Workplace Health and Safety

Fatality Report

WORKER ENTANGLED IN MACHINERY'S ROTATING SHAFT
Date of Incident: October 12, 2007
Type of Incident: Fatal

Government of Alberta
Employment and Immigration

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SECTION 1.0 DATE AND TIME OF INCIDENT

1.1 The incident occurred on October 12, 2007 at approximately 10:00 a.m.

SECTION 2.0 NAME AND ADDRESS OF PRINCIPAL PARTIES

2.1 Owner(s)

2.1.1 National-Oilwell Canada Ltd.
Suite 1200, 700-2 Street S.W.
Calgary, Alberta T2P 4V5

2.2 Prime Contractor

Not Applicable

2.3 Employer(s)

2.3.1 National Oilwell Varco (Distribution Services Group - Canada)
6101-56 Street
Lloydminster, Alberta T9V 2T2

2.4 Contractor(s)

3.1 Not Applicable

2.5 Supplier(s)

3.2 Not Applicable

2.6 Worker(s)

2.6.1 Pump Tech,

2.7 Others

3.3 Not Applicable

SECTION 3.0 DESCRIPTION OF PRINCIPAL PARTIES

3.1 Owner

3.1.1 National-Oilwell Canada Ltd is a source of rig equipment, integrated systems, down hole tools, and supply chain solutions. They supply spare parts from comprehensive drilling systems to a generic valve to a fully integrated supply chain process.

3.2 Prime Contractor

3.2.1 Not Applicable

3.3 Employer

3.3.1 National Oilwell Varco, located in Lloydminster, AB, is an industrial supply store and oilfield service shop. The building has a service and drilling shop, warehouse for oilfield products distribution and a pump shop.

SECTION 4.0 LOCATION OF INCIDENT

4.1 The incident occurred at National Oilwell Varco, 6101-56 Street, Lloydminster, Alberta. (Attachment "A" Map).

SECTION 5.0 EQUIPMENT, MATERIAL AND OBSERVATIONS

5.1 Equipment and Material

5.1.1 **Progressive Cavity (PC) Pump Test Bench**
Test Bench Specifications: Maximum speed 300 revolutions per minute (rpm) maximum pressure 3000 pounds per square inch (psi), maximum torque 1330 ft-lbs. All components are assembled by Corlac Equipment Ltd. The bench consisted of three parts. (Attachment "C" Photographs #1, 2)

5.1.1.1 The PC Pump Test Bench, Dimensions: Approximately 225 cm long and 95 cm wide and 200 cm tall;

5.1.1.2. Operator interface by Bracework;

5.1.1.3. Flux Vector AC Drive;

5.1.2 **Polish Rod** (Attachment "C" Photograph # 2)

5.1.2.1 The polish rod that extended from the Progressive Cavity Test Bench measured approximated 470 mm in length and 30 mm in diameter. It was comprised of steel material.

5.1.3 **Pony rods** (Attachment "C" Photograph # 3)

5.1.3.1 The first pony rod was attached to the polish rod. It measured 355 mm in length from A to B. The ends measured 50 mm in diameter and machined or designed to accept a 45 mm wrench. The intermediate or middle shaft rod tapered to 25 mm in diameter and was comprised of steel material.

The coupler was not able to be removed from the pony rod and its dimensions are noted in Photograph #7. This shaft was noted as having a slight bow or wobble. (Attachment "C" Photograph # 6)

5.1.3.2 Two pony rods were attached to each other by a female adapter. The adapter measured 103 mm long from B to C and 40 mm in diameter and was comprised of steel material.
(Attachment "C" Photograph # 7)

5.1.3.3 The second pony rod measured 580 mm in length from D to E. This measurement includes the thread length hidden inside the adapter. The threaded end at the widest part measured 40 mm. The ends were also designed to fit a 23 mm wrench. The intermediate or middle shaft measured 25 mm in diameter and was made of steel material. (Attachment "C" Photograph # 8)

5.1.4 **Progressive Cavity Pump Stand** (Attachment "C" Photograph # 9)

5.1.4.1 The stand measured approximately 3300 mm long, 1560 mm wide and 1100 mm tall. It was made of steel material and was equipped with a chain vise to secure progressive cavity pumps being serviced.

5.1.5 **Progressive Cavity Pump** (Attachment "C" Photograph # 10, 11)

5.1.5.1 It measured approximately 6740 mm in length and 100 mm in diameter. The assembly is made up of a stator and rotor components. The stator is the exterior casing made of steel with a double internal helix made of synthetic elastomer liner which is bonded to the inside of the steel casing. The rotor is a chrome-plated steel external helix, which rotates inside of the liner and casing.

5.2 Observations

5.2.1 The incident scene had been secured by RCMP until Alberta Workplace Health and Safety Compliance arrived on the scene.

5.2.2 There were no eyewitnesses to the incident.

SECTION 6.0 NARRATIVE DESCRIPTION OF THE INCIDENT

6.1 On October 12, 2007 at approximately 9:45 a.m, the Pump Tech was welding a coupler onto the rotor of a Progressive Cavity (PC) Pump. The Pump Tech was telling the Service Foreman he was having difficulty lining up the coupling and welding it on straight.
(Attachment "C" Photograph #10)

6.2 Before leaving, the Service Foreman told the Pump Tech to cut off the coupler and try to weld it on again or get help from Tong Repairman and then left for the other shop a few blocks away. When the Service Foreman left, the Pump Tech was standing in the pump shop area working on a PC pump.

6.3 At some time during the Service Foreman's absence, the Pump Tech went to assemble the pony rod to the polish rod by operating the PC Pump Test Bench. During this action of engaging the threads of the pony rod by machine power, his hand and arm were wrapped around the rotating assembly that extended from the PC pump test bench.

6.4 At approximately 10:00 a.m., the Service Foreman returned from the other shop and entered through the rear door and found the PC Pump Test Bench in operation. The Service Foreman noticed rags on the end of the pony rods and approached the PC Pump Test Bench to turn if off. It was at this moment that the Service Foreman observed the Pump Tech lying on the floor.

6.5 The Service Foreman went into the front office and called 911 and provided directions to the shop as the others assisted the Pump Tech.

