



TELLUS

Underground Technology

GTI Keyhole Conference Spring 2013

Creating well planned Keyhole Procedures

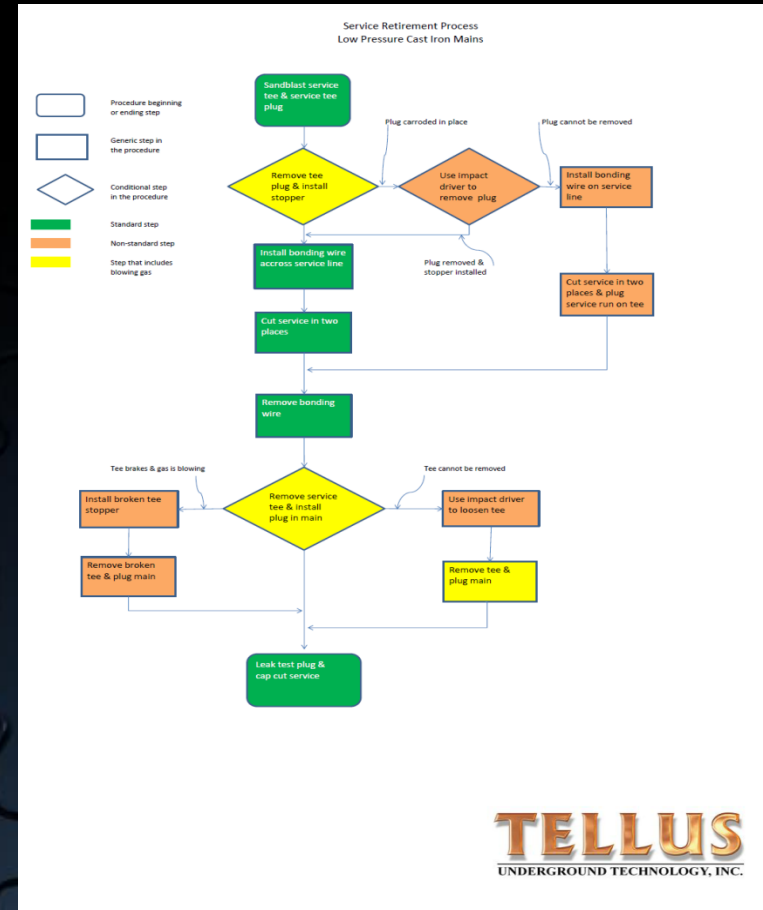
By [Frank Russo](#)

