SERIES "Q" WIRE LINE

FAMILIARIZATION

The Series "Q" Core Barrel has been carefully assembled and inspected at the factory. It is not necessary to disassemble any part of the core barrel except to make minor field adjustments.

CORE BARREL

1. Study the attached parts lists and core barrel illustrations attached to the end of these instructions.

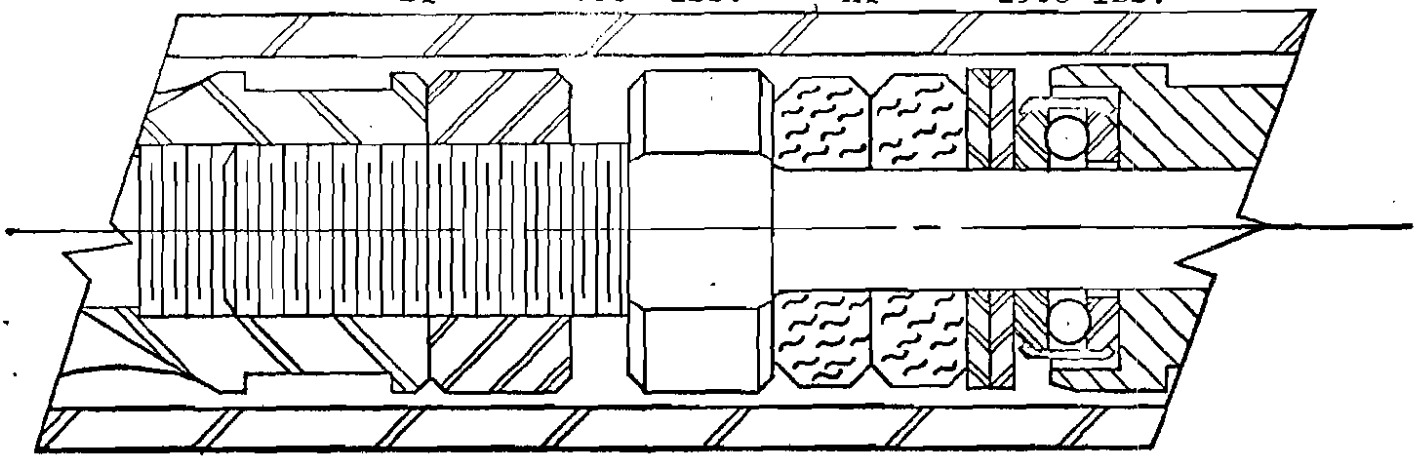
2. Remove the inner tube assembly (Items 1 through 33) from the outer tube assembly (40-51) by grasping the spearhead (1) with an overshot, then pulling out until the latches release. Pull out the inner tube assembly and place it along side the outer tube assembly.

3. Note the two rubber shut off valves (12) and two steel washers (13). When a core block occurs, the blocked core resists the downward drilling force and in turn, exerts a force up through the inner tube assembly expanding the rubber shut off valves. When the rubber valve diameter expands into the annulus between the inner tube and the outer tube, the downward flow of water is restricted and a rise in water pump pressure results. This signal warns the operator that a core block has occurred.