6.6 The Service Foreman yelled to the Tong Repairman, already at the rear of the shop, to check on the Pump Tech. The Tong Repairman began providing first aid.

6.7 The Shipper/Receiver and the Warehouse Supervisor returned from a coffee break and heard the commotion in the shop. The Shipper/Receiver assisted the Tong Repairman.

6.8 Pump Tech came to the aid of the Shipper/Receiver and the Tong Repairman and indicated he knew first aid. The Shipper/Receiver asked the Pump Tech to take over artificial resuscitation for her because she was getting tired. It was at this moment the Shipper/Receiver noticed the left arm of the Pump Tech was severed.

6.9 The Pump Tech applied artificial resuscitation for a few moments before the ambulance and paramedics arrived.

6.10 Pump Tech was stabilized at the worksite and transported to hospital.

6.11 Pump Tech died in hospital from his injuries at 3:35 p.m. October 12, 2007.

SECTION 7.0 ANALYSIS

7.1 Direct Cause

7.1.1 The Pump Tech was seriously injured when his hand and arm was drawn into in the rotating polish rod and pony rod assembly which extended from the PC Pump Test Bench.

7.2 Contributing Factors

7.2.1 Workers routinely attached the PC Pump to the bench while the PC Pump Test Bench was in operation. The PC Pump Test Bench was observed having a rotational speed of 73 revolutions per minute at the time of the incident.

7.2.2 Supervision was aware of the practice of operating the PC Pump Test Bench to attach a PC Pump rotor for servicing despite a reference in a Job Safety Analysis titled "Basic Test Bench Operation" conducted by Service Foreman; recommending to only hand tighten without the machine in operation.

7.2.3 Although a Job Safety Analysis was conducted on February 20, 2007; there were no records that indicated this document was reviewed with operators of the PC Pump Test Bench.

7.2.4 Although the Pump Tech was provided an Employee Safety Orientation, no records were available to the investigators that indicated the Pump Tech was provided safety training in the operation of the PC Pump Test Bench.

7.2.5 Although a PC Pump Service Procedure was developed, there were no records available to the investigators that indicated the procedure was reviewed with the affected PC Pump Techs before work began.

SECTION 8.0 FOLLOW-UP/ ACTION TAKEN

8.1 Employment and Immigration; Workplace Health and Safety Compliance

8.1.1 Workplace Health and Safety Compliance issued an order to provide PC Pump Test Bench specifications, a hazard assessment, worker training records and first aid certifications.

8.1.2 Workplace Health and Safety Compliance issued an order to National Oilwell Varco to conduct an investigation, prepare a report and have it available for review by Workplace Health and Safety Compliance.

8.1.3 Workplace Health and Safety Compliance issued an order to National Oilwell Varco to have the Emergency Shut Down (ESD) on the PC Pump Test Bench inspected by a Professional Engineer.

8.1.4 Workplace Health and Safety Compliance issued a Stop Use Order to National Oilwell Varco and asked them to respond in writing to the officer on how they intend on controlling or eliminating hazards identified in their hazard assessments.

8.1.5 Workplace Health and Safety Compliance issued an order to National Oilwell Varco to respond in writing on how they propose to ensure the competency of workers, document the operator training process and who will monitor improvements or changes to their Health Safety and Environment (HSE) program.

8.2 Industry

8.2.1 National Oilwell Varco submitted the requested documents available to Alberta Workplace Health and Safety Compliance.

8.2.2 National Oilwell Varco conducted the investigation into the incident and made available a copy of the report to Alberta Workplace Health and Safety Compliance.

8.2.3 National Oilwell Varco had the Emergency Shut Down on the PC Pump Test Bench inspected by a Professional Engineer and submitted a report from the Professional Engineer to Workplace Health and Safety Compliance for review.

8.2.4 National Oilwell Varco retrofitted the PC Test bench with two-handed starting to prevent operation of the equipment while in the hazardous area and a pressure mat installed in the hazardous area will shut the machine off when stood on by an operator. A “Stay Clear Zone” will be marked on the floor around the rotating end of the PC Test bench and the ESD has been reconfigured to engage dynamic braking when the ESD is activated. In addition, high visible warning signs would be applied to the test bench equipment

8.2.5 New workers will be evaluated by a designated trainer; a senior PC Pump technician. Operators will be required to have an 80% grade on a written and practical skills exam.

8.2.5.1 A PC Pump test bench audit team, consisting of a designated trainer with 1 or 2 members of the National Oilwell Varco Engineering and design team, are responsible to follow-up and ensure adherence with the company procedure manual. This team will also be responsible for the documentation and training process.

8.2.5.2 Improvements to the existing HSE program will have direction from the corporate HSE Manager. Day to day operation will be a responsibility of the local HSE supervisor and the management group. Weekly leadership meetings currently take place where HSE performance will be discussed.

