

X-SPAN® Tubing/Casing Patch

MAN-PAT-005-(R04)

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Overview

Description

Owen Tubing/Casing Patches provide a heavy-duty permanent seal over splits, holes, perforations in tubing or casing and are ideal for water shut off. These patches are run on electric wire, tubing or coil tubing and are set with a pressure setting tool (electric, mechanical or hydraulic). Their large bores assure easy passage of tools and equipment and present little restriction to fluid flow.

Benefits/Capabilities

- Patches can be customized for most well applications including premium alloys, restrictions and geothermal wells.
- The Tubing/Casing Patch consists of three basic components; a top soft element, a tubular extension and a bottom soft element.
- Since the system is modular, various patch lengths can be obtained by adding tubular extensions.
- Only the top and bottom elements are swaged outward during the setting process. The tubular extensions are not swaged.

Operation

During the setting process, the pressure setting tool exerts a pushing force on the top metal swage and a pulling force on the bottom swage. Both swages are driven into the soft metal sealing elements, which then expand into a metal-to-metal seal contact with the casing bore. At a predetermined force, a calibrated weak point shears and the setting process ceases. A collapsible setting collet located in the bottom swage, retracts and allows the setting tool and the setting equipment to be retrieved. The damaged interval is now isolated by full circle, metal-to-metal seal.



Caution: *Owen highly recommends the use of a casing scraper before patch installation to rid the interval of foreign matter. A gauge ring or drift run is a minimum requirement. Also recommended is the use of a casing caliper to provide an accurate record of casing ID and condition.*

Standard X-SPAN® Sealing Element Cutaway



GTX-SPAN® Sealing Element Cutaway



Tubing Patch Single Pick-up

1.0 Pre-Assembly



Warning: *Make sure all tool parts and components have been thoroughly cleaned or serious damage and/or injury could occur!*



Warning: *Personal Protective Equipment (PPE) such as steel toed footwear, safety glasses, etc..., should be worn at all times!*



Note: *Verify that the correct O-ring and quantities are used as specified on the Bill of Materials (for example, 5 each etc...). Lay out all components on a clean surface.*



Note: *Make sure to lubricate all O-rings and threaded surfaces.*



Caution: *Make sure to wrench only on wrenching surfaces (knurled areas) provided! Always file wrench marks and burrs and clean off debris!*

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. The patch is supported through the center rod system. The center rod system must be held at all times.

Handling equipment required at minimum will be, a safety plate SET-2125-119 and rod/ swivel hook assembly SET-3250-110.

Removable thread loctite (medium) must be applied to all deployment rod connections, including Collet Support and Release Ring threads.

2.0 Assembly

2.1 Collet Assembly with Release Ring Adapter:

- A. Screw the Release Ring Adapter (item #28) and a Rod Tandem Connector Coupling (item #20) onto the Bottom Rod (item #24). Screw the Release Ring (item #8) onto the Collet assembly (item #25), and slide them onto the Bottom Rod (item #24) and screw them onto the Release Ring Adapter (item #28) and make wrench tight.

- B. Vise the Rod assembly just above the Release Ring Adapter. Lightly lube the OD and ID of the Collet fingers. Screw the Collet Support (item #26) onto the Bottom Rod (item #24) and into the Collet assembly (item #25). Screw the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



Caution: *Do not vise on the Release Ring! This could severely damage the shear value!*

- C. Remove assembly from vise. Slide the Bottom Swage, with the Collet profile groove in the ID (item #5) over the top end of the Bottom Rod (item #24) and push it down over the Collet (item #25) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.
- D. Screw the Collet Support (item #26) back out tight against the Collet. Make wrench tight.



Caution: *Be careful not to loosen the engagement of the Release Ring. The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the tubing patch illustration!*



Note: *If temperature permits, a Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock.*

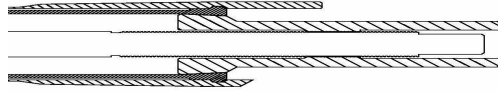
2.2 Collet Assembly with Release Ring:

- A. Screw the Release Ring (item #8) onto the Collet assembly (item #25), and slide them onto the Bottom Rod (item #24) and make wrench tight.
- B. Vise the Rod assembly just above the Release Ring. Lightly lube the OD and ID of the Collet fingers. Screw the Collet Support (item #26) onto the Bottom Rod (item #24) and into the Collet assembly (item #25). Screw the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



- C. Remove assembly from vise. Slide the Bottom Swage, with the Collet profile groove in the ID (item #5) over the top of the Bottom Rod (item #24) and push it down over the Collet (item #25) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.

