing to ____psi (tubing pressure will drop and circulation will be established with the annulus when SST is set and the Release Ring sheared).

Note: *Pressure required too initiate the setting process = ____psi.*

Note: *Estimated pressure required to set the SST = ____psi.*

28. Once pressure drops to zero, indicating shear and the SST is set, slack off 10,000 lbs slowly and tag lightly to confirm SST placement.

29. Pick up slowly out of the SST, there should be a noticeable loss of weight.

30. POOH while continuing to monitor well.

31. Lay down BHA, HST and setting rods.

32. If the assembly fails to set see contingency plans below.

Contingency #1: *The SST is set and the string is pulling wet.*

- Drop the ____" Ball. Pressure up to ____psi and shear the Ball Seat in the secondary circulating valve (top of the setting tool). Flow checks the well for 10 minutes. Circulate if necessary and continue POOH.

Contingency #2: *The SST fails to set.*

- Inform the Owen Office and Company man
- If the SST fails to set and shear off, increase DP pressure in 1000 psi (6800 Kpa) increments up to the maximum allowed pressure. Hold pressure for 2-3 minutes between each increment. Hold and maintain pressure at maximum pressure for 30 minutes. Bleed off pressure rapidly to surge tool via bleed off line. Pressure up the drill pipe quickly to maximum allowed pressure, hold 1 minute and bleed off rapidly. Repeat 4 or 5 times. Slack off 5,000 lbs on SST.
- If SST is holding weight, try to pick up 5000-10,000 lbs over-pull. If it is holding, re-apply maximum pressure and maintain. Pick up to set SST and shear the Shear Ring by using both hydraulic and mechanical forces. POOH
- If the SST cannot be set the string may have to be pulled out of the hole wet.

Caution: ***Do not attempt to open the Circulating Valve if the SST is not at the required setting depth!***

Contingency #3: *Mechanical Release: The Patch sets but the shear ring doesn't shear and the running tools fail to release from the patch.*

Caution: ***Do not attempt this until all previous contingency plans have been attempted.***

- On the tubing/drill pipe make clear marks at you're up and down weights and at your neutral point. You should be able to clearly see the neutral point as the weight indicator will remain the same as the HST setting tool pistons will have a small amount of stroke.
- Confirm the maximum pull allowed on the pulling unit, the running string and the down hole tools including the rods.
- While maintaining maximum pump pressure pull on the string to the shear ring value in the collet or to maximum pull allowed. Work the string up and down but always maintain at least a 10,000 lb. over pull and try to fatigue the shear ring into shearing and releasing the collet assembly and running tools from the patch.
- Watch for a drop in pressure and fluid returns while working the running string up and down.
- If it's possible to pump clean fluids down the well. Set down 5000 to 10,000 lbs. weight on patch, pump 4 or 5 barrels of fluid through the patch at 2 to 3 lbs./minute. Work string up and down increasing weights to -15,000 to +15,000 pounds over string weight. If running tools fail to release continue to next step.
- Make a vertical mark on the running string so as the number of rotations can easily be counted.
- Note maximum torque that is allowed on the running string and the down hole tools including the rods.

Caution: ***The purpose of the over-pull is to keep the pistons in the HST setting tool from turning and to transfer the torque to the rods. The over-pull will also put force on the collet fingers and help hold the collet support in place. When applying right hand rotations to the string and rod to the collet support should thread up on the bottom rod and after about 10 to 12 turns at the bottom rod the collet support should be threaded up the rod far enough to allow the collet to release from the profile in bottom swage.***

- Pick up on the string and pull 10,000 lbs over-pull. Rotate the string slowly 5 turns to the right taking note of the torque required to turn the string. Release the torque, work

string up and down always maintaining a positive over-pull (5,000 to 10,000 lbs.) on the patch and count the back turns. This confirms the amount of turns that you are getting down hole. You should only get about 1/2 to 1-1/2 turns back.

- Pick up on the string pull 10,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over- pull (5,000 to 10,000 lbs.) Repeat this step 4 to 5 times.
- Pick up on the string and pull 15,000lbs over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over-pull (10,000 to 40,000 lbs.). Repeat this step a few times and the collet should release from the profile in the bottom swage.