8.3 Additional Measures

8.3.1 No additional measures at this time.

SECTION 9.0 SIGNATURES

ORIGINAL SIGNED

*Original Report Signed*_____ _____
Investigator Date

*Original Report Signed*_____ _____
Investigator Date

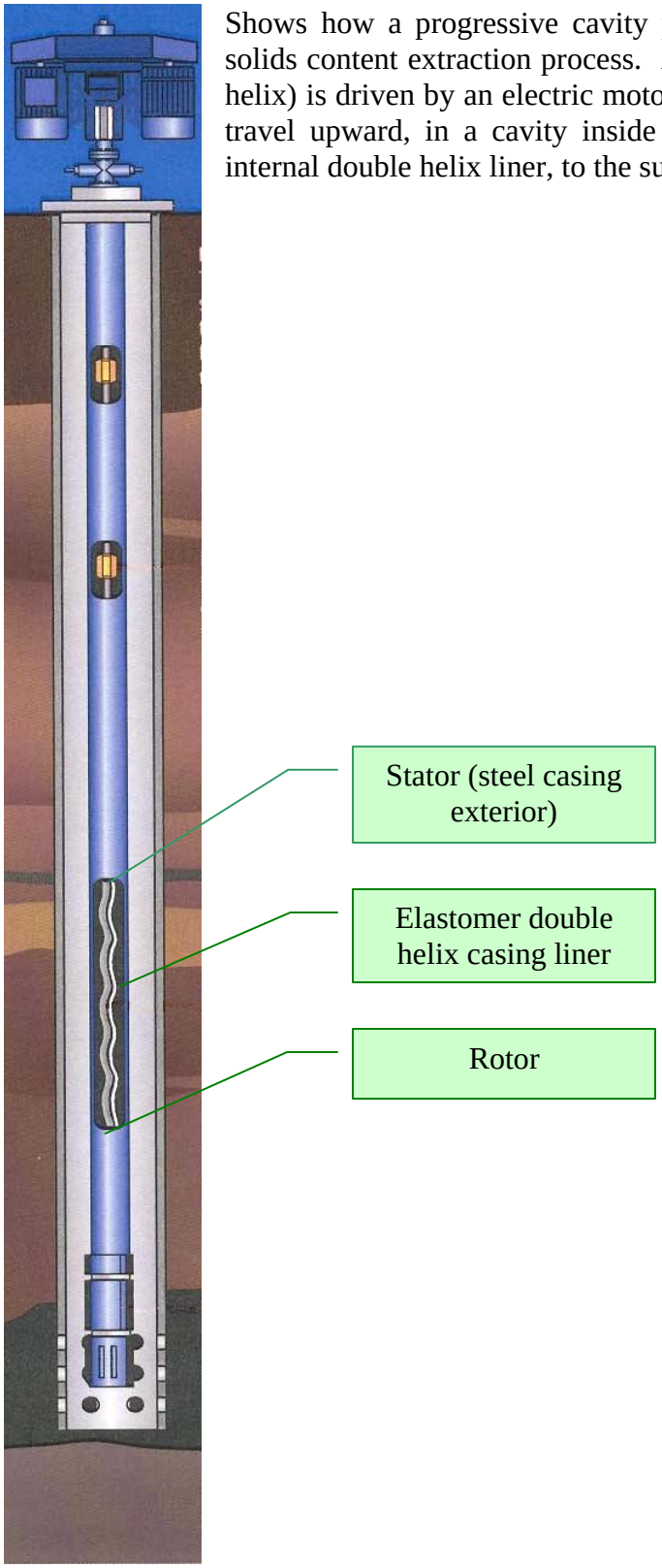
*Original Report Signed*_____ _____
Manager Date

*Original Report Signed*_____ _____
Regional Senior Manager, North Date

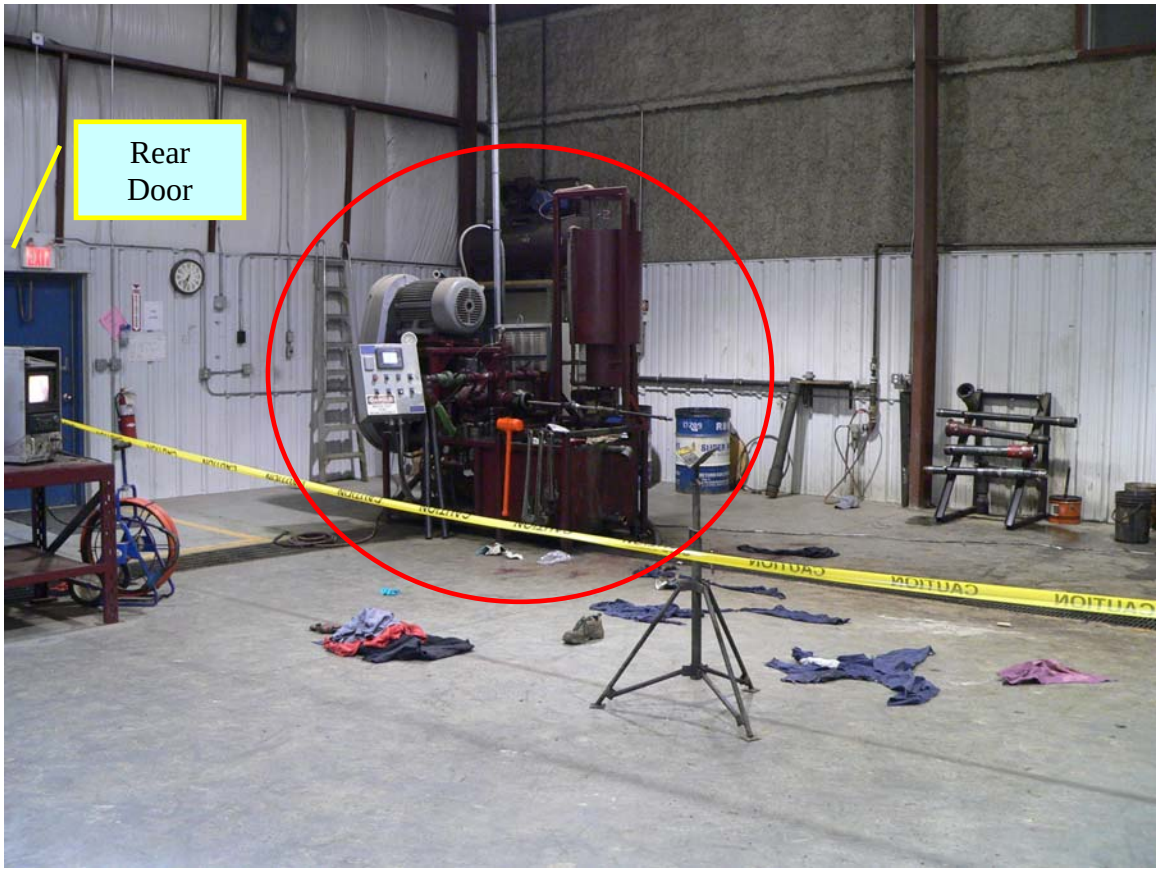
SECTION 10.0 ATTACHMENTS:

