Geopro S.A.

Inflatable packers and equipment
for water wells

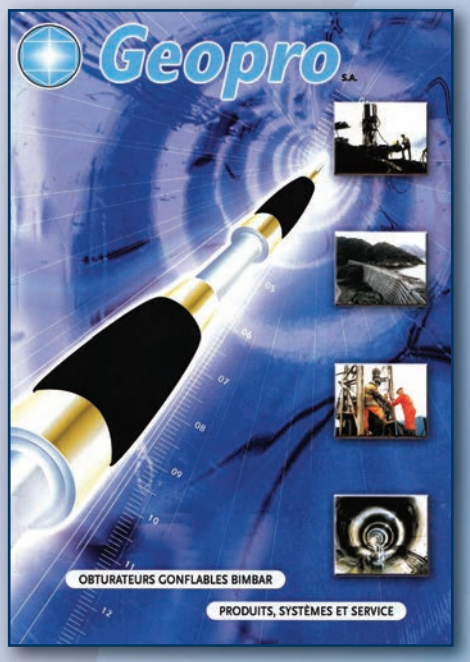

PUMPING


CEMENTATION


LINING
REHABILITATION

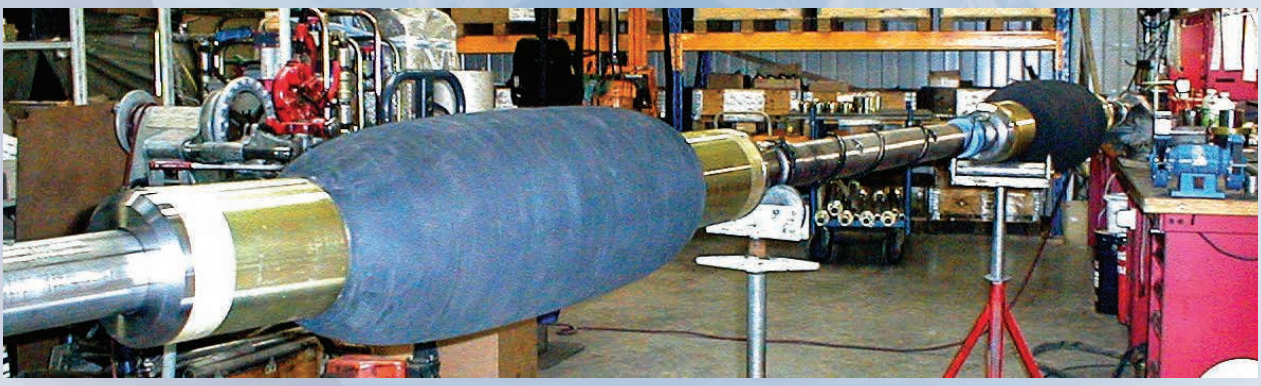
MGS

Edition november 2004



The *"Bimbar Inflatable Packers"* Catalogue is available on our website **www.geopro.be**

Since its creation , ***Geopro*** has continually expanded its sales throughout the world. Today ,Geopro exports its **BIMBAR inflatable packers** in more than 50 countries. This achievement confirms the quality and reliability of our products in this exacting market of special foundations works and hydro dams construction.
A fast and efficient technical department has largely contributed to this success.



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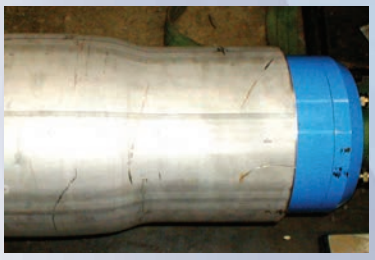
Today ***Geopro*** is developing innovative systems for
water well production and rehabilitation.

The purpose of this catalogue is to introduce our range of inflatable packers and services for which Geopro has numerous references all over the world.



Summary

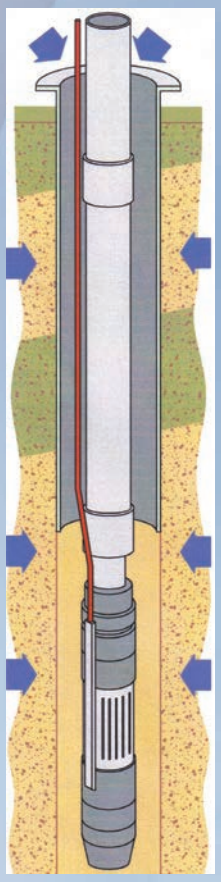
Pumping and water extraction

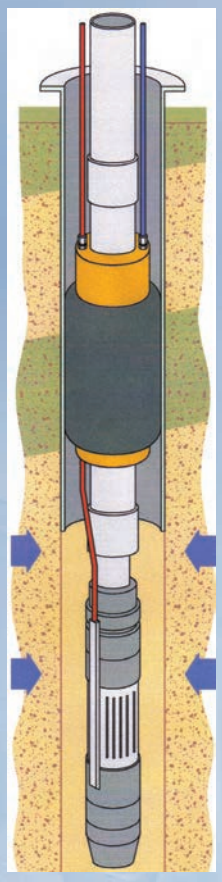
Repair and cementation systems for water wells

Products and services

PUMPING AND WATER EXTRACTION

Advantages of using inflatable packers in water pumping systems





When a pump is installed in a well using a traditional method i.e. without an inflatable packer, the production zone of the well is in direct contact with external atmosphere and the water surface.