Flow Chart for Low Pressure Service Cut-off

When events proceed as planned

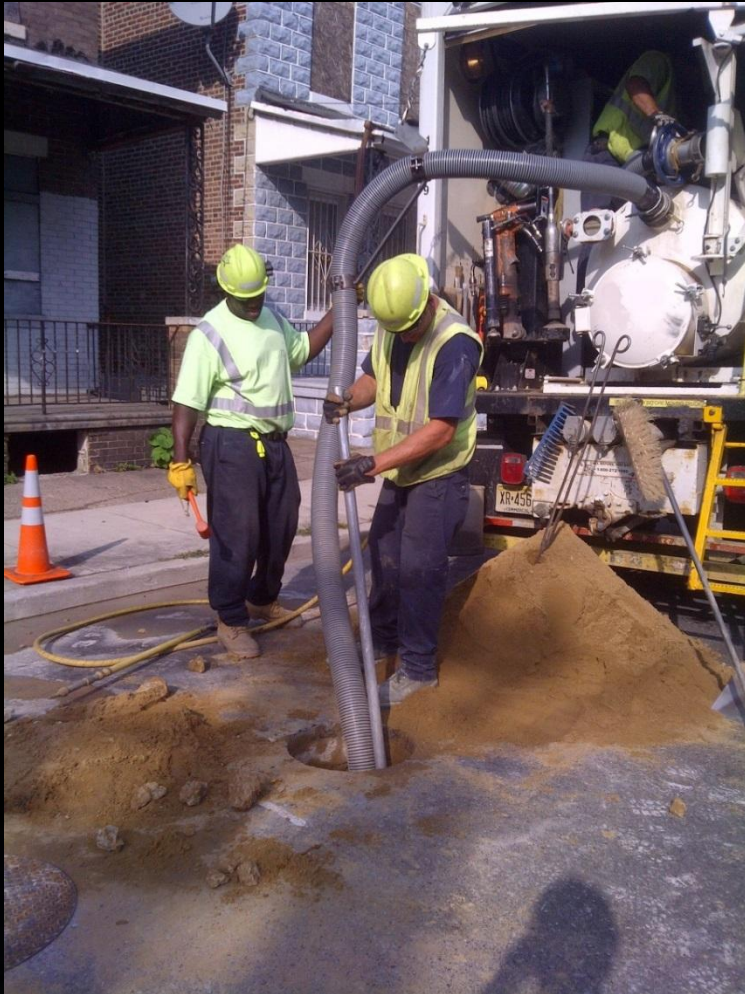


When events do not proceed as planned



When events don't proceed as expected

It can be difficult and dangerous for the gas mechanic to gain access to underground infrastructure thru an 18" diameter cored opening

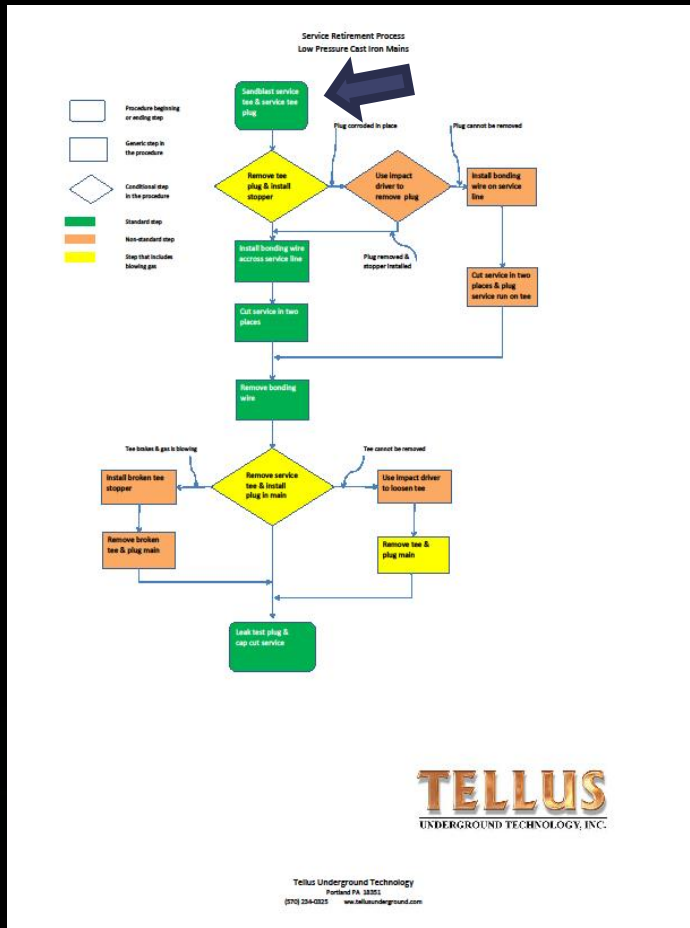


- All standard operating procedures must include plans to deal with unexpected events. (service tee breaks, tee plug cannot be removed, no completion plug in the service tee etc.)



Low pressure service cut-off procedure

After the service and main are exposed the service tee and tee plug must be cleaned to allow tool access.



Stopping-off gas flow to the service line

Well designed tools are constructed to prevent cracking or rounding of the tee plug.

- This is a two man operation to reduce the amount of blowing gas.
 - As the first operator removes the tee plug the second operator installs the stopper into the tee.