4. These rubber valves can be set for two ranges of operation for each size core barrel.

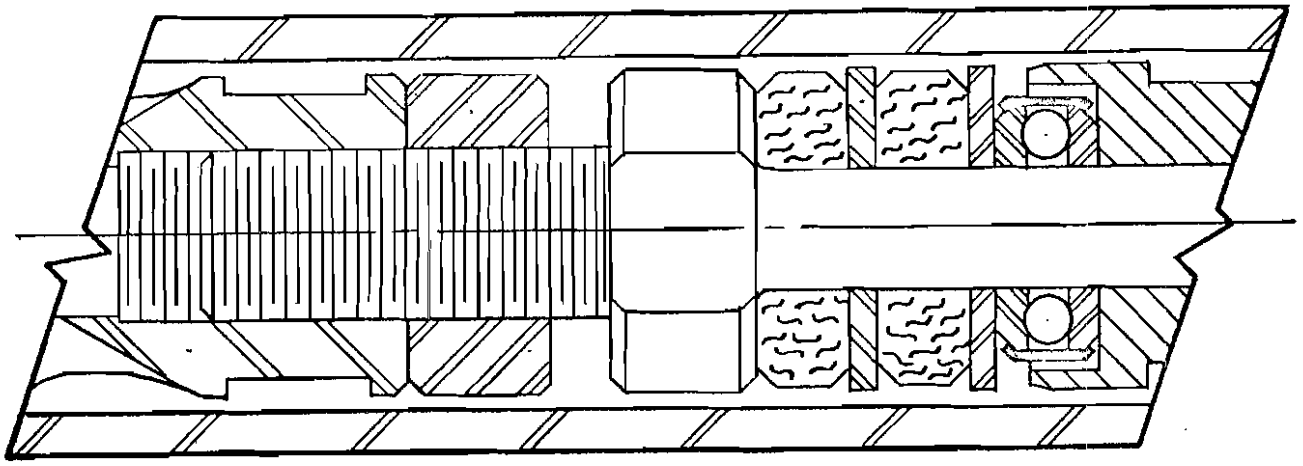
POSITION 1: Note the two rubber shut off valves are in contact with each other. Use this arrangement when coring soft or friable rock. The table below shows the approximate core block forces necessary to actuate the shut off valve in the position shown:

AQ-	320 lbs.	NQ-	1150 lbs.
BQ-	700 lbs.	HQ-	1900 lbs.



POSITION 2: Two rubber shut off valves are separated by a steel washer. Use this arrangement when coring harder formations. The table below shows the approximate core block forces necessary to actuate the shut off valve in the position shown.

AQ-	550	lbs.	NQ-	1750	lbs.
BQ-	950	lbs.	HQ-	2900	lbs.



5. Within the inner tube is a heavy duty compression spring (16). The purpose of this spring is to allow the inner tube to set on the bit during the core breaking operation. This feature transfers the load from the inner tube to the bit, protecting the hanger bearing and the inner tube assembly from damaging stress.

6. Check the action of the latches (5). They should swing out freely and have a "snappy" action when the latch retracting case (2) is moved up and down.

7. The head assembly sets in the landing ring of outer tube. Being centered, it cannot vibrate during operation. Set the head assembly aside.

8. Note that both ends of the inner tube have pin threads. All Series "Q" inner tubes are reversible so the operating life is almost doubled as compared to conventional inner tubes.

9. Examine the core lifter case (31). Note the stop ring (32) above the core lifter (33). The stop ring provides a hardened surface for the core lifter to bear against during coring. Before a worn core lifter can be extracted, the stop ring must be removed. To remove the stop ring, insert a screw driver blade under the split in the ring and pry loose. Rotate the stop ring so that the ring hoop is at 90° with the diameter of the core lifter case and pull it out. Replace the core lifter. To install: slide in the stop ring in the 90° position, then rotate the hoop

and snap it into the recess. Visually inspect the inside of the core lifter case to be sure the stop ring is properly positioned.

10. Reassemble the core lifter case to the inner tube and reassemble the inner tube to the head assembly.

11. Examine the outer tube. Note that the outer tube assembly consists of the following items: locking coupling (40), adapter coupling (41), ring landing (42), outer tube (43) and inner tube stabilizing ring (44). A thread protector is attached to the outer tube. Within the thread protector counter-bore is the inner tube stabilizer ring (44). The thread protector provided for shipment of the core barrel is not shown on the cross sectional drawing.

SERVICING THE CORE BARREL FOR USE

1. Remove the inner tube stabilizing ring (44) from the thread protector and install it into the deep counter bore of a new reaming shell (50). This stabilizing ring centralizes the inner tube and is a particularly important aid in coring because it holds the core lifter and the core lifter case in the proper position to receive core.

2. Assemble both the reaming shell (50) and the diamond bit (51) to the outer tube.

3. Wipe the inner tube assembly clean and lightly oil the outside surface. Install the inner tube assembly into the outer tube so the landing shoulder is seated firmly on the landing ring.

4. Check the gap or distance between the beveled shoulder inside of the bit and the lower end of the core lifter case. The gap should measure 1/16 of an inch (1.6 mm.), plus or minus 1/32 of an inch. If the gap setting is not within the limits specified above, extract the inner tube assembly, loosen lock nut (10) and adjust the spindle assembly so the proper gap, 1/16" (1.6 mm.) is made. After the adjustment is made, tighten lock nut (10). Insert the inner tube and again check the gap as indicated above.