In this case, the well is not protected against potential chemical and bacterial contamination.

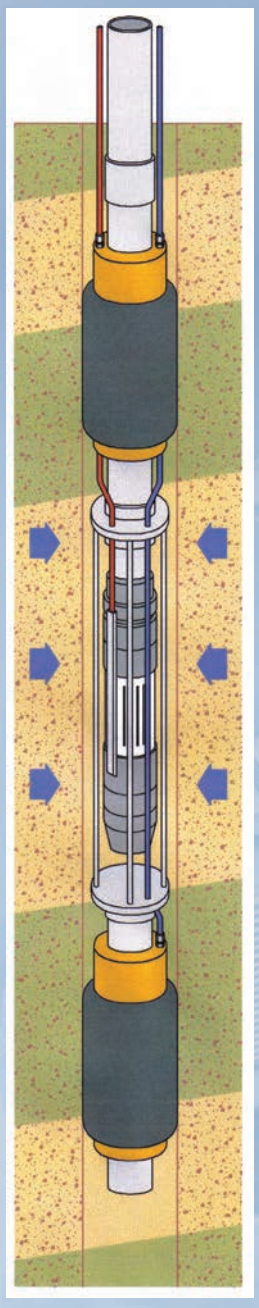
For an uncased well or if the casing is corroded and leaking, aquifers of different quality can be mixed lowering the produced water quality.

The installation of an inflatable packer (with or without riser), eliminates the majority of these problems.

- **Pumping is selective and produces only the aquifers selected for their quality.**
- **The produced zone is isolated and protected against contamination from the surface.**
- **The zone of marling is eliminated and bacterial activity is drastically reduced.**
- **The well section below the packer can remains under pressure**

Different possibilities of using inflatable packers for well pumping

Submersible pump hanged to a packer in progress of installation in a water well.



Submersible pump positionned between two packers.

Single packer.

The single packer is a system equipped with only one inflatable element.

The pump is connected under the packer. This assembly can then be used with riser or without riser (Riserless).

Double packer.

The double packer is a system equipped with two inflatable elements.

The pump is positioned between two inflatable packers.This configuration allows selective pumping. The production zone is isolated from the remainder of the bore hole.

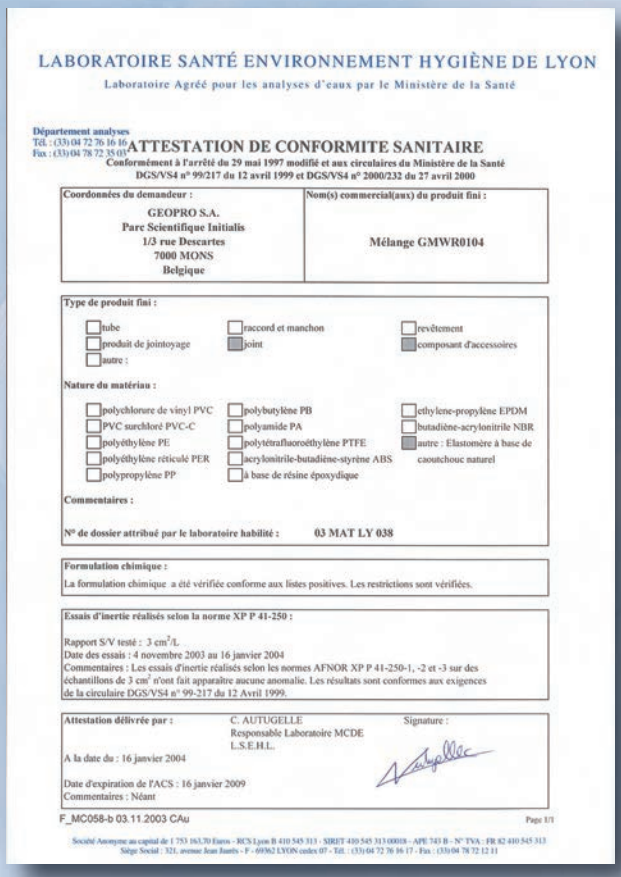
The distance between the two inflatable elements is adjustable.

It is possible to mount the pump below the double packer system. In this case, an undesirable zone is isolated from production by the two inflatable elements.