D. Screw the Collet Support (item #26) back out tight against the Collet.



Caution: *Be careful not to loosen the engagement of the Release Ring. The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the tubing patch illustration!*



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

- 2.3 Install 1 O-ring (item #6) onto the pin-end and 1 O-ring (item #7) into the box-end of the 10 ft sections. Lightly lube the O-rings and assemble the sections and snug up. Do not tighten excessively.
- 2.4 Install the O-rings (item #6,7) onto pin-end of the Element and into the box-end of the Element. For GTX-SPAN® systems, lightly grease the 4 Elastomers (item #1) and install 2 onto each of the Elements. Make sure that the Elastomers are completely seated in their grooves.
- 2.5 Screw Bottom Element (item #2) onto the section and snug up. Then, install the Top Element (item #3) and Swage and snug up. Do not tighten excessively and keep pipe wrenches away from the X-SPAN® system sealing area.
- 2.6 If Rod Supports (item #27) are needed, slide them over the 10-foot rods (item #21). Screw Rod Tandem Connector Couplings (item #20) onto the top of the rods and then assemble and tighten the rods. Use loctite on couplings and wrench tight. You will require one 10 ft Rod for each 10 ft Section. Install Top Adaptor Rod (item #19) onto the top end of the rods. Slide the Rod assembly into the Section assembly.
- 2.7 Take the Bottom Rod Collet assembly and screw it onto the Rod (loctite) that is in the Section. Slide the rods up into the Section until the Swage (item #5) is in position inside the Bottom Element (item #2).
- 2.8 Screw the swivel hook lift assembly with Rod Tandem Connector Coupling onto the top of the Top Adaptor Rod for lifting.



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 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 below.*

- 2.9 Lift the tubing patch section by the swivel hook and position it over the wellhead. Inspect to see that the Bottom Swage is inside the Element.
- 2.10 Lower the patch assembly into the well and install the safety plate under the support shoulder on the top Rod and continue to lower the assembly until the safety plate is bottomed out on the support shoulder.
- 2.11 Unscrew the lifting rod assembly from the top Rod.
- 2.12 Install the Quick Change Rod (item #17) and Quick Change Nut (item #18) and make up to setting tool (item #12).
- 2.13 Screw the Setting Sleeve Lock Nut (item #15) and Setting Sleeve assembly (item #16) up on the Sleeve Nut (item #14). Install Sleeve Nut onto the setting tool and lock it in place with the setting tool Lock Ring.
- 2.14 Lift setting tool into position with the wireline or by the tubing elevators.
- 2.15 Slide the Setting Sleeve and Lock Nut up the Sleeve Nut. These parts must be held by hand or rig lines with a hook.
- 2.16 Align the two slots in the Top Adapter Rod (item #19) with the roll pin in the Quick Change Rod (item #17) and lower the setting tool down onto the Top Adapter Rod. Make up with loctite and wrench tight.
- 2.17 Lift the setting tool and patch assembly up until section is accessible. Remove the safety plate.

2.18 Screw the Setting Sleeve (item #16) firmly against the Top Swage.



Caution: *Do not tighten excessively or the patch could be damaged!*

2.19 Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve (item #16).

2.20 Follow running procedures as per the type of setting tool being used.



Caution: *Personnel installing X-SPAN® Patch systems must be trained and approved by Owen Oil Tools!*



Note: *Clean and lubricate all parts as soon after use as possible.*



Note: *Visually inspect setting equipment and rods for damage after each use. Damaged components **must be** replaced.*



Note: *It is recommended that a Magnetic Particle Inspection (MPI) be completed on all components at least every 20 runs.*

Casing Patch Single Pick-up

3.0 Pre-Assembly



Warning: *Make sure all tool parts and components have been thoroughly cleaned or serious damage and/or injury could occur!*



Warning: *Safety glasses and Personal Protective Equipment (PPE) such as steel toed footwear, hard hat, etc..., should be worn at all times!*



Note: *Verify that the correct O-ring redress kit and quantities are used as specified on the Bill of Materials (for example, 5 each etc....). Lay out all components on a clean surface.*



Note: *Make sure to lubricate all O-rings and threaded surfaces.*



Caution: *Make sure to wrench only on wrenching surfaces (knurled areas) provided! Always file wrench marks and burrs and clean off debris!*

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 (9m) patch with the setting tool installed. The patch is supported through the center rod system. The center rod system must be held at all times.

The minimum handling equipment required is a safety plate SET-3250-105, and rod/swivel hook assembly SET-3250-110.

Removable thread loctite (medium) **must be** applied to all deployment rod connections, including Collet support and Release Ring threads.

4.0 Assembly

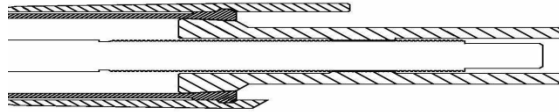
4.1 Bottom Rod and Collet assembly:

- A. Slide the Collet (item #26) over the Bottom Rod (item #25), then screw the Release Ring (item #8) onto the Bottom Rod. Screw the Set Screw (item #9) into the Release Ring and tighten it into the recess provided on the Bottom Rod.
- B. Slide the Collet (item #26) down over the Release Ring. Screw the Rod Tandem Connector Coupling (item #21) onto the top of the Bottom Rod (item #25) and wrench tight.
- C. Vise rod assembly just above the Release Ring, then lightly lube the OD and ID of the Collet fingers. Thread the Collet Support (item #27) onto the Bottom Rod and into the Collet and screw the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



- D. Remove the assembly from vise. Now, slide the Bottom Swage, with the collet profile groove in the ID (item #5), over the top end of the Bottom Rod (item #25) and push it down over the Collet (item #26) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.