5. Whenever a new bit or reaming shell is first installed or if the inner tube or a core lifter case is replaced, the gap between the core lifter case and the bit should be checked to assure full core recovery.

6. Whenever more than one inner tube assembly is used interchangeably with the same outer tube assembly, each companion inner tube assembly must be gap adjusted to the same length from the landing shoulder to the core lifter case.

A FINAL CHECK FOR PROPER GAP SETTING

Before the core barrel assembly is used, suspend the entire assembly sufficiently so that a gap inspection can be made in the vertically suspended position. The correct gap 1/16" (1.6mm.) must be evident, otherwise, core recovery may be adversely affected.

ADDING NEW TOOL JOINTS TO THE DRILL STRING

Experience shows that the first few trips in the hole are the most 'hazardous' in the life of rod tool joints. For this reason, extra care must be taken during the break-in period. On newly machined surfaces, galling is most likely to occur. Resistance to galling can be built by using a high quality thread lubricant and by properly torquing each rod joint. After some service, the metal surfaces undergo changes which make them less susceptible to galling.

The following are the recommended steps for handling new tool joints:

1. It is important to keep the threads on the water swivel and the hoisting plug in good condition as they mate with every box.

2. Pin and box threads and shoulders must be thoroughly cleaned.

3. When rod joints are run in the hole, both the pin and the box threads and shoulders should be liberally coated with a good grade of lubricant. Field experience shows a very satisfactory lubricant is one which contains a minimum of 40% by weight of finely powdered, metallic zinc. Use "TEXACO THREADTEX" or equivalent thread lubricant.

4. In making each trip, the box threads and shoulders should be coated with the lubricant again.

5. Avoid forced make up of improperly engaged threads. In stabbing, the flat crests on new threads sometimes wedge against each other. A slight amount of back up will free them.

STARTING THE CORING OPERATION

1. After the last rod is connected and the drill string is still held by the foot clamp, disconnect the hoisting plug.

2. Connect the water swivel to the rod and connect the hoist to water swivel ball.

3. Raise the rod string high enough to remove the foot clamp.

4. Lower the drill string within a few inches of the bottom of the hole.

5. Tighten the chuck on the drill head to the drill string.

6. Start the water pump and the drill, but do not advance the drill string into the hole until the water pressure rise is indicated on the pressure gauge or until water is returning from the hole. Water must be circulating around the diamond bit before core cutting begins.

7. Water pressure of 50 to 100 psi is sufficient water pressure to start advancing the rotating drill head into the hole and to start coring. As the hole deepens, the water pressure will gradually rise to higher operating pressures.

RETRACTING THE INNER TUBE

1. Paint a 5 foot section of the wireline cable about 30 feet above the overshot. The painted section will help to signal the approach of the overshot when it is being retrieved from the hole.

2. Insert the overshot into the drill string and lower it into the rods without over-running the cable.

3. As the overshot approaches the inner tube, slow its speed until the overshot is latched onto the inner tube spearhead assembly.

4. When the overshot assembly has contacted the inner tube spearhead, tie a string marker to the wireline cable a few feet above the point of contact. This string marker will help warn the drill operator when the overshot approaches the inner tube spearhead on future runs. Move this marker upward after each core run.

5. Slow the overshot when the string marker appears-then ease the overshot over the inner tube spearhead.

6. To check if the overshot has properly latched over the inner tube assembly spearhead, take up the cable slack so the cable is tight and then by pulling the taut cable by hand, it will be noted that the combined weight of the core filled inner tube and the overshot is greater than the weight of the overshot alone.

7. Hoist the overshot and the inner tube assembly from

the hole. As the overshot assembly approaches the surface, the paint marker will appear. Reduce the speed of the hoist.

8. Lift the inner tube assembly until it is out of the hole. Then, carefully lower the core laden inner tube assembly so the overshot can be removed.

9. Disengage the overshot from the inner tube. Place the inner tube on a pair of wooden work horses or a bench.

10. Unscrew the inner tube from the inner tube head assembly using an open end wrench on the head assembly and an inner tube wrench on the inner tube.

11. Before coring runs, inspect the inner tube assembly for wear. Set the head assembly aside for servicing between core runs--See servicing instructions. Move the core laden inner tube to the core removal area.