Attachment A Map
Attachment B Diagrams
Attachment C Photographs

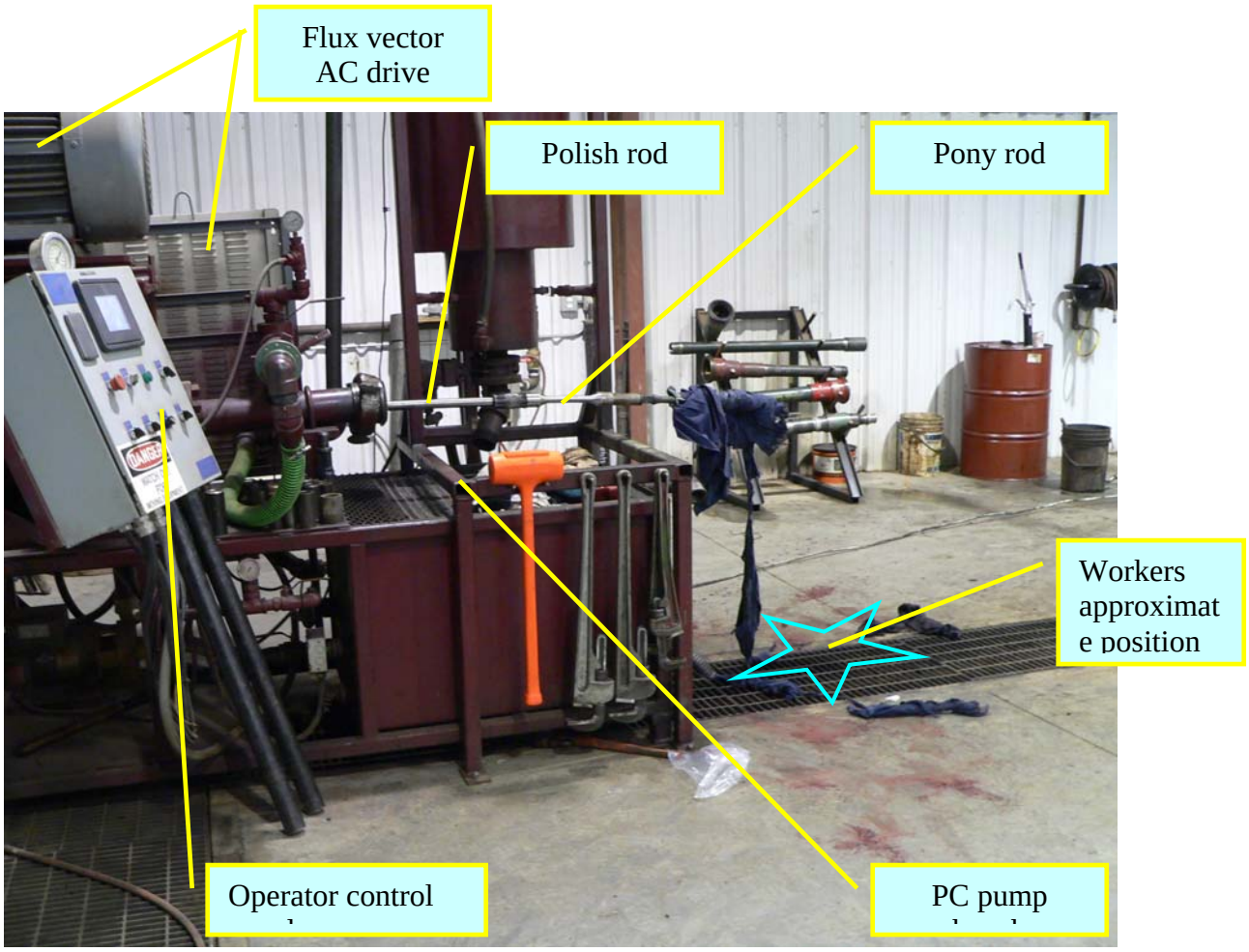

National Oilwell Varco
56 St
60 Ave
55 St
62
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
© 2008 Europa Technologies
Google
53°17'29.23" N 110°01'51.00" W
elev 2136 ft
Aug 19, 2004
Eye alt 5048 ft



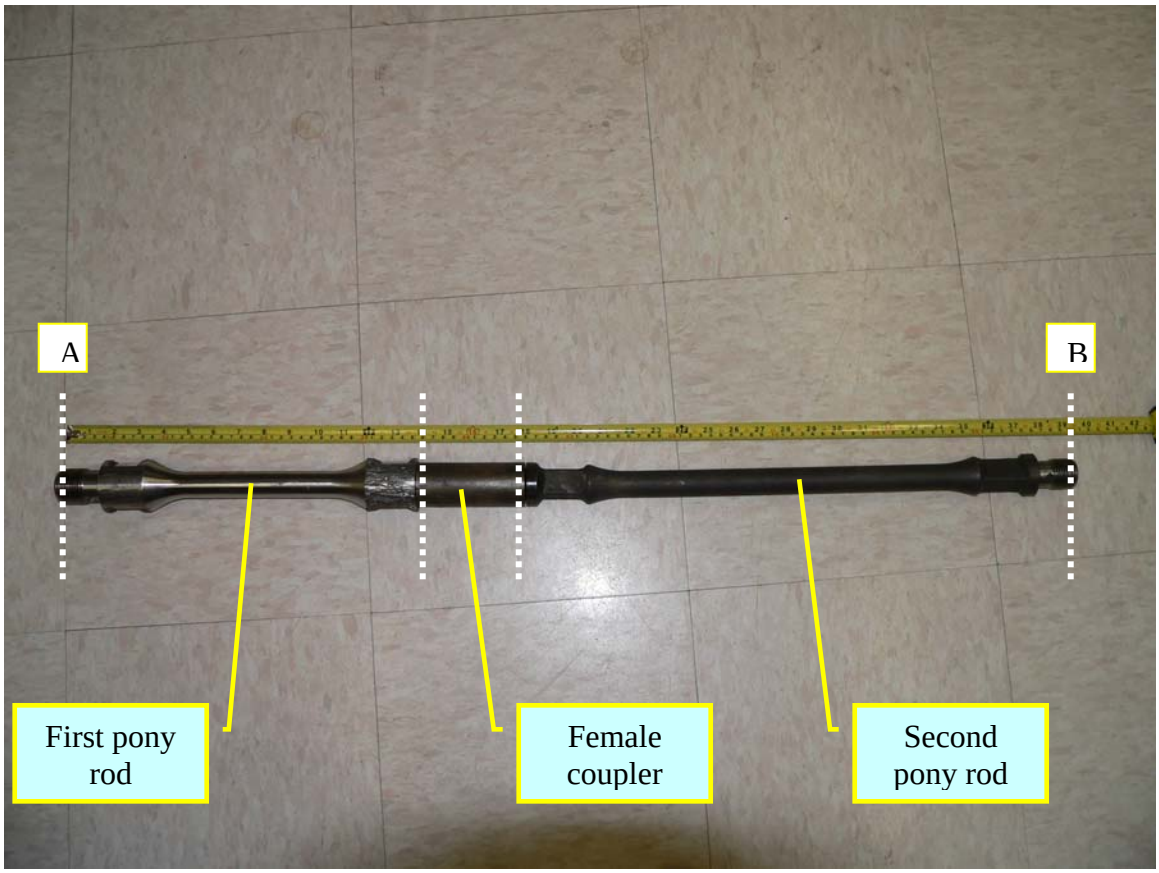
Shows how a progressive cavity pump is used in a heavy oil or high solids content extraction process. As the rotor (a chrome plated external helix) is driven by an electric motor at the surface this causes the fluid to travel upward, in a cavity inside the steel casing through the molded internal double helix liner, to the surface to be collected.