E. Screw the Collet Support (item #27) back out tight against the Collet. Make wrench tight.



Caution: *Be careful not to loosen the engagement of the Release Ring! The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the casing patch illustration!*



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

- 4.2 Install 1 O-ring (item #6) onto the pin-end and 1 O-ring (item #7) into the box-end of the 10 ft sections. Lightly grease the O-rings and assemble the sections and snug up. Do not tighten excessively.
- 4.3 Install the O-rings (item #6,7) onto pin-end of the Element and into the box-end of the Element. For GTX-SPAN® systems, lightly grease the 4 Elastomers (item #1) and install 2 onto each of the Elements. Make sure that the Elastomers are completely seated in their grooves.
- 4.4 Screw Bottom Element onto section and snug up. Do not tighten excessively and keep pipe wrenches away from the X-SPAN® system sealing area.
- 4.5 If Rod Supports (item #28) are needed, slide them over the 10 ft rods (item #22). Screw Rod Tandem Connector Couplings (item #21) onto the top of the rods, then assemble and tighten the rods. Use loctite on couplings and wrench tight. You will require one 10 ft Rod for each 10 ft Section. Slide the Rod assembly into the Section assembly.
- 4.6 Take the Bottom Rod Collet assembly and screw it wrench tight onto the Rod (loctite) that is in the section. Slide the rods up into the section until the Swage (item #5) is in position inside the Bottom Element (item #2).
- 4.7 Install top adapter rod (Item #20) and then install top element (item #3) and swage (Item #4). Do not tighten element excessively and keep pipe wrenches away from the X-SPAN® system sealing area.

- 4.8 Screw the Swivel Hook Lift assembly with the Quick Change Rod and Quick Change Nut installed, into the Top Rod for lifting.



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 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 an 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 below.*

- 4.9 Lift the casing patch section by the swivel hook and position it over the wellhead. Inspect to see that the Bottom Swage is inside the Element.
- 4.10 Lower the patch assembly into the well. Install the Safety Plate in the slot on the Top Rod and continue to lower the assembly until it is bottomed out in the recess of the Safety Plate.
- 4.11 Unscrew the lifting rod assembly from the Top Rod.
- 4.12 Make up Setting Tool (item #13) with the Quick Change Rod (item #17), Quick Change Nut (item #18) and Rod Lock Nut (item #19).
- 4.13 Slide Setting Sleeve Lock Nut (item #15) and Setting Sleeve assembly (item #16) over bottom of setting tool. Install Sleeve Nut (item #14) onto the setting tool and lock it in place with the setting tool Lock Ring.
- 4.14 Lift setting tool into position with the wireline or by the tubing elevators.
- 4.15 Slide the Setting Sleeve and lock nut up the setting tool. These parts must be held by hand or rig lines with a hook. Align the two slots in the Top Adapter Rod (item #20) with the Roll Pin in the Quick Change Rod (item #17) and lower the setting tool down onto the Top Adapter Rod. Make up with loctite and wrench tight.
- 4.16 Lift the setting tool and patch assembly up until section is accessible, remove the Safety Plate.
- 4.17 Screw the Setting Sleeve (item #16) firmly against the Top Swage.



Caution: Do not tighten excessively or the patch could be damaged!

4.18 Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.

4.19 Follow running procedures as per the type of setting tool being used.



Caution: Personnel installing X-SPAN® Patch systems must be trained and approved by Owen Oil Tools!



Note: Clean and lubricate all parts as soon after use as possible.



Note: Visually inspect setting equipment for damage and stretching after each use. Damaged components **must be** replaced.



Note: It is recommended that a Magnetic Particle Inspection (MPI) be completed on all components at least every 20 runs.

Tubing/Casing Patch Multi Pick-ups

5.0 Pre-Assembly



Warning: Make sure all tool parts and components have been thoroughly cleaned or serious damage and /or injury could occur!



Warning: Personal Protective Equipment (PPE) such as steel toed footwear, safety glasses, etc..., should be worn at all times!



Note: Verify that the correct O-rings and quantities are used as specified on the Bill of Materials (for example, 5 each etc....). Lay out all components on a clean surface.



Note: Make sure to lubricate all O-rings and threaded surfaces.



Caution: *Make sure to wrench only on wrenching surfaces (knurled areas) provided! Always file wrench marks and burrs and clean off debris!*

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 (9m) patch with the setting tool installed. However, you can build up the required length of patch by assembling it while lowering it down hole in modular sections. The patch is supported through the center rod system. The center rod system must be held at all times.