Caution: ***If the collet fails to release from the patch after all other attempt have been made it may be necessary to pull on the string hard enough to break the weak point and then to fish the running tools. If that is not an option then the tubing would have to be released from the setting tool and then a work string and fishing tools used to recover the running tools.***

Running Procedures, SST Washdown

Introduction

Owen highly recommends the use of a casing scraper before Screen Suspension Tool (SST) installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in the SST sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Refer to 4.750 or 6.000 Hydraulic Setting Tool (HST) Tech Manual

Additional Handling Equipment and Tools Required:

- Refer to SST Wash down Tech Manual
- False Rotary table
- Elevators for inner wash string
- Cavin Air Slips or equivalent for inner wash string.
- Correct make up and handling Equipment for inner wash string
- Slips, pick-up subs and Dog Collar for particular Screen size
- Lift subs for screen
- Correct Make up and handling equipment for Screen
- 1 ft., 2 ft., 3 ft. & 5 ft. Pup Joints for space out on inner wash string
- Drill Collar safety clamp suitable for Screen size.
- Drill Collar lift nubbin.

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the rig floor and pipe deck for the operation and remove all unnecessary equipment. Prepare elevators to handle the correct size equipment and inspect ALL handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used. Be careful not to drop any foreign debris/ objects such as tape and metal strips into the hole while making up and running the assembly.

4. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

5. Confirm that the SST hanger Element will not be set across a coupling or connection.

6. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

7. Pre-assemble the HST, Hydraulic Running Tool (HRT) and all other down hole tools required, following the recommended assembly instructions in the SST Tech Manual.

Deployment

1. Make up screen assembly and land last Screen/Blank Pipe in slips, with enough room to install Safety Clamp and tongs.

2. Check and record Bottom Hole Assembly (BHA) hang weight.

3. Rig up false rotary and handling equipment to run inner wash string.

4. Change elevators to pick-up inner wash string.

5. Make up seal assembly or stinger onto the bottom of the wash string.

6. Run in hole (RIH) with Inner wash string (length depending on screen length). Land out the Seal Assembly on No-Go and mark pipe. Strap out from mark to connection and then add pup joints accordingly to space out.

7. Pick up pre-assembled SST Hanger and HRT by utilizing a drill collar lift nubbin. Make up crossover on swivel to wash string and tighten to required torque.

8. Pick up wash pipe assembly and remove inner wash string air slips, and false rotary. Lower wash pipe assembly and make up HRT assembly (with customer crossover) onto screen or blank pipe. Torque connection to required torque (Fig 5a in the SST Tech Manual).

Note: *While making up to the blank pipe, confirm that the Inner Mandrel of the HRT (connected to work string) is also turning. This is to prevent excess left hand torque to the HRT mechanical release mechanism.*

9. Lower the assembly to a suitable working height and use tongs to put the 2-3/8 in IF or 3-1/2 in IF connection on the HRT.

10. Change elevators to pick up HST assembly.

11. Pick up setting tool with required retrofit kit, place in mouse hole and torque drill pipe pup joint and top sub to 2000-3000 ft./lbs. Pick up setting tool and make up to Top Adapter on HRT and torque connection to 2000-3000 ft./lbs (Fig 5b in the 6.000 in HST Tech Manual).

12. Lower Setting Sleeve and screw down until it bottoms out on the Top Swage, back off 1/16-1/8 in and lock sleeve with Lock Ring (Fig 5b in the Tech Manual).

13. Record up and down weight and hang off the assembly in drill pipe slips. Hook up pump in nubbin and mud line and circulate 120% of inner wash string volume, recording rates and pressures.

Caution: ***Do not exceed 400 psi pump pressure!***

14. Make sure all crossovers and new items are drifted to allow an Owen Ball to pass through and that there are no square shoulders inside any of them (____" OD Ball to seat in Circulation Sub and activate HST).

15. All drill pipe/tubing is to be drifted prior or while RIH and only one rabbit should be on the rig floor at one time.

16. Apply pipe dope to pin end of pipe threads only.

17. If you experience any heavy losses while running in the hole, close the string and pump down from the backside.

18. To prevent rotation while tripping pipe, make sure that the rotary is locked (do not turn the pipe when in a static position).

19. Install 1 joint of drill pipe and RIH.

20. Install stabilizer and/or centralizer. On highly deviated wells (greater than 30 degrees), run a spiral centralizer in the string ±30 ft. (10 m) above the setting tool.

21. If the SST is going to be positioned on depth with a wire line Gamma Ray Casing Collar Locater (CCL) tool, install a radioactive marker sub, a pup joint or both, one joint above the centralizer. Accurate measurements are required from the top of the SST to the radioactive marker sub or short joint.