- If the plug cannot be removed:
 - A rotary impact tool can be used to break the plug free.
 - or
 - Cut the service line and install a 90 degree stopper



Cutting the service line

Bonding clamps must be installed across the section that is about to be cut

- With the stopper in place there is no flow of gas into the service line.
 - The extension tool that was used to install the stopper into the tee is released from the stopper so that the service tee can be removed with a tee socket



- The service line must be cut in two places to allow rotation of the tee and cut stub.
 - The first cut must be made as far from the tee as possible
 - The second cut is made as close to the tee as possible



When the flow of gas into the service cannot be stopped

The service line must be plugged

- If the tee plug cannot be removed
 - The service line is cut in two places.
 - A 90 degree stopper is installed in the service line.



Services that do not contain tees

- The service line is cut in two places.
- A 90 degree stopper is installed in the live service line.



Removing the service tee from the main

The risk of breaking the tee can be very high if poorly designed tooling is utilized

- Special tee sockets that fit snugly over the fitting create torque forces that are transmitted directly thru the centerline of the tee to reduce the possibility of breaking the fitting.



- If the service tee breaks a specially designed “EZ Out” tool can be installed on the $\frac{3}{4}$ ” extension drive to remove the broken tee stub



If the service tee breaks

Gas is blowing and must be controlled

- A rubber stopper is installed into the broken service tee to stop the blowing gas.
 - Tapered rubber stoppers with a $\frac{1}{4}$ " hex drive can be pressed into the broken tee to stop the blowing gas while the crew fits the correct size "EZ-Out" onto the $\frac{3}{4}$ " extension drive.



- Using the "EZ-Out" the broken stub can be removed.
 - With both gas mechanics on the tee handle a torque force of 500 lbs.-ft. can be applied to the "EZ-Out" tool.



Plugging the main

The tools are designed to reduce the possibility of cross threading the plug in the main

- This step is also a two man operation to reduce the amount of blowing gas
 - As one operator removes the service tee from the main the second operator starts threading the pipe plug into the threaded hole in the main.

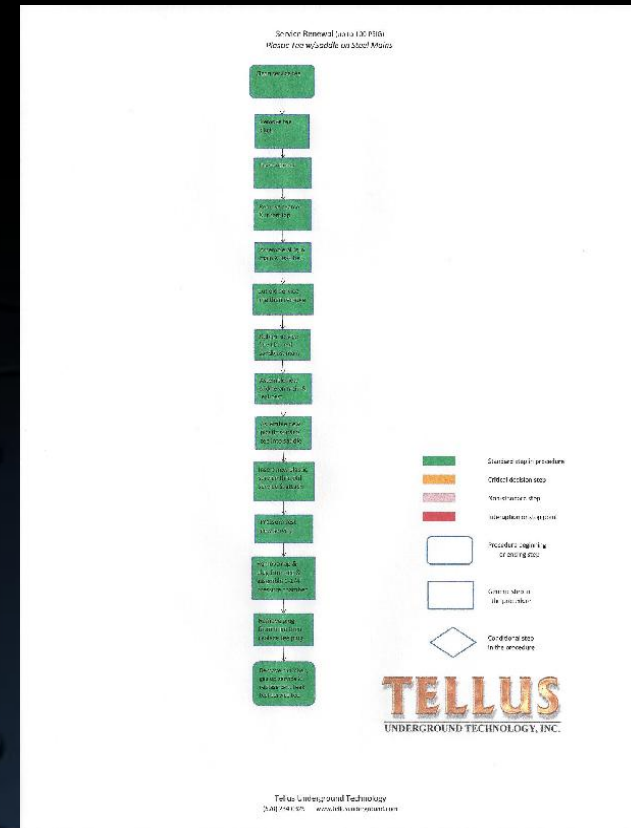


- After the pipe plug has been successfully started into the main the plug is tightened using the pipe plug socket on the $\frac{3}{4}$ " drive extension.