The minimum handling equipment required is a safety plate SET-2125-119 (for tubing patches), SET-3250-105 (for casing patches), and a rod/swivel hook assembly SET- 3250-110 for both. Other handling equipment to be considered are lift nubbins for the extensions, a dog collar safety clamp and single joint elevators for the extensions.

Removable thread loctite (medium) **must be** applied to all deployment rod connections, including Collet Support and Release Ring threads.

One method, outlined below is an example for a typical forty foot patch. Refer to Tubing Patch (TP) and Casing Patch (CP) illustrations.



Note: *For an optional lifting method, see page 45.*

6.0 Assembly

6.1 Tubing Patch-Collet assembly with Release Ring Adapter:

- A. Screw the Release Ring Adapter (item #28) and a Rod Tandem Connector Coupling (item #20) onto the Bottom Rod (item #24). Screw the Release Ring (item #8) onto the Collet assembly (item #25). Slide them onto the Bottom Rod (item #24), then screw them onto the Release Ring Adapter (item #28) and make wrench tight.
- B. Vise Rod assembly just above the Release Ring Adapter. Lightly lube the OD and ID of the Collet fingers, then screw the Collet Support (item #26) onto the Bottom Rod (item #24) and into the Collet assembly (item #25). Thread the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



Caution: *Do not vise on the Release Ring!*

- C. Remove assembly from vise and slide the Bottom Swage, with the collet profile groove in the ID (item #5) over the top of the Bottom Rod (item #24) and push it down over the Collet (item #25) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.
- D. Screw the Collet Support (item #26) back out tight against the Collet. Make wrench tight.



Caution: *Be careful not to loosen the engagement of the Release Ring! The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the tubing patch illustration!*



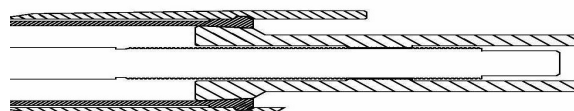
Note: *A Teflon zip tie lock can be used below the collet support on the Bottom Rod instead of thread lock if temperature permits.*

6.2 Tubing Patch-Collet Assembly with Release Ring:

- A. Screw the Release Ring (item #8) onto the Collet assembly (item #25). Slide them onto the Bottom Rod (item #24) and make wrench tight.
- B. Vise the rod assembly just above the Release Ring. Lightly lube the OD and ID of the Collet fingers, then screw the Collet Support (item #26) onto the Bottom Rod (item #24) and into the Collet assembly (item #25). Screw the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



- C. Remove assembly from vise and slide the Bottom Swage, with the collet profile groove in the ID (item #5) over the top of the Bottom Rod (item #24) and push it down over the Collet (item #25) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.
- D. Screw the Collet Support (item #26) back out tight against the Collet. Make wrench tight.





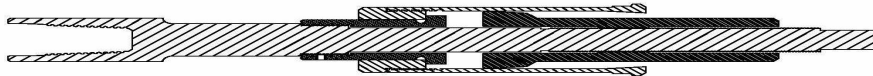
Caution: *Be careful not to loosen the engagement of the release ring! The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the tubing patch illustration!*



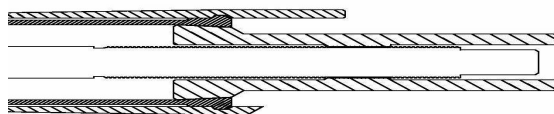
Note: *A Teflon zip tie lock can be used below the Collet Support on the Bottom Rod instead of thread lock if temperature permits.*

6.3 Casing Patch, Bottom Rod and Collet assembly:

- A. Slide the Collet (item #26) over the Bottom Rod (item #25), then screw the Release Ring (item #8) onto the Bottom Rod. Screw the Set Screw (item #9) into the Release Ring and tighten it into the recess provided on the Bottom Rod.
- B. Slide the Collet (item #26) down over the Release Ring. Screw the Rod Tandem Connector Coupling (item #21) onto the top of the Bottom Rod (item #25) and wrench tight.
- C. Vise rod assembly just above the Release Ring, then lightly lube the OD and ID of the Collet fingers. Thread the Collet Support (item #27) onto the Bottom Rod and into the Collet and screw the support far enough into the Collet (about half way) to allow the fingers of the Collet to move inwardly over the support.



- D. Remove the assembly from vise. Now, slide the Bottom Swage, with the collet profile groove in the ID (item #5), over the top end of the Bottom Rod (item #25) and push it down over the Collet (item #26) until Collet fingers engage the profile inside the Swage. You may need to drop the assembly against a strike plate to engage the Collet fingers into the profile.
- E. Screw the Collet Support (item #27) back out tight against the Collet. Make wrench tight.