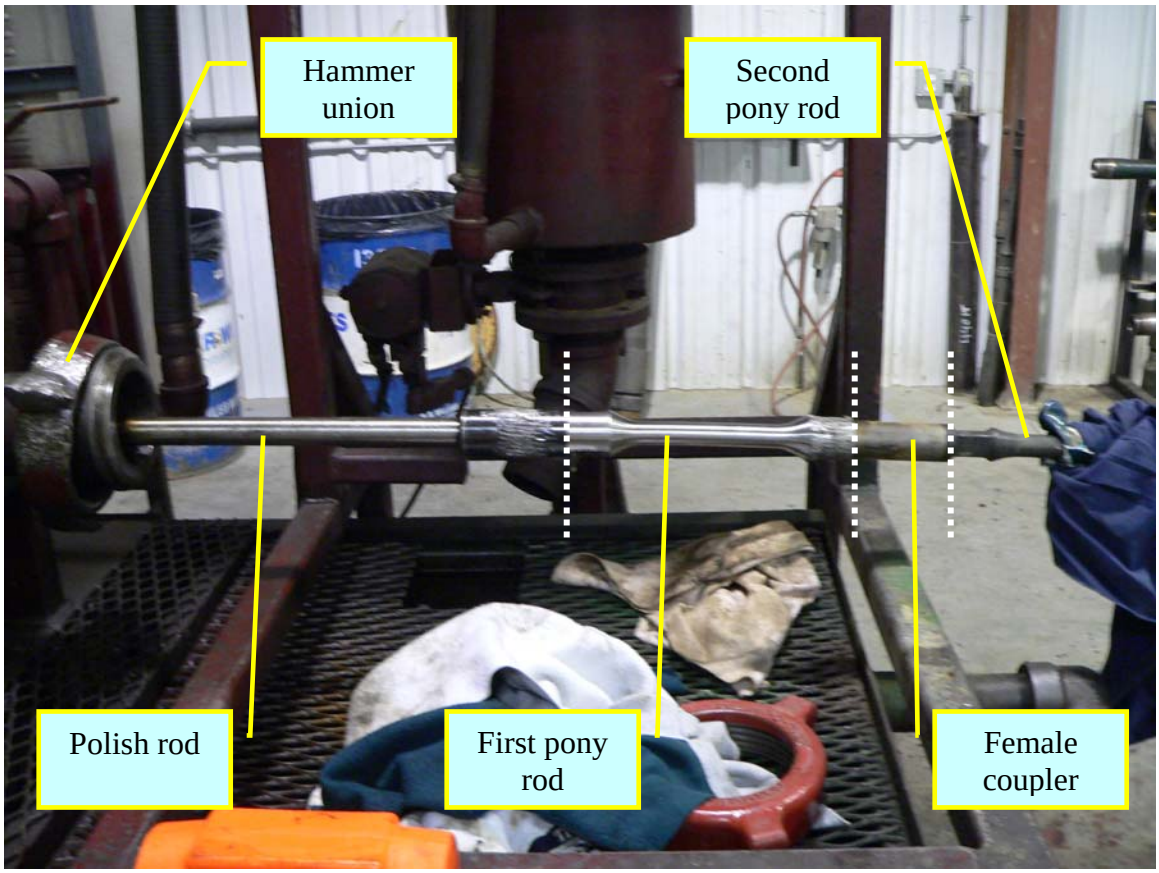
Photograph #1 Shows the progressive cavity pump test bench located in the northeast corner of the pump shop (circled in red).