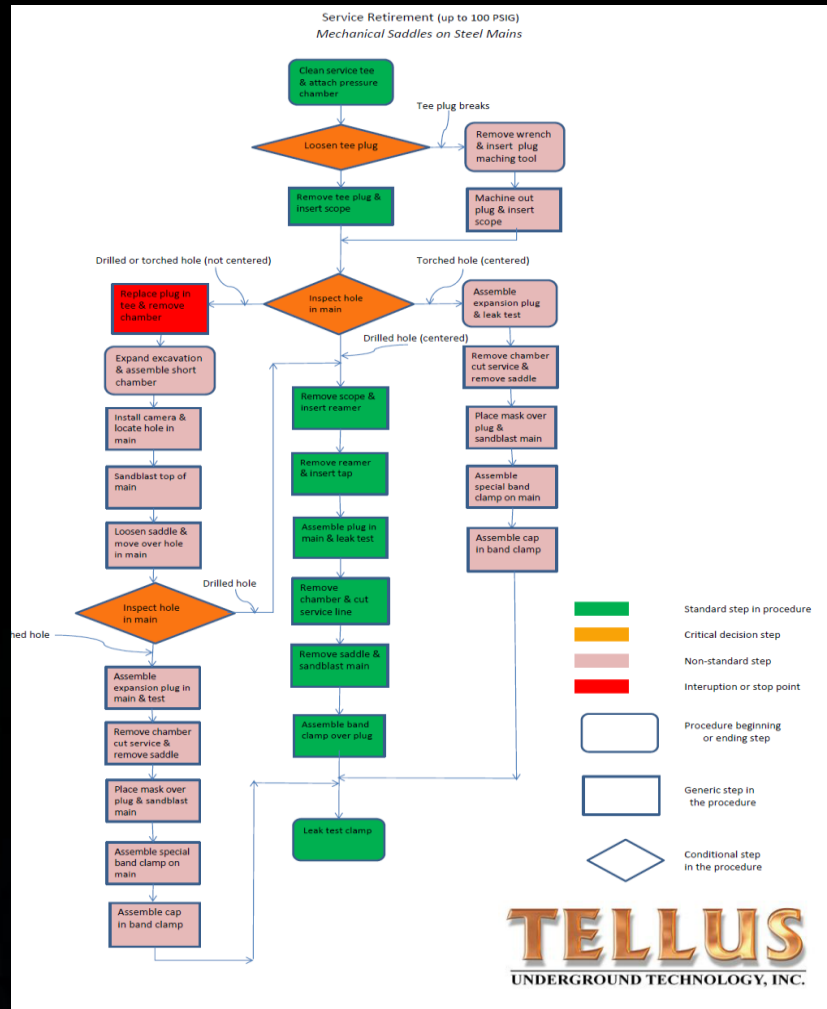
Medium & High-Pressure Service Cut-off Procedure

A no-blow service retirement process to remove saddle mounted services mounted on steel mains.



Using a fully mapped flow chart for medium & high-pressure service cut-offs

When events do not follow the standard sequence of events alternate steps must be planned into the procedure.



Pressure chamber design

All no-blow chambers consist of a
“launch chamber” & “sealing chamber”

- The “launch chamber” provides a compartment to take tools from atmospheric pressure to the elevated pressure environment.



- The “sealing chamber” provides a pressure tight connection between the pressure chamber and the live gas line.