Caution: *Be careful not to loosen the engagement of the Release Ring! The bottom end of the taper on the Collet Support should be near the bottom end of the Collet fingers as shown in the casing patch illustration!*



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

- 6.4 Install 1 O-ring (item #6) onto the pin-end and 1 O-ring (item #7) into the box-end of the 10 ft sections. Lightly lube the O-rings and assemble the sections in 20 ft lengths and snug up. Do not tighten excessively.
- 6.5 Install the O-rings (item #6,7) onto pin-end of the Element and into the box-end of the Element. For GTX-SPAN® systems, lightly grease 2 Elastomers (item #1) and install onto the Bottom Element. Make sure that the Elastomers are completely seated in their grooves.
- 6.6 Screw Bottom Element (item #2) to one of the 20 ft lengths of section and snug up. Do not tighten excessively and keep pipe wrenches away from the X-SPAN® system sealing area.
- 6.7 If Rod Supports (item #27TP or item #28CP) are needed, slide them over the 10 ft rods (item #21TP or item #22CP). Screw Rod Tandem Connector Couplings (item #20TP or item #21CP) onto the top of the rods, then assemble and tighten the rods in 20 ft lengths. Use loctite on couplings and wrench tight. You will require one 10 ft Rod for each 10 ft Section. Slide the rod assemblies into the section assemblies.
- 6.8 Take the Bottom Rod Collet assembly and using loctite, screw it onto the Rod that is in the section with the installed Bottom Element. Slide the rods up into the section until the Swage (item #5) is in position inside the Bottom Element (item #2).
- 6.9 Screw the Swivel Hook Lift assembly into the top end of the rods for lifting.
- 6.10 Lift the patch section by the swivel hook and position it over the wellhead. Inspect to see that the Bottom Swage is inside the Element.



Note: *Take note of the distance from the top of the section to the bottom of the Rod Tandem Connector Coupling. This length should stay consistent on jobs with multiple pick-ups and confirms that the Bottom Swage is in position.*

- 6.11 Lower the patch assembly into the well and install the safety plate below the Rod Tandem Connector Coupling (item #20TP or item #21CP) and continue to lower the assembly until the coupling is bottomed out in the recess of the safety plate.
- 6.12 Unscrew the lifting rod assembly from the Rod Tandem Connector Coupling, then screw the lifting rod assembly onto the Rod of the next section to be picked up.
- 6.13 Install a safety clamp (dog collar) near the top of the section and install a lifting strap below it.
- 6.14 Lift up the rods with a sandline, catline or blocks by means of the swivel hook, and the sections with a sand or catline connected to the lifting strap. Position it over the patch section in the well head.
- 6.15 Make up the pin of the suspended Rod to the Rod Tandem Connector Coupling that is hanging on the Safety Plate and make up the connection with loctite, wrench tight.
- 6.16 Lift up on rods (and lower patch section) until top of patch section is accessible, then remove safety plate.
- 6.17 Continue lifting up on the rods (lifting the whole lower patch assembly) by the sand line, catline or blocks and guide the section connections together. Make up extension sections of the patch.
- 6.18 Lower the patch assembly by lowering the sandline, catline or blocks attached to the swivel hook assembly. Remove dog collar and install safety plate under the Rod Tandem Connector Coupling. Remove swivel assembly.



Note: For longer patches that have additional pick-ups, repeat steps 11-16.

- 6.19 If you are using a GTX-SPAN® system, lightly grease 2 Elastomers (item #1) and install onto the Top Element. Make sure that the Elastomers are completely seated in their grooves.



Note: Tubing Patches- On the last or uppermost section, install the Top Rod, Top Element and Top Swage prior to picking up the assembly. Do not tighten Element excessively and keep pipe wrenches away from the X-SPAN® system sealing area. Screw the swivel hook lift assembly/

Rod Tandem Connector Coupling, onto the top of the top Rod Adapter for lifting.



Note: *Casing Patches- On the last or uppermost section, install the safety plate in place under the Rod Tandem Connector Coupling and land off on the wellhead and remove the swivel hook assembly. Make up the top Adapter Rod (item #20CP) into the top Rod Tandem Connector Coupling. Make up with loctite and wrench tight.*

- 6.20 Make up setting tool (item #12TP or item #13CP) with the Quick Change Rod (item #17), Quick Change Nut (item #18) and Rod Lock Nut (item #19CP).
- 6.21 Slide Setting Sleeve Lock Nut (item #15) and Setting Sleeve assembly (item #16) over bottom of setting tool. Install Sleeve Nut (item #14) onto the setting tool and lock it in place with the setting tool Lock Ring.
- 6.22 Lift setting tool into position with the wireline or by the tubing elevators.
- 6.23 **Casing Patches** - Slide the Setting Sleeve and Lock Nut up the setting tool, along with the following components; Top Swage (item #4) and Top Element (item #3). These parts must be held by hand or rig lines with a hook. On some patch sizes the Top Element and Swage can be placed over the Top Adapter Rod and set on the support plate.
- 6.24 Align the two slots in the Top Adapter Rod (item #19TP and item #20CP) with the roll pin in the Quick Change Rod (item #17) and lower the setting tool down onto the Top Adapter Rod. Make up with loctite, and wrench tight.
- 6.25 Lift the setting tool and patch assembly up until section is accessible, remove the safety plate and check for the same relative distance of the box connector in step 7. This ensures the Bottom Swage is inside the Bottom Element.
- 6.26 **Casing Patches** - Screw the Top Element onto the section and insert the Top Swage into the Top Element. Do not tighten excessively and keep pipe wrenches away from the X-SPAN® system sealing area.
- 6.27 Screw the Setting Sleeve (item #16) firmly against the Top Swage. Do not tighten excessively. Tighten the Sleeve Lock Nut (item #15) against the Setting Sleeve.
- 6.28 Follow running procedures as per the type of setting tool being used.