Caution: ***Make sure the electric line operator understands what is being done and knows the maximum distance allowed below the radioactive Collar or short joint! Because some logging tools have an extension or end cap that is smaller than the rest of the tools, make sure that the OD of the logging tools is compatible with tubular ID's! Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools.! Confirm that the wireline tools OD are larger than No-Go!***

Note: *Owen requires that a telescopic joint, that can be torqued through, be used on jobs that are on floaters or on deep highly deviated wells. It is also required that the telescopic joint can be pinned in the open position and have at least 5 ft. (1.5 m) of stroke. The telescopic joint is for two reasons; one is to aid in finding neutral and releasing from the HRT and the second for finding neutral when picking up and pulling an over-pull on the SST after it is set.*

22. Prepare slips, elevators and tubing tongs to handle work string drill pipe.

23. Install wiper rubber to prevent debris ingress.

24. Be careful while running the SST assembly to the required depth. Avoid jarring stops when running the tool and don't spud or force the SST down the well. Do not exceed _____ lbs of set down weight on the SST running into the well or 100 ft./min. (30 m/min.) running speed. Cover the tubing while taking breaks, changing elevators etc….

25. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

26. Position SST on depth by either tagging a fixed position in the well, pipe tally or by the use of a Gamma Ray and CCL log.

27. Run in 16 ft. (5 m) below setting depth. Pick up 10 ft. (3 m) and set slips. Record up and down weight.

Note: *The will enable the hanger to be spaced out and set while SST is in pick-up weight.*

28. Drop an Owen ____" OD Setting Ball, flush lines and pump down (max rate 1.50 Bbls/min.) keeping pressure differential at the setting tool to less than 400 psi.

Caution. ***Slow down pump rate prior to Ball seating!***

29. Make sure that all non-essential personnel are clear from pressure lines, the annulus is opened, the trip tank is gauged and monitored and that the pop off valves are set to required pressures or are isolated.

30. Once Ball seats, pressure up on the tubing slowly to ____psi / ____Kpa to shear the pins in the Shuttle Valve (Shear Screw chart 2). Hold the pressure for a 2 minute period and bleed off slowly.

Note: *Pressure required to complete the setting process = ____psi.*

Note: *Estimated pressure required to release the HRT = ____psi.*

Note: *Estimated pressure required to shear the Ball Seat in the Circulation sub = ____psi.*

31. Over-pull 20,000 lbs to confirm that the SST is set, then slack back to neutral weight.

32. Pressure up on drill pipe to shear pressure of Lug Shear Piston in HRT (refer to Shear Screw chart 3 and appropriate SST size). Hold pressure for 2-3 minutes and bleed off.

33. Pick up slowly on drill pipe and observe weight indicator, there should be a noticeable loss of weight. If no over-pull is observed, pick up a maximum of 3ft (1m) and over-pull should be detected again as the shear stop collar tags out against the pack off housing. Slack back down 2 ft. (0.6 m).

Caution: ***After picking up 3 ft. (1 m), do not over-pull more than 10,000 lbs!***

Caution: ***When picking up, if over-pull is immediately observed, slack back to neutral and re-pressure to 100 psi over last pressure and repeat!***

Caution: ***When the HRT is released, do not slack back off on SST!***

34. When the HRT is released and the 3 ft. (1 m) of travel is detected, pressure up on drill pipe until Tubing Circulating Valve shears (refer to Shear Screw chart 4).

35. With the Ball Seat sheared, positive pressure is maintained down drill pipe. Line up pumps on annulus and pressure test SST Element to 500 psi to check for positive seal.

36. Pick up slowly and observe weight indicator. Once this is done and you are completely released from the SST hanger assembly, there should be a noticeable loss of BHA weight.

37. Pick up tools and wash string slowly out of the SST. POOH while continuing to monitor well.

38. Lay down BHA and tools then wash string.

39. If the SST assembly fails to set see contingency plans below.

Contingency No 1: *Mechanical Release*

- In the event that the HRT does not hydraulically release, or the TCV shears early, it is possible to mechanically release the HRT.
- Make sure that all of the pressure is bled off. Place tool in neutral to slight over pull. Rotate drill pipe to the right 5 turns, and work down to tool, to Shear Release Sleeve (4300 ft./lbs). Continue working torque down to obtain 10-15 turns to the right or until increase in torque is observed.
- Pick up slowly and observe weight indicator, you should see loss of weight.
- When released, do not slack back off on SST.
- Pick up tools and wash string slowly out of the SST.
- POOH while continuing to monitor well.
- Lay down BHA, Tools and wash string.