REMOVING CORE FROM THE INNER TUBE

1. Empty core from the top end of the inner tube.

2. Before removing core, slip the steel "protective sleeve" over the inner tube. Then, using a ball peen hammer, jar the core loose from the inner tube. The protective sleeve will absorb the shock of the tapping.

3. Check the inner tube to be sure all the core has been removed.

SERVICE & MAINTENANCE (BETWEEN CORE RUNS)
INNER TUBE

1. After the core has been removed, pour clean water down the inner tube to wash out the sand particles and grit.

2. Inspect the inner tube to see if any particles are lodged on the smooth inside surface.

3. Check the core lifter case, stop ring and core lifter. The core lifter should rotate freely. If the inside surface of the core lifter is smooth, the core lifter should be checked by inserting a short section of core into the core lifter and pulling it out to see if the core lifter will grip the core. If the core slips, the core lifter should be replaced. See Service Instruction (After Service).

SERVICING INNER TUBE

HEAD ASSEMBLY

1. Wash the head assembly in clear water to remove drilling mud and grit.

2. Inspect the action of the latches and the latch retracting case. Both should work freely.

3. Check the movement of the spindle bearings. They should spin freely and there should be no end play. If end play exists, the head assembly may need further repairs (See Maintenance Instructions- After Service).

4. Check the rubber shut off valve for shredding. At this point, a determination should be made on positioning the rubber shut off valves, as described in "Familiarization Section". If the rubber shut off valve is to be rearranged, it is necessary to remove the inner tube cap (18), lock nut (17), compression spring (16) and the 3 bearings. Make the necessary changes with the rubber valves. Install the bearings in the same position as originally assembled. Do not reverse either ball bearing. Assemble the lower end and tighten the lock nut (17) to remove free play, but do not preload the compression spring (16).

5. If no parts have been replaced and the bearings are in good condition, apply cup grease to the latches and the latch retracting case. Pump "TEXACO MULTIFAK #2" or equivalent grease into the grease fitting until clean grease exudes out of the top thrust bearings.

6. Rejoin the head assembly to the inner tube.

DROPPING THE INNER TUBE ASSEMBLY (DURING A CORING CYCLE)

1. Attach inner tube spearhead to the overshot assembly. The "AQ" inner tube can be hand carried.

2. Hoist inner tube assembly above rod opening.

3. Release inner tube so it falls freely, providing there is at least 20 feet of fluid in the drill hole.

4. Add necessary rod.

5. Attach water swivel to rods.

6. Circulate water while inner tube is dropping. REASON: If rock particles are on the inside of the bit, they will be

WIRELINE CORE DRILLING PROCEEDURES

PREPARATION

Assemble the barrel above ground to check and adjust, if necessary, the clearance between the lifter case and the bit for proper water/coolant flow

Check the core lifter action. It should be able to slide easily within the lifter case.

Check the innertube for obvious distortion or bends.

Check the latching – retrieving actions of the innertube head and the overshot. Be certain that it is clean, lubricated and operates freely.

INSERTION

The initial drilling of the hole with wire line equipment is accomplished with the inner barrel assembled in the outer barrel. Not until this first portion is drilled and the inner barrel and core retrieved can the true use of "wire line" be realized.

If there is standing water in the drill rod the innertube assembly can be placed in position at the collar of the hole and released for "free fall".

If there is at least 100 ft of water in the rods, it is still possible (but risky) to position the inner barrel at the collar and let it free fall, the water will cushion and slow the final phase of the fall and permit the assembly to seat without damage.

With experience, in a hole that does not loose its fluid too rapidly to fill the rods with water an quickly place and release the inner barrel for free fall. This is recommended only for the experienced driller.

As the inner barrel descends in free fall the sound it makes as it travels thru the fluid is audible if you hold an ear close to the open end of the drill rod. The loud click as it latches in the outer tube head is also discernable.

The sounds noted above are still more discernable if a wrench is affixed to the upper end of the drill pipe and your ear placed close to the end of the handle.

On some deep holes, the experienced driller can drop the inner barrel, then hook up the fluid pump and "pump" the inner barrel into position faster. The latching action is still audible (or felt), but a further indication of latching is the rapid and

significant increase in pump pressure as the flow is now more restricted after the latching/seating action.