6.29 Optional Lifting Method:

1. Install lift nubbins onto the top end of the sections.
2. Screw the swivel hook onto the Rod of the next section to be picked up.
3. Slide the rods down through the sections so that the bottom end of the Rod is accessible. Install a safety clamp or support plate onto the bottom end of the Rod.



Note: *The section will sit on the safety clamp or support plate when the Rod is being picked up.*

4. Lift the rods (and sections) with a sandline, catline or blocks by means of the swivel hook and position it over the well head.
5. Install single joint elevators around the sections and use sandline or catline to pick them up to the lift nubbins. When the elevators tag out against the nubbins continue to pick up the sections enough to remove the safety clamp or support plate from the bottom end of the Rod.
6. Make up the pin of the suspended Rod to the Rod Tandem Connector Coupling with loctite and wrench tight.
7. Lift up on rods until top of patch section is accessible, remove safety plate.
8. Continue lifting up on the rods (lifting the whole lower patch assembly) by the sand line, catline or blocks, and guide the section connections together. Make up extension sections of the patch.
9. Lower the patch assembly by lowering the sandline, catline or blocks attached to the swivel hook assembly. Install safety plate under the Rod Tandem Connector Coupling and remove swivel assembly.
10. Repeat steps #1 to #9 as required.



Caution: *Personnel installing X-SPAN® Patch systems must be trained and approved by Owen Oil Tools.*



Note: *Clean and lubricate all parts as soon after use as possible.*



Note: *Visually inspect setting equipment and rods for damage and stretching after each use. Damaged components must be replaced.*



Note: *It is recommended that a Magnetic Particle Inspection (MPI) be completed on all components at least every 20 runs*

Tubing/Casing Patch Disassembly

7.0 Pre-Disassembly



Warning: *Personal Protective Equipment (PPE) such as steel toed footwear, safety glasses, etc..., should be worn at all times!*



Warning: *Be aware that the setting tool could be very hot and may contain trapped pressure!*



Note: *This tool takes at least two people to assemble and disassemble.*



Note: *In most cases, because of the working height of the rig or mast unit, it is not possible to lay down more than 30ft (9m). However, when a single pick-up patch has been set it may be possible to lay down the setting tool and patch rods at one time. Long Casing/Tubing Patches will have to be removed in sections.*

8.0 Disassembly-Single Pick-up or Short Assemblies

- 8.1 After the setting tool and the patch rods have been laid down, remove the rods by holding a back-up on the Rod Tandem Connector Coupling. Then remove the Rod Tandem Connector Coupling by holding a back-up on the next rod.



Caution: *Take care not to bend the rods when laying the assembly down.*

- 8.2 Now, you should be able to hold a back-up on the Top Rod Adapter and remove the last rod.



Note: *The Top Rod Adapter will have to be removed when the setting tool is disassembled.*

9.0 Disassembly-Multi Pick-ups

- 9.1 First, pick up the tool to the first Rod Tandem Connector Coupling and land off on a safety plate. Back-off the Setting Sleeve and then remove the Top Rod from the coupling. Lay down setting tool.



Note: *In some cases you might not be able to get a wrench on the Top Rod Adapter. If this happens, remove the safety plate and lift the setting tool/rods to the next coupling. Install the safety plate underneath the coupling, remove the setting tool/rod assembly and lay down.*

- 9.2 Attach a swivel lift hook to the Rod Tandem Connector Coupling. Pick up as many rods as rig height will allow, and then put a safety plate underneath the next Rod Tandem Connector Coupling.

- 9.3 Remove the Rod/Rod string from the Rod Tandem Connector Coupling and lay down for later disassembly



Caution: *Take care not to bend the rods when laying the assembly down.*

- 9.4 Repeat steps 19.2-19.3 for the remaining Rods and couplings.

- 9.5 After the setting tool and the patch rods have been laid down, remove the rods by holding a back-up on the Rod Tandem Connector Coupling. Then remove the Rod Tandem Connector Coupling by holding a back-up on the next rod.