Contingency No 2: *The SST cannot be set.*

- The string may have to be pulled out of the hole.

Running Procedures, STX Patch w/MSST Eline

Introduction

Owen highly recommends the use of a casing scraper before patch installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition.

Caution: ***A drift run or gauge ring is a minimum requirement!***

In instances where there is corrosion and holes in the casing, it is recommended to straddle the complete joint with the Casing Patch; with at least 5 ft. (1.5 m) overlap on the couplings.

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in patches sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the work area for the operation and remove all unnecessary equipment. Prepare assembly lifting and handling equipment and inspect ALL handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. Check that all of the explosive components are compatible with each other and with well temperatures.

4. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

5. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

6. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

7. Confirm that the patch Elements will not be set across a coupling or connection.

8. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment of Bottom Anchor

1. Assemble the Collet assembly into the Bottom Anchor Assembly as per the Owen recommended assembly instructions in the STX-Span™ tech manual.

Caution: ***Blue Thread Lock (medium) should be applied to all deployment rod connections, including Collet Support!***

Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

2. Lower the Bottom Anchor Assembly into positioning the well. In cases where, because of the working height of the rig or mast unit, it is not possible to pick up more than a 30 ft. (9 m) assembly with the setting tool installed. However, you can build up the required length by assembling it in modular sections in a vertical position.

Note: *If the overall length of the section is quite long and is not deployed in a lubricator; lift nubbins, a dog collar safety clamp, swivel lift hook, rod support plate and elevators are needed to lift and assemble the extensions vertically.*

3. Because the Bottom Anchor Assembly is supported through the center rod system, the center rod must be held at all times.

4. Install the Seal Bore Receptacle to the top of the extensions.

5. Assemble explosives components as per the American Petroleum Institute (API) and the Owen well site safety checklist. Lift the Multi-Stage Setting Tool (MSST) into position with the wireline. Attach the setting tool to the anchor assembly by means of the Quick Change Nut. Screw the Setting Sleeve firmly against the Lower Seal Bore Receiver. Do not over torque. Tighten the Sleeve Lock Nut against the Setting Sleeve.

Note: *It may be possible to pick up a short assembly with the setting tool installed. The preferred method is to insert the complete assembled patch Bottom Hole Assembly (BHA) into the lubricator on the deck and then pick up the lubricator. If the patch BHA is being picked up unsupported, ensure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Top Swage. After the patch BHA is vertical then screw the Setting Sleeve firmly against the Top Swage and lock it in place with the Sleeve Lock Nut as described above.*

6. Check and record hang weight.

7. Be careful while running the Bottom Anchor to the required depth. Avoid jarring stops when running the tool and don't spud or force the it down the well. Do not exceed 80 ft./ min. (25 m/min.) running speed.

8. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

9. Position Bottom Anchor on depth by either tagging a fixed position in the well or by the use of a Casing Collar Locator (CCL) log.

Note: *A shooting Gamma Ray tool may be required when isolating perforations.*

10. When at setting depth, (last motion up), record the up and down weight, initiate the firing sequence to detonate the power charge and then wait 10 minutes.

11. Pick up slowly to confirm the Collet is released. Once this is done, there should be a noticeable loss of BHA weight. Now, if overall length permits, pick up approximately 10 ft. (3 m).

Caution: ***Do not pull Collet assembly completely out of the anchor assembly!***

12. Run back in slowly and tag lightly to confirm anchor placement. Pull out of hole (POOH) and lay down setting assembly.

Note: *The running tools retrieved will be the same over all length as the original running assembly.*

Warning: ***Bleed off pressure in the MSST prior to laying it down!***

Deployment of Stinger Sections

13. If stinger sections are not required go to step #14

A. Assemble stinger seal unit and the next section of the straddle.

Note: *If the overall length of the section is quite long and is not deployed in a lubricator; lift nubbins, a dog collar safety clamp and elevators are needed to lift and assemble the extensions vertically.*

B. Install the Seal Bore Receptacle to the top of the extensions.

C. Install Linear Deployment Tool and wireline tools to Seal Bore Receptacle. Consult the STX manual for the number of shear pins to be used in the Linear Deployment Tool.

Note: *The wireline tools should consist of a Linear Deployment Tool, long stroke spang jars, a minimum 100 pound sinker bar, CCL and cable head.*

D. Check and record hang weight.

E. Be careful while running the assembly to the required depth. Avoid jarring stops when running the tool and don't spud or force it down the well. Do not exceed 100 ft./min. (30 m/min.) running speed.

F. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

G. Check and record hang weight prior to latching into Seal Bore Receptacle.

H. Slowly lower stinger seal unit into Seal Bore Receptacle. Note the depth that spang jars close.

I. Pick up and pull 500-1,000 lbs, over-pull to confirm that the stinger seal unit is latched into the Seal Bore Receptacle.

J. Set back down, then pick up 1/2 - 3/4 the length of the spang jars stroke and then jar down on assembly, repeat 2 or 3 times, then release the Linear Deployment Tool.

K. Pick up slowly to confirm that the Linear Deployment Tool is released. Once this is done, there should be a noticeable loss of BHA weight.

Note: *The upper most Seal Bore Receptacle has an 86 degree wicker that matches the Latch Collet. This allows for wireline retrieval of the Top Element assembly in case of setting tool failure,*

Note: *For additional center sections, repeat step 13, A-K.*

Deployment of Top Element and Section

14. Assemble stinger seal unit and top section of the straddle.

Note: *The upper most stinger seal unit will has an Latch Collet w/86 degree wicker to match the profile in the uppermost Seal Bore Receptacle. This allows for retrieval of the Top Element assembly in case of setting tool failure.*

Note: *If the overall length of the section is quite long and is not deployed in a lubricator; lift nubbins, a dog collar safety clamp and elevators are needed to lift and assemble the extensions vertically.*

15. Install the top Element Assembly (Profile Sub, Element and Swage) to the top of the extensions.

Note: *These items should be pre-assembled and include the Collet and Collet Support along with a bottom and top Rod.*

Caution: ***Apply Blue Thread Lock (medium) to all deployment rod connections, including Collet Support!***

Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

16. Assemble explosives components as per the American Petroleum Institute (API) and the Owen well site safety checklist. Lift the MSST into position with the wireline. Attach the setting tool to the anchor assembly by means of the Quick Change Nut. Screw the Setting Sleeve (item #16) firmly against the Swage. Do not over torque. Unscrew the setting sleeve approximately one half of a turn or enough to create a 1/8 in. gap between the shoulder of the Setting Sleeve and the top of the Swage. Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.

Caution: ***Blue Thread Lock (medium) should be applied to the Sleeve Lock Nut!***

Caution: ***Install a centralizer or stabilizer near the top of the setting tool. The O.D of the centralizer or stabilizer should be the same O.D as the Setting Sleeve!***

Note: *It may be possible to pick up a short assembly with the setting tool installed. The preferred method is to insert the complete assembled patch Bottom Hole Assembly (BHA) into the lubricator on the deck and then pick up the lubricator. If the BHA is being picked up unsupported, make sure that the Setting Sleeve is backed off 1-2 in (3-5 cm) from the Top Swage. After the BHA is vertical then screw the Setting Sleeve firmly against the Top Swage and lock it in place with the Sleeve Lock Nut as described above.*

17. Check and record hang weight.

18. Be careful while running the assembly to the required depth. Avoid jarring stops when running the tool and don't spud or force the it down the well. Do not exceed 100 ft./min. (30 m/min.) running speed.

19. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

20. Check and record hang weight prior to latching into the lower Seal Bore Receptacle.

21. Slowly lower stinger seal unit into Seal Bore Receptacle.

22. Pick up and pull 500-1000 lbs over-pull to confirm that the stinger seal unit is latched into the Seal Bore Receptacle.

23. Set back down and then pull back up to neutral weight (last motion up).

24. Initiate firing sequence to detonate the power charge, wait 10 minutes.

25. Pick up slowly to confirm Collet is released. Once this is done, there should be a noticeable loss of BHA weight.

26. Lay down MSST and setting assembly.

Warning: ***Bleed off pressure in the MSST prior to laying it down!***

27. If down hole conditions permit, pressure-test Casing Patch to desired pressure, being careful not to exceed 80% of rating.

Running Procedures for LITe w/HST

Introduction

Owen highly recommends the use of a casing scraper to clean the area where the liner will be set before installation to rid the interval of foreign matter. Also, recommended is a casing caliper or pipe inspection log to provide an accurate record of casing ID and condition. Because the X-Span™ system will be landed in the liner setting sleeve, the depth of the scraper must be determined by the length of the X-Span™ patch.