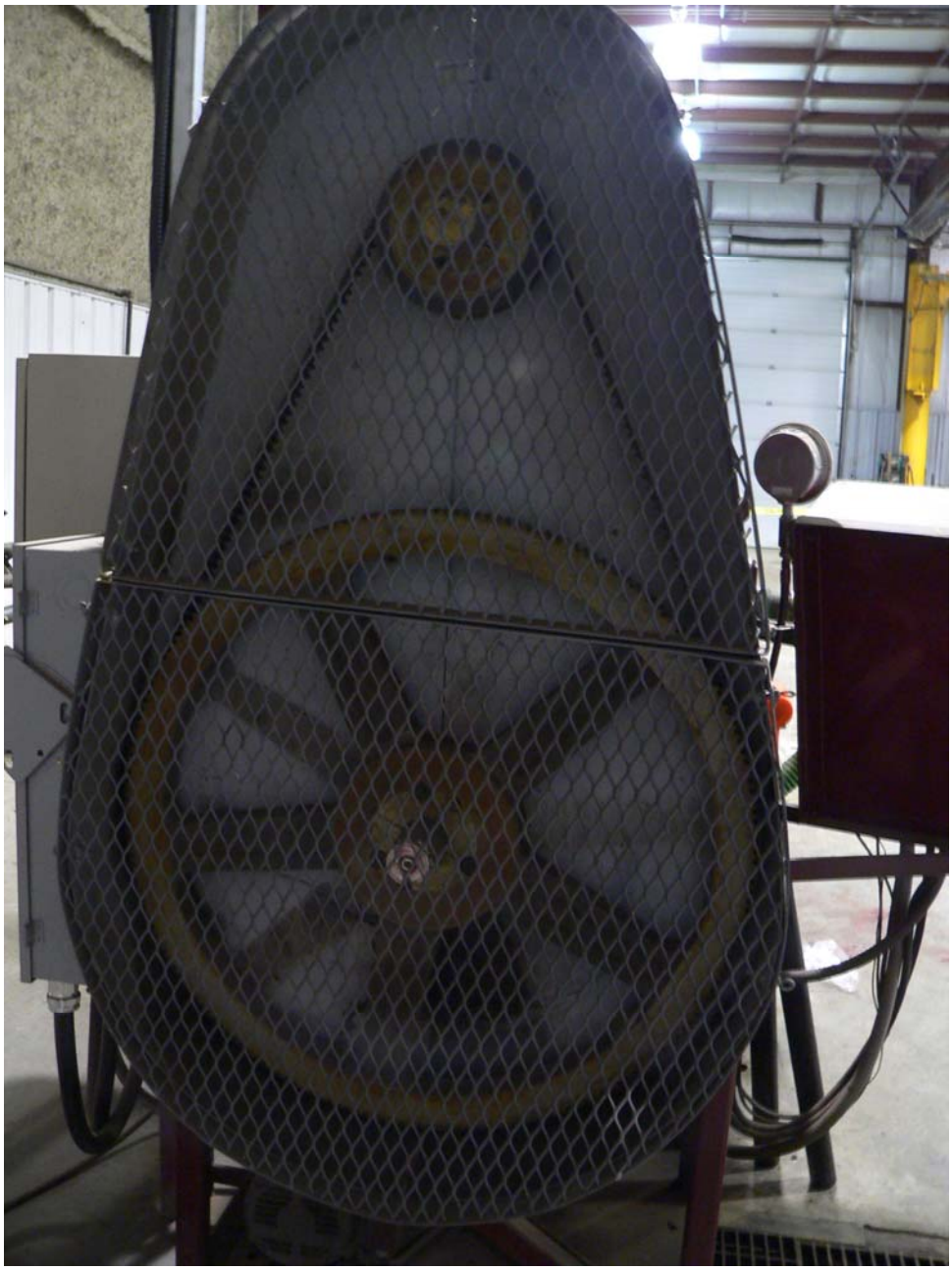
Photograph #2 Shows the different components that make up the progressive cavity pump test bench. The rods were rotating in a counter clockwise direction at the time of the incident.



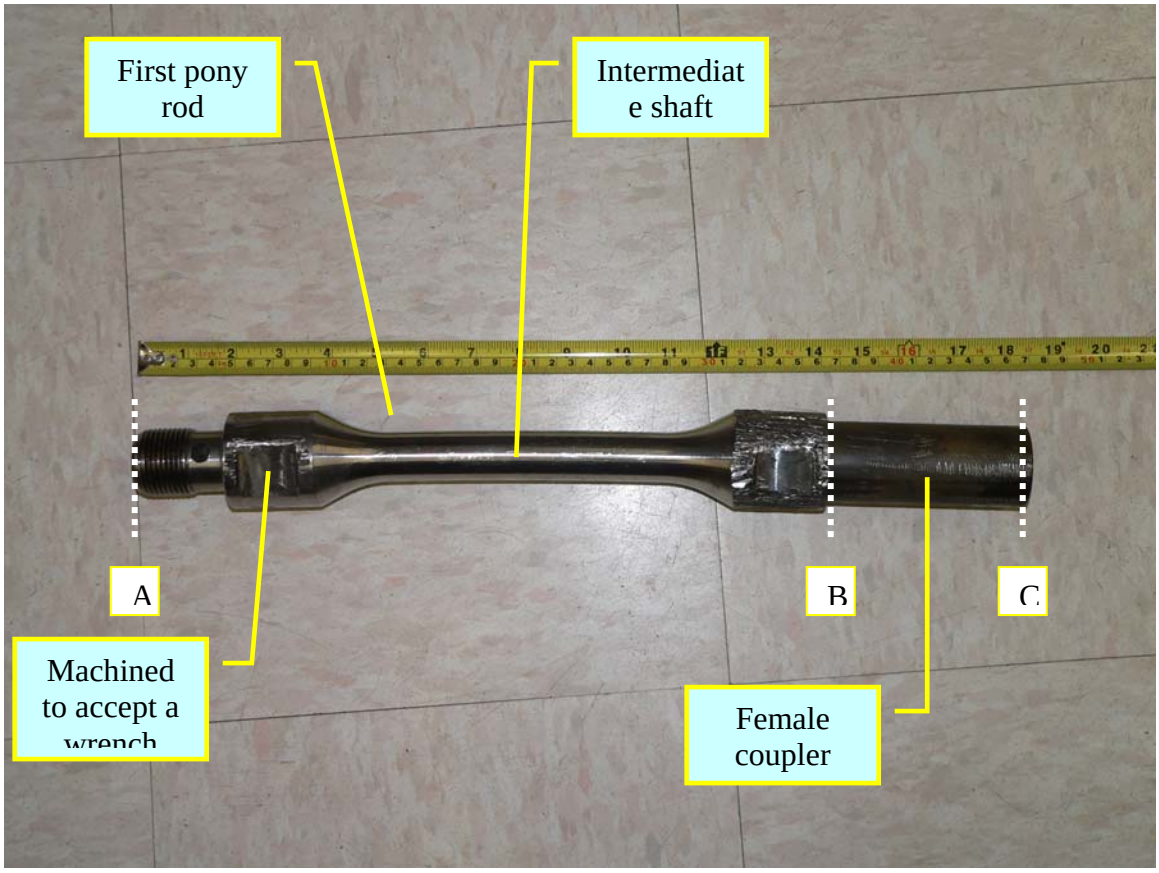
Photograph #3 Shows the pony rods attached by a female coupler. The entire assembly measured 995 mm long from A to B and is made from steel material.