Note: *The Top Rod Adapter will have to be removed when the setting tool is disassembled.*



Note: *Clean and lubricate all parts immediately after each use.*



Note: *Visually inspect setting equipment and rods for damage or stretching after each use. Damaged or stretched components **must** be replaced.*

X-SPAN® Systems Fishing and Removal-Rotary Drilling

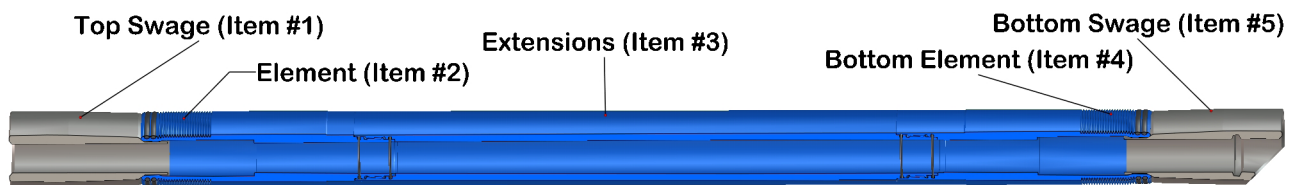
10.0 Pre-Fishing and Removal



Warning: *Personal Protective Equipment (PPE) such as steel toed footwear, safety glasses, etc..., should be worn at all times!*



Caution: *Make sure to wrench only on wrenching surfaces (knurled areas) provided! Always file wrench marks and burrs and clean off debris!*



11.0 Fishing and Removal Procedures

- 11.1** A closed circulating system using a viscosified milling fluid is recommended.
- 11.2** Using a pilot mill or a Modified section Mill, mill off the Top Swage and Element (item 1 & 2) and an additional 8 inches (0.2m) of Extension. (The diameter of the Mill should be at least drift or as large as the I.D. of the casing.)
- 11.3** Run in with the required size spear and engage it in the lower most extension about 1m or so above the bottom sealing element. There is a weak point in the connection at the o-ring gland (see illustration below). Jar up to break connection at the weak point and retrieve the extensions (body of the patch) from the well. The amount of force required to shear the connection will depend on the size of patch and material type but in general it will take about 45,000 to 60,000 pounds jarring force at the spear so a sufficient work string is required. Depending on the Patch ID a chemical cutter or mechanical cutter are optional methods of retrieving the extension. When using an internal mechanical cutter we recommend the use of a collar stop on the drill string that cannot enter the patch (collar stop O.D. is larger than the patch I.D.). The collar stop tags out on the top of the patch and positions the cutter at the correct depth. The collar stop must be spaced out prior to running in the hole. (Depending on the fishing companies tools they may be able to pull the extensions with the mechanical cutter.)



Note: *Depending on the Patch ID a chemical cutter is an optional method of cutting the extension.*

- 11.4** Using the same pilot mill or Modified section Mill as above in step #2, run back in and mill out the Bottom Element (item 4) and Swage (item 5). Part of the bottom swage may fall down the hole once the element is removed. Note: If leaving the bottom swage mule shoe in the well is not an option we recommend to use a small spring loaded catch or spear attached to the bottom of the mill (it will collapse when going through the extensions and snap back out below the swage). See illustration below



Note: Set an inflatable bridge plug below the patch and dump sand on it prior to starting fishing operations.

Patch Thread connection

- 11.5** Run a spear and pull the extensions out of hole (depending on the fishing companies' tools they may be able to pull the extensions on the mechanical cutter run).
- 11.6** Run back in with the Mill and mill out the Bottom Element (item #4) and Swage (item #5). Part of the Bottom Swage may fall down the hole once the Element is removed.



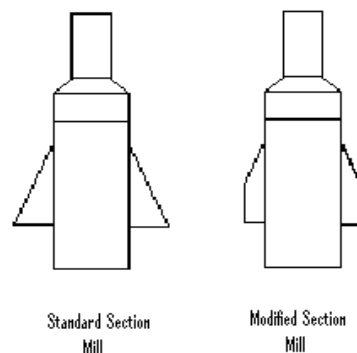
Note: *If leaving the mule shoe of the Bottom Swage in the well is not an option, Owen recommends using a small spring loaded catch attached to the bottom of the mill (it will collapse when going through the extensions and snap back out below the swage). If a spring loaded catch is not available, RIH with a standard Itco Spear assembly and grapple with a collar stop on fishing string to fish the Bottom Swage (item #5) on patch diagram attached. The Bottom Swage is "long, the collar stop and the grapple on the spear must be assembled so as the grapple does not protrude more than 6in (15cm) past the collar stop. Locate the fish and lower the fishing string slowly until the spear has entered the fish to the desired depth, engage the grapple by rotating the string one full turn to the left with the string in the neutral position, pull up and POOH.*

12.0 Optional Fishing and Removal Procedures

- 12.1** Make up and run in the hole with a hydraulically activated milling assembly to just above the patch. The mill has hydraulically extendable cutters which will open from a collapsed OD to the preset milling OD. The tool works on the same principal as a section mill.
- 12.2** Establish operating parameters, wash down and tag the top of the patch.