Caution: ***A drift run or gauge ring is a minimum requirement!***

Caution: ***In actual well situations, failure to follow recommended procedures has resulted in the LITe sliding or failing to hold pressure!***

Caution: ***It is crucial that well fluids, casing and tubulars are clean and free of debris and/or solids!***

Pre-Deployment

1. Caliper and record all OD's and ID's and lengths of the equipment to be run. Prepare the rig floor and pipe deck for the operation and remove all unnecessary equipment. Prepare elevators to handle the correct size equipment and inspect ALL pipe handling equipment for loose parts (slip dies', nuts, dog collars, bolts etc…).

2. Make sure that the O-Rings and Elastomers are rated for the actual well conditions.

3. **ALL** hand tools must be strapped and clipped to the user. Make sure that the hole is covered when hand tools are being used.

4. Be careful not to drop any foreign debris/objects such as tape and metal strips into the hole while making up and running the assembly.

5. All distances from the Blow Out Preventer (BOP)/Wellhead to rig floor need to be verified.

6. Confirm that the LITe Elements will not be set across a coupling or connection.

7. Conduct a Job Safety Analysis (JSA) meeting with the personnel involved and go over all operational procedures before continuing.

Deployment

1. The entire LITe assembly should be made up on the pipe rack and lifted to the rig floor as a complete assembly. The assembly will include the following; Hydraulic Setting Tool (HST), Top Swage, Sealing Anchor Element, Collet Profile Sub, Polish Bore Receptacle, Crossover to Seal Assembly, Seal Assembly with 1/2 mule shoe.

Caution: ***Blue Thread Lock (medium) should be applied to all deployment rod connections, including Collet support!***

Note: *A Teflon zip tie lock can be used below the Collet support on the Bottom Rod instead of thread lock.*

Note: *The HST should have a Screen Sub debris catcher installed.*

2. Make sure that the Setting Sleeve is backed off an 1-2 in (3-5 cm) from the Swage. After the LITe Bottom Hole Assembly (BHA) is vertical, screw the Setting Sleeve firmly against the Swage and lock it in place with the Sleeve Lock Nut.

3. Check and record hang weight.

4. Make sure all crossovers and new items are drifted to allow an Owen Ball to pass through and that there are no square shoulders inside any of them (____" OD Ball to close circulation ports and activate HST, ____" OD Ball to open Secondary Circulation Valve).

5. All drill pipe/tubing is to be drifted prior or while running in hole (RIH) and only one rabbit should be on the rig floor at one time.

6. If you are running a closed system, the drill pipe (DP) has to be filled by hand.

Note: *Closed circulation ports on the HST, prevents foreign debris from entering the string from annulus.*

7. Fill up string every stand with filtered fluid from surface using a fill up line. Flush the line before inserting nozzle into DP and make sure the nozzle is properly secured.

Caution: ***Keep the annulus topped up while RIH!***

8. Install wiper rubber to prevent debris access.

9. Apply pipe dope to pin end of threads only.

10. On highly deviated wells (greater than 30 degrees) run a spiral centralizer or stabilizer in the string ±30 ft. (10 m) above the setting tool.

11. If the LITe is going to be positioned on depth with a wireline Gamma Ray and Casing Collar Locator (CCL) tool, install a radioactive marker sub, a pup joint or both, one joint above the centralizer. Accurate measurements are required from the top of the sealing element to the radioactive marker sub or short joint.

Caution: ***Make sure the electric line operator understands what is being done and knows the maximum distance allowed below the radioactive Collar or short joint! Because some logging tools have an extension or end cap that is smaller than the rest of the tools, make sure that the OD of the logging tools is compatible with tubular ID's! Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools. Confirm that the wireline tools OD are larger than No-Go!***

12. To prevent rotation while tripping pipe, make sure that the rotary is locked (do not turn the pipe when in a static position).

13. If you experience any heavy losses while running in the hole, close the string and pump down from the backside.

14. Be careful while running the LITe to the required depth. Avoid jarring stops when running the tool and don't spud or force the liner down the well. Do not exceed 10,000 lbs of set down weight or 100 ft./min. (30 m/min.) running speed when RIH. Cover the tubing while taking breaks, changing elevators etc….

15. Before entering liner or tight spots, record the up and down weights and be sure to slow down when entering these areas. Keep the number of runs through perforations or tight spots to a minimum.

16. Once the LITe is at depth carefully sting into Setting Sleeve. Seal stack No-Go should land-out on the bottom of the Setting Sleeve. Set down 5,000-10,000 lbs and then pull back up to neutral.