Photograph #4 Shows the polish rod and connected pony rods that make up the rotating drive assembly of the progressive cavity pump test bench. The polish rod is attached to the test bench’s flywheel which rotates the polish rod up to 300 revolutions per minute (rpm) and 1330 ft-lbs of torque

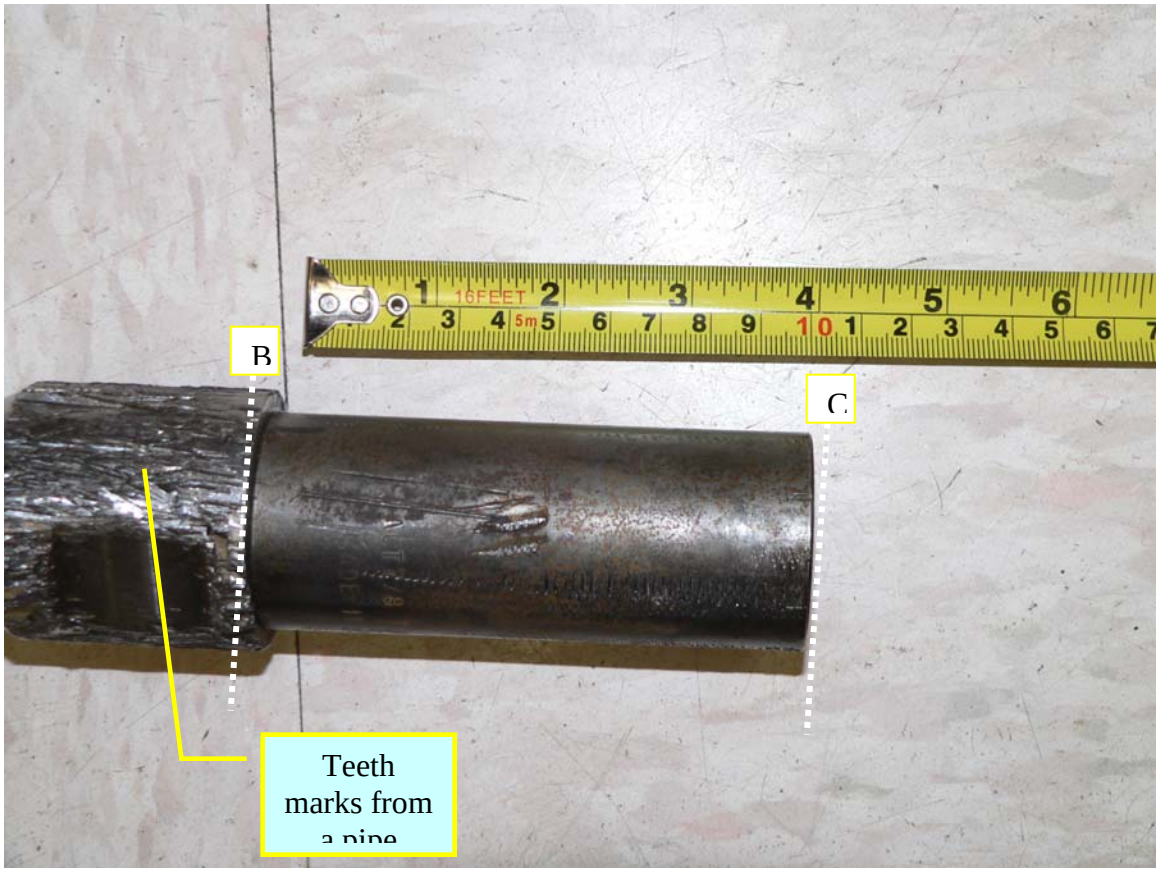


Photograph #5 Shows the right side of the progressive cavity test bench. The flywheel enables the polish rod to rotate at the maximum 300 revolutions per minute (rpm) and 1330 ft-lbs of torque.



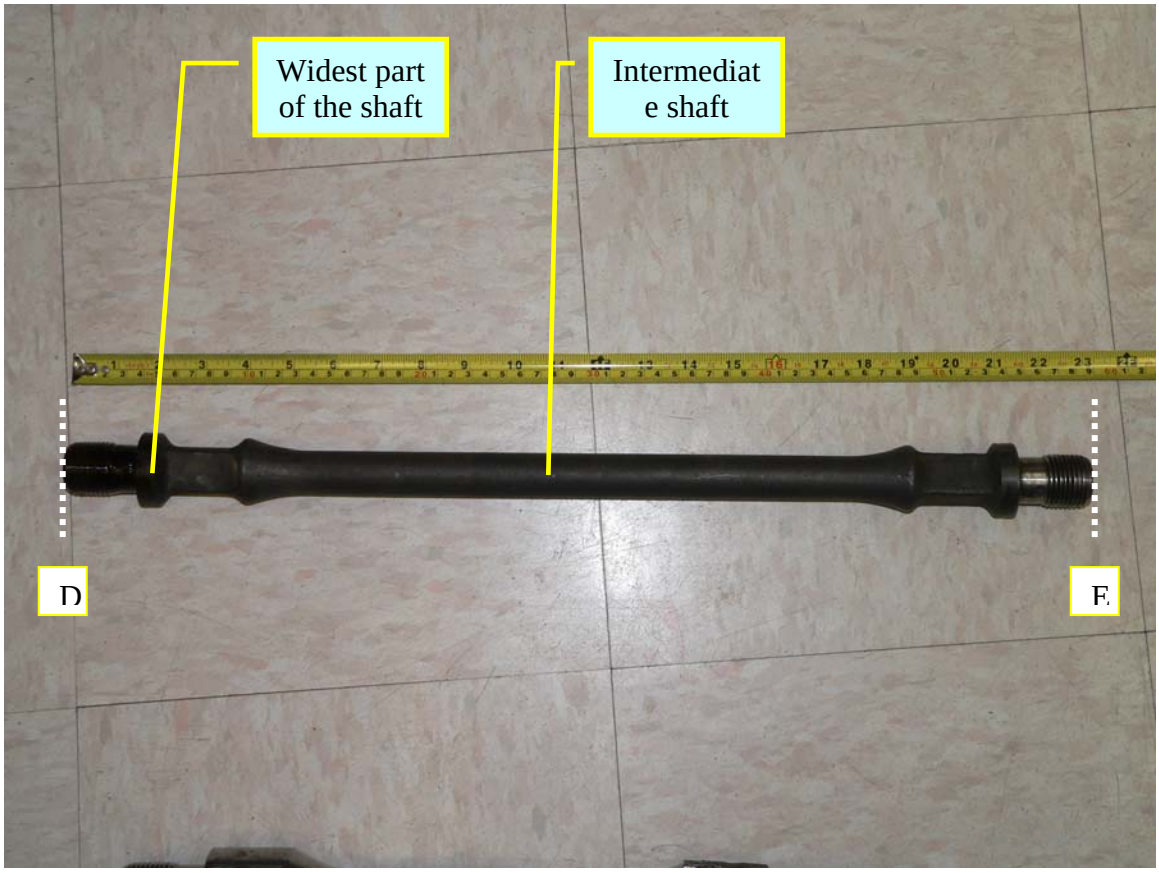
Photograph #6 Shows the first pony rod that was found attached to the polish rod of the progressive cavity pump test bench. It measured approximately 355 mm from A to B. The ends measured 50 mm diameter and were machined or designed to accept a 45 mm wrench. The intermediate or middle shaft measured 25 mm in diameter.