DRY HOLE INSERTION

If there is no water (fluid) in the hole, the innerbarrel assembly cannot be inserted using "free fall" procedure. This in all probability would damage both the inner and outer barrel assemblies.

A preferred procedure in this application is to suspend the inner barrel in the drill rods at the collar of the hole and then attach the over shot. This reduced the chance of premature release in placing the inner barrel and overshot in position

The retriever (overshot) is employed for the purpose of lowering and positioning the inner barrel is used. It is attached to the inner barrel and the assembly is lowered by means of the attached wireline cable. Be sure the overshot release mechanism is operative so that once the innerbarrel is in position and latched, the overshot can be released and retrieves before the drilling begins.

If it is known (in a dry hole) that there may be a slight bend or obstruction in the drill rods that might slow down the descent, the assembly should be lowered cautiously and slowly in that area. If the descent is slowed by the bend or irregularity the over shot can "catch up" with the inner barrel and in effect, release it. After the inner barrel passes the slight obstruction it would then be able to "free fall" and be damaged

HORIZONTAL, UP AND ANGLE HOLES

When gravity cannot be used to lower the inner barrel into position, again a specially modified or a different design over shot must be employed. This over-shot is equipped with packing or seals the allow it to be pumped in with the attached inner barrel. Again, be sure the release mechanism is operational so that the overshot and wire line can be retrieved before drilling can begin.

The sudden significant increase in pump pressure is the indication that the inner barrel has latched.

Retrieval is accomplished with the modified overshot being pumped in, but this time without the release mechanism installed

DRILLING

The actual drilling operation, under normal conditions, is most unlike that of any double tube core barrel operation with the following exceptions.

Do not try to drill past a core block. Severe damage to the inner barrel assembly may result. The advantage of wire line core barrel drilling is that pulling the inner barrel and the core is so much easier than with conventional drilling that the risk of core barrel damage is avoided with a low cost of time.
If the core lifter did not retrieve the entire core and you now know that there are loose core pieces in the outer barrel above the bit. The reentering inner barrel will not be able to seat, and the string will have to be pulled and the core removed. If this is not done, and drilling is proceeded with the inner barrel not latched, a full length of core could end up in the outer tube and still require the string to be pulled and cleared of the core that may possibly damaged and useless.

If loose pieces are below the bit, drilling progress should be very cautious as in conventional drilling until the pieces are cleared. This is essentially the same as with regular double tube core barrel operations.

RETRIEVING

At the end of the core run, the core must be broken off before it can be retrieved. Pulling back the whole string enough to break off the core does this. Never by pulling the wireline retriever and inner barrel.

The overshot (retriever) can be lowered or in some applications pumped in to engage and lock onto the inner barrel assembly. This can often be felt or heard, or in the case of pumping the overshot in, a rise in pressure is observed. The latching can also be tested by manually pulling on the wireline cable.

A recommended procedural trick is to tie a string around the cable to indicate when the overshot is close to arrival or at arrival for latching. The overshot decent can then be slowed if advisable (as in a dry hole) to reduce the impact of latching. It also helps prevents excess wireline from being played out.

CORE RECOVERY & SERVICING

Once the inner barrel is back on surface and out of the hole, it should be suspended at an angle, the lifter case removed and the core allowed to be slid out and the core placed in proper sequence in the core box.

If the core does not slide out easily, increase the angle of suspension or the inner barrel and only if necessary tap lightly with a wooden or rubber mallet on the outer tube. Care should be taken that no damage or distortion to the outer tube occurs.

In a wet hole, a good practice is to have a second inner barrel assembly ready to go, and as soon as the first inner barrel is removed from the hole, the second can

be inserted and be descending while the first is having its core recovered and the assembly can be serviced for its next trip.

After the core is removed, the barrel/latch assembly/overshot should be serviced.

Check the condition and action of the core lifter. Wash out and remove any grit that may be in the lifter case as it could hamper the proper action of the core lifter.

Check that the inner tube rotates freely in the core barrel head. Washing/rinsing and occasional light lubrication may be required.

Check the inner tube for and signs of bending or distortion

Some experienced drillers may insert a small piece of core in the core lifter before returning it to the hole. The purpose is so that the inner barrel as it reaches the latch on it descent will not be restricted by any core still standing in the hole, as its entry into the core lifter will be *smooth* and the latching not delayed or prevented. This is added as a *note*, and not as a recommendation