17. Drop an Owen ____" OD Setting Ball then flush lines and pump down (max rate 1.50 Bbls/min.).

Caution: ***Slow down pump rate prior to Ball seating!***

18. Make sure that all non-essential personnel are clear from pressure lines, the annulus is opened, the trip tank is gauged and monitored and that the pop off valves are set to required pressures.

19. Pressure up on the tubing slowly to 1000 psi / 6800 Kpa. The Shear Screws holding the Ball Seat will shear, closing the circulation ports and direct the pressure to the working pistons. Increase tubing pressure in 500 psi / 3500 Kpa increments with a 2 minute wait period between each pressure increase. Pressure the tubing to ____psi (tubing pressure will drop and circulation will be established with the annulus when patch is set and the Release Ring sheared).

Note: *Pressure required to initiate the setting process = ____psi.*

Note: *Estimated pressure required to set the patch = ____psi.*

20. When pressure drops to zero, indicating shear and the Element is set, slack off 5,000-10,000 lbs to confirm Element placement. Pick up slowly, you should see a noticeable loss of BHA weight. Pull out of hole (POOH) and lay down setting assembly.

21. If down hole conditions permit, pressure test LITe to desired pressure, being careful not to exceed 80% of rating.

22. If the liner assembly fails to set see contingency plans below.

Contingency #1: *The LITe is set and the string is pulling wet.*

- Drop the ____" ball. Pressure up to ____psi and shear the Ball Seat in the Secondary Circulating Valve (top of the setting tool). Flow checks the well for 10 minutes. Circulate if necessary and continue POOH.

Contingency #2: *The LITe fails to set.*

- Inform the Owen Office and Company man.
- If the LITe fails to set and shear off, increase DP pressure in 1000 psi / 6800 Kpa increments up to the maximum allowed pressure. Hold pressure for 2-3 minutes between each increment. Hold and maintain pressure at maximum pressure for 30 minutes. Bleed off pressure rapidly to surge tool via bleed off line. Pressure up the drill pipe quickly to maximum allowed pressure, hold 1 minute and bleed off rapidly. Repeat 4 or 5 times then pick up 5,000 -10,000 lbs over-pull on LITe.
- If it is holding, re-apply maximum pressure and maintain. Pick up to set LITe and shear the Shear Ring by using both hydraulic and mechanical forces. POOH.
- If the LITe cannot be set, the string may have to be pulled out of the hole wet.

Caution: ***Do not attempt to open the Circulating Valve if not at the required setting depth!***

Contingency #3: *Mechanical Release: The Patch sets but the shear ring doesn't shear and the running tools fail to release from the patch.*

Caution: ***Do not attempt this until all previous contingency plans have been attempted.***

- On the tubing/drill pipe make clear marks at you're up and down weights and at your neutral point. You should be able to clearly see the neutral point as the weight indicator will remain the same as the HST setting tool pistons will have a small amount of stroke.
- Confirm the maximum pull allowed on the pulling unit, the running string and the down hole tools including the rods.
- While maintaining maximum pump pressure pull on the string to the shear ring value in the collet or to maximum pull allowed. Work the string up and down but always

maintain at least a 10,000 lb. over pull and try to fatigue the shear ring into shearing and releasing the collet assembly and running tools from the patch.

- Watch for a drop in pressure and fluid returns while working the running string up and down.
- If it's possible to pump clean fluids down the well. Set down 5000 to 10,000 lbs. weight on patch, pump 4 or 5 barrels of fluid through the patch at 2 to 3 lbs./minute. Work string up and down increasing weights to -15,000 to +15,000 pounds over string weight. If running tools fail to release continue to next step.
- Make a vertical mark on the running string so as the number of rotations can easily be counted.
- Note maximum torque that is allowed on the running string and the down hole tools including the rods.

Caution: ***The purpose of the over-pull is to keep the pistons in the HST setting tool from turning and to transfer the torque to the rods. The over-pull will also put force on the collet fingers and help hold the collet support in place. When applying right hand rotations to the string and rod to the collet support should thread up on the bottom rod and after about 10 to 12 turns at the bottom rod the collet support should be threaded up the rod far enough to allow the collet to release from the profile in bottom swage.***

- Pick up on the string and pull 10,000lbs over-pull. Rotate the string slowly 5 turns to the right taking note of the torque required to turn the string. Release the torque, work string up and down always maintaining a positive over-pull (5,000 to 10,000 lbs.) on the patch and count the back turns. This confirms the amount of turns that you are getting down hole. You should only get about 1/2 to 1-1/2 turns back.
- Pick up on the string pull 10,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over- pull (5,000 to 10,000 lbs.) Repeat this step 4 to 5 times.
- Pick up on the string and pull 15,000 lbs. over-pull. Rotate the string slowly 3 turns to the right, hold the torque if possible and then work the string up and down always maintaining a positive over-pull (10,000 to 40,000 lbs.). Repeat this step a few times and the collet should release from the profile in the bottom swage.