The coupler was not able to be removed from the pony rod and its dimensions are noted in Photograph #7. This shaft was noted as having a slight bow or wobble.



Photograph #7 Shows the coupler that connected the first pony rod and the second longer pony rod together. The coupler measured 103 mm from B to C in length and measured 40 mm outside diameter. It was made of steel material. The ends were internally threaded.

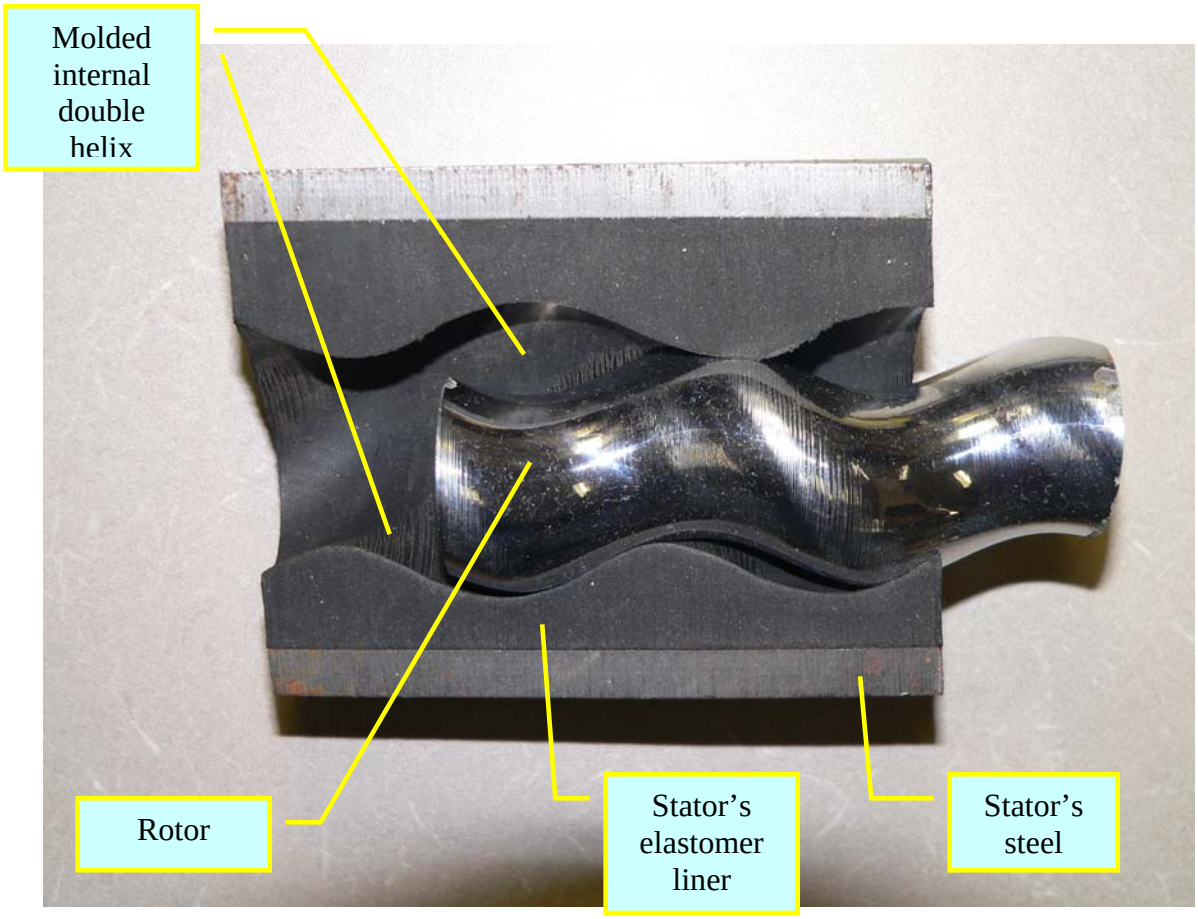
A pipe wrench was used primarily to tighten rods together.



Photograph #8 Shows the second pony rod that attached to the rotor of the progressive cavity pump. It measured 580 mm in length from D to E. This measurement includes the thread length hidden inside the adapter. The threaded end at the widest part measured 40 mm. The ends were also designed to fit a 23 mm wrench. The intermediate or middle shaft measured 25 mm in diameter and was made of steel material.

Photograph #9 Shows the progressive cavity pump and the progressive cavity pump stand. A progressive cavity pump is also referred to as an eccentric screw pump, cavity pump or single screw pump.

Photograph #10	Shows the progressive cavity pump assembly. It is made up of two parts: A rotor and a stator. The rotor, when spun by electric motor, causes the well fluids to progress in an upwards direction. The stator, which is made up of a synthetic elastomer liner has a double internal helix permanently bonded to the inside of a steel housing. (See Photograph #11 and Attachment "B" Diagram) The female coupler was welded onto the rotor by the worker. The coupler attaches to a pony rod extending from the progressive cavity test bench. The worker welded the coupler onto the rotor in anticipation of attaching the rotor to the pony rod to extract the rotor from the stator.



Photograph #11	Shows the cross-section of a progressive cavity pump and internal descriptions of parts.