- 12.3** Mill ± 20 in (50cm). Circulate bottoms up and pull out of the hole.
- 12.4** Redress the hydraulic mill with a set of bottom up cutters and run in the hole to just below the bottom of the patch.
- 12.5** Establish parameters and mill the lower end of the patch.
- 12.6** Once ± 12 in (30cm) has been milled attempt to pick up, if free travel is observed circulate bottoms up and pull out of the hole. If free upward travel cannot be obtained continue to mill up until the patch is free.
- 12.7** There is a high possibility that the patch will be recovered on the mill. However, if the patch is not recovered, make up and run in the hole with a spear assembly, engage in the ID of the patch and recover to surface.

13.0 Modified Section Mill



- 13.1** Use a standard 5500 series or similar type section mill with knives designed to cut and mill casing. Take the standard tool dressed with casing milling knives; with the knives fully extended, weld them into position. Place the tool in a grinding machine and reduce the OD of the knives to 0.010" below casing ID to prevent skimming the clad. The grinding process will change the profile of the section mill knives as depicted above.

14.0 How To Read Cuttings For Conventional Milling Operations

- Ideal cuttings should be about 1/32" thick and up to 2.5 to 3.00" long.
- Hair like cuttings with a low penetration rate means that you should increase your WOB.

- Fish like scale cuttings when Pilot Milling or Section Milling (common when you are milling H-40 Pipe), tells you that the penetration rate can be improved by “decreasing” weight, and “increasing” the rotary table speed.
- If you are milling P-110 type pipe, then expect cuttings that are a lot finer, due to the metal composition, this is normal.

15.0 General Guidelines for Efficient Milling

15.1 Steel cuttings removal is the name of the game when milling.

15.2 Ideally aim for a minimum annular velocity of 120Ft/Min.

15.3 Don’t use Oil Base Mud for milling operations if there is any alternative.

15.4 Turbulent flow is the best pumping rate because the cuttings are tossed around and never actually get a chance to settle or “bird-nest” in the wrong place, which happens normally just above the Drill-Collars, but few pumps on the smaller work-over rigs have the capacity to produce turbulent flow.

15.5 In the absence of “big-pump” capability, see chart below.

15.5-1 If the Well permits, add weighting material such as barite.

15.5-2 Increase the yield point of the mud with moderate increase in viscosity, below are some common additives you can use;

Mud Type	Additive	Amount
Water Base Mud (9 – 10Lg/Gall)	Ben-Ex	0.1 Lbs/Gall
Salt Water or Fresh Water	Ground Asbestos	2.0 – 4.0 Lbs/Gall
Water Base with less than 10% Oil	Ben-Ex	0.1 Lbs/Gall
Polymer	CMC – High Vis	0.5 – 1.0 Lb/Gall

If you cannot find or have these additives on location, then simply increase the viscosity, try 60 - 70cps for a start.

16.0 Getting Rid of Cuttings at the Right Rate

After mud conditioning, optimum annular velocity and mud viscosity - mud yield are taken into consideration above, the following suggestions will help you get cuttings out as fast as they are milled.

- 16.1 Make sure all subs, or other auxiliary tools in the milling string are full bore, restrictions can create fluid volume problems hampering cuttings removal, if you are using Hydraulically Actuate Tools like a Section Mill or Internal Cutter, this volume loss can be serious.
- 16.2 On small or short time milling jobs, and if you cannot get annular velocity high enough for cuttings removal, RUN A JUNK SUB.
- 16.3 If cuttings are not being removed as they are being milled use bailers or junk snatchers / baskets to periodically remove them, doubt if this would happen when milling the Patch though.
- 16.4 Reverse Circulation with open ended drill pipe is a good way to remove cuttings accumulation; some mills have special big bore exit ports for this purpose.
- 16.5 When milling anything tubular, such as wash-pipe liner, casing or whatever, cutting can accumulate inside the fish. So when cuttings removal is not optimum, and more particularly on long milling jobs, it is a good idea to periodically clean out to bottom inside the fish with a junk mill or by reverse circulation method mentioned above.

17.0 General Tips on Weight and Speed

- 17.1 As a general rule of thumb, better milling results are achieved with Rotary Table Speeds of 100rpm and up, exceptions include Taper Mills and Wash Over Shoes which usually operate at around 75rpm.
- 17.2 Never start a mill on the fish, always start rotating with the mill at least 1 foot above the fish, and with a rotary speed of 100rpm - LESS for Taper Mill and Wash-Over Shoe and other torque producing mills, slowly lower the mill onto the fish and adjust the speed and the weight to achieve optimum penetration rate.
- 17.3 For best penetration rates, try and maintain a constant WOB, and don;t allow the tool to drill-off, do not feed weight by allowing the draw-works drum to turn in large increments, the drum should “creep”.