Caution: ***If the collet fails to release from the patch after all other attempt have been made it may be necessary to pull on the string hard enough to break the weak point and then to fish the running tools. If that is not an option then the tubing would have to be released from the setting tool and then a work string and fishing tools used to recover the running tools.***

X-Span™ Systems, Correlation Logging

Introduction

Depth correlation is one of the most critical factors in isolation success.

A radioactive bead, a short joint or both is placed a specific distance above the top of the setting tool and is recorded on the Gamma Ray/Casing Collar Locator (CCL) log. This log is then compared to the log from which the setting depth was chosen. This will determine the relationship of the top of the patch to the chosen setting depth.

The Gamma Ray log is recorded through the tubing or drill pipe.

Running Procedures

1. The patch is run in the well to the approximate depth; measured by pipe tally. Run 10-13 ft. (3-4 m) past the calculated setting depth and then pick back up 6-10 ft. (2-3 m). This will take the stretch out of the tubing and should position the patch slightly lower than required. The last movement before setting should be up. The tubing can be set in the slips, positioned in the tubing hanger flange or hung in the elevators. When the tubing is placed in the slips or landed, the distance from the bottom of the tubing collar to the tubing hanger flange must be measured and recorded. A minimum requirement is to place a chalk mark on the pipe at a recorded distance above the slips.

2. The Gamma Ray and the CCL tool are run inside the tubing/drill pipe for the correlation log. The tools should be operating at all times while going down hole to avoid passing the locator collar (possible even with the radioactive bead) without identifying it. This can happen if a mistake is made in the tubing tally.

3. A short section of the well should be logged. This section should be 500 ft. (150 m) or more above the expected radioactive (RA) collar depth. At this time, tie the logging tools on depth with the original log. After correlating the tools on depth, continue logging down slowly until the RA collar or short joint is located. Lower the logging tools below the RA collar.

4. Log a 330-500 ft. (100 - 150 m) section of the well. Lay this section of log over the log from which the Setting depth was chosen. Mark the position of the RA collar on the log with which it was correlated.

5. Compare the depth of the RA collar to short joint with the depth needed to position the patch on depth. Space out with tubing and subs as needed. Last movement should be up.

Note: *The tools and equipment below the RA marker will determine how far below it you can go with the logging tools.*

6. It is good practice to check on the correlation log before running in the hole with wire line that at the pipe tally position depth of the radioactive bead or short joint that it has a good gamma ray deflection signature above it. If not it may be required to run an extra amount of tubing/drill pipe to position the radioactive bead or short joint in an area that has a good signature.

7. To determine the location of the RA collar in the gamma ray deflection spike, measure the distance of the log from the point the gamma ray line begins the deflection to the point the gamma ray line returns. Normally the deflection caused by the radioactive bead is very large. Divide the deflection space measurement by three (3) and measure up from the beginning of the deflection this distance. Mark the RA collar. If the collar locator is properly set up and working, the locator pup joint / RA collar should coincide with the tubing collar marker.

Precautions

1. Accurate measurements are required from the top of the patch to the locator collar pup joint / RA collar or short joint.

2. Be certain of the locator collar pup joint / RA Collar depth to position the top of the patch at the correct setting depth.

3. Be certain the electric line operator understands what is being done and knows the maximum distance the wireline tools are allowed below the RA Collar or short joint. Insure that the OD of the logging tools is compatible with tubular ID's. Check this yourself.

Caution: ***Some logging tools will have an extension or end cap that is smaller than the rest of the tools. Be certain that this extension's OD does not risk the chance of getting stuck in any lower tools. If it does, ask that it be changed or modified to a larger OD!***

4. Always insist that the logging company representative checks the physical tool spacing verses his surface recording system and the tools are working properly before getting close to the RA Collar. If there are problems with the equipment, insist the electric line operator stop until the problem is solved, and the equipment is set up properly.

5. The oil company representative always makes the final decision on well correlations. If the technician on the job has a disagreement, the technician should explain the point of disagreement, but then allow the company representative to make the decision. If the disagreement is not resolved, the oil company representative's correlations should be used. If possible, the technician should call his manager. If it is not possible to call, have the oil company representative sign for responsibility.