The chamber is sealed to the service tee and the tee plug is removed

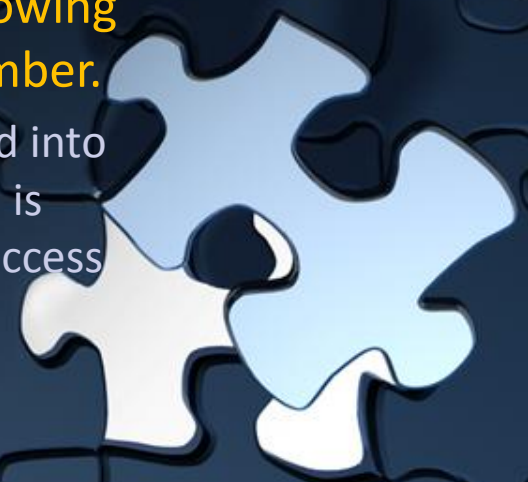
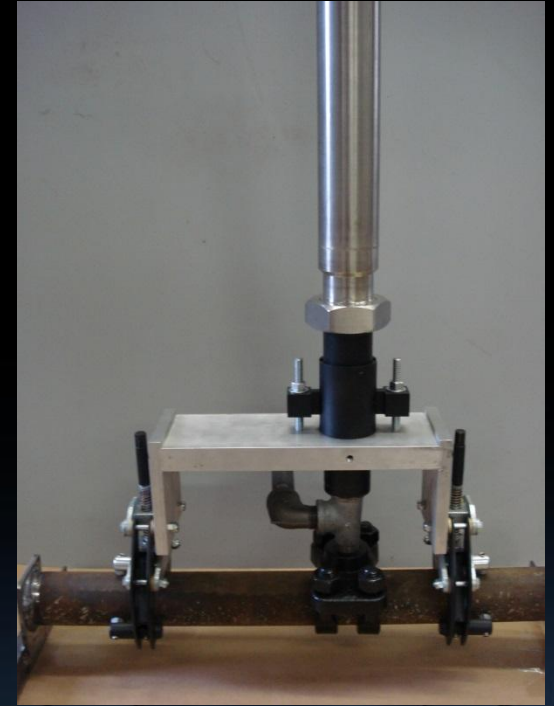
The tee plug is loosened thru the pressure chamber

- A special magnetic plug socket is used to remove the tee plug from the service tee.



If the plug breaks there is no blowing gas because it is inside the chamber.

- A cutting tool is assembled into the chamber and the plug is machined away to allow access into the service tee.



If the tee plug breaks a hole is cut thru the plug to permit access into the tee

The operating procedure is designed to deal with this type of event by establishing a secondary course of actions to address the situation.



Inspecting the opening in the main

The hole in the main may have been drilled or torched thru the pipe wall.

- A fiber-optic scope is installed into the pressure chamber to inspect the opening in the main.
 - If the hole has been drilled it can be threaded to accept a special steel plug.
 - If the hole has been torched it can be plugged with a special rubber seal plug.



- When the opening in the main is off center and can not be accessed thru the service tee the saddle must be moved.



Tapping the main for a steel plug

Most mains were drilled using a drilling fixture

- The opening is cut to size using a special reaming tool to produce a hole that is an exact diameter.
 - When the operator sizes the hole to the proper diameter the reaming tool will turn freely.



• The hole is then tapped by hand.

- Since these are straight threads the operator can feel the cutting of the threads and will feel no resistance when tapping is complete.



Installing the plug in the main

A fine thread plug is installed into the main

- Using a magnetic hex key a threaded steel plug is installed in the main.
 - The threads are sealed using pipe thread sealing tape that is applied prior to installation.



- These plugs are designed to fit flush with the top of the main and have a small round protrusion into the inside of the main.



Install a band clamp over the plug

A stainless steel band clamp is installed over the plug.

- A section of the main on both sides of the plug is sandblasted to create a good seal surface for the band clamp.



- Standard keyhole tools are used to install and tighten the band clamp in place.
 - For those installations that require corrosion protection, a corrosion kit is available.



Well planned Keyhole Processes

- Leak location & repair
- Service retirement (service cut-offs)
- Corrosion control
- Service renewals
- Anode installation
- Service installation
- Camera launch & inspection
- Underground plant location
- Meter replacement & relocation
- Tracer wire repair
- Test station installation
- Gas evacuation: emergency leaks
- Tie-overs on main replacements



Unexpected events must be addressed if keyhole technology is to be successful

We cannot leave these people alone. When we loose control of a procedure we compromise the safety of the operator and they are forced to resort to conventional methods.



- When we fail to plan we have a plan for failure.

Benjamin Franklin



Captain Chesley Sullenberger's unscheduled landing

When Capt. Sullenberger encountered the “unexpected” event of having both engines fail he referred to aircraft manufacturers emergency procedures to prepare the airplane for an water landing. **Capt. Sullenberger was not alone**, he was supported by good planning and training to avert a situation that could have resulted in disaster.