THE FOOD GRADE CERTIFICATION

Geopro has developped an elastomer destinated to the manufacture of dilatable elements for which we have received a Food grade certification conforming with the French standard reference DGS/VS4 and DGS/VS4 N° 99/217.This standard is related to the materials used in installation for water distribution destinated to human comsumption. Therefore, Geopro is able to supply inflatable packers and accessories for the thermal or mineral water industries such as :

- **Inflatable packers – pumps assemblies with or without riser**
- **Double packer for selective pumping**
- **Repair and rehabilitation "swage packer" system for water wells**
- **Inflatable packer and cementation valve**



LABORATOIRE SANTÉ ENVIRONNEMENT HYGIÈNE DE LYON

Laboratoire Agréé pour les analyses d'eaux par le Ministère de la Santé

Département analyses
Tél. : (33) 04 72 76 16 16
Fax : (33) 04 78 72 35 03

ATTESTATION DE CONFORMITE SANITAIRE

Conformément à l'arrêté du 29 mai 1997 modifié et aux circulaires du Ministère de la Santé DGS/VS4 n° 99/217 du 12 avril 1999 et DGS/VS4 n° 2000/232 du 27 avril 2000

Coordonnées du demandeur :	Nom(s) commercial(aux) du produit fini :
GEOPRO S.A. Parc Scientifique Initialis 1/3 rue Descartes 7000 MONS Belgique	Mélange GMWR0104

Type de produit fini :

☐ tube ☐ raccord et manchon ☐ revêtement
☐ produit de jointoyage ☒ joint ☐ composant d'accessoires
☐ autre :

Nature du matériau :

☐ polychlorure de vinyl PVC ☐ polybutylène PB ☐ ethylene-propylène EPDM
☐ PVC surchloré PVC-C ☐ polyamide PA ☐ butadiène-acrylonitrile NBR
☐ polyéthylène PE ☐ polytétrafluoroéthylène PTFE ☒ autre : Elastomère à base de caoutchouc naturel
☐ polyéthylène réticulé PER ☐ acrylonitrile-butadiène-styrène ABS
☐ polypropylène PP ☐ à base de résine époxydique

Commentaires :

N° de dossier attribué par le laboratoire habilité : 03 MAT LY 038

Formulation chimique :
La formulation chimique a été vérifiée conforme aux listes positives. Les restrictions sont vérifiées.

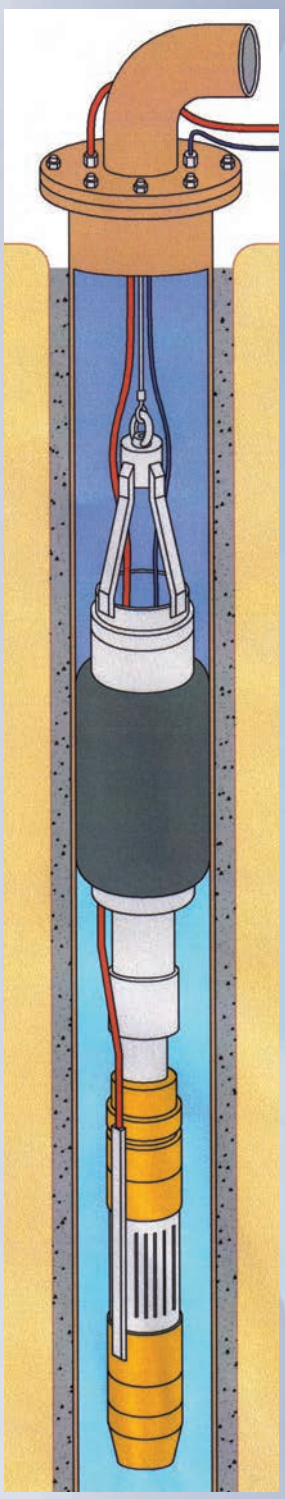
Essais d'inertie réalisés selon la norme XP P 41-250 :
Rapport S/V testé : 3 cm^2/L
Date des essais : 4 novembre 2003 au 16 janvier 2004
Commentaires : Les essais d'inertie réalisés selon les normes AFNOR XP P 41-250-1, -2 et -3 sur des échantillons de 3 cm^2 n'ont fait apparaître aucune anomalie. Les résultats sont conformes aux exigences de la circulaire DGS/VS4 n° 99-217 du 12 Avril 1999.

Attestation délivrée par : C. AUTUGELLE, Responsable Laboratoire MCDE L.S.E.H.L. Signature :
A la date du : 16 janvier 2004
Date d'expiration de l'ACS : 16 janvier 2009
Commentaires : Néant

F_MC058-b 03.11.2003 CAu Page 1/1

Société Anonyme au capital de 1 753 163,70 Euros - RCS Lyon B 410 545 313 - SIRET 410 545 313 00018 - APE 743 B - N° TVA : FR 82 410 545 313
Siège Social : 321, avenue Jean Jaurès - F - 69362 LYON cedex 07 - Tél. : (33) 04 72 76 16 17 - Fax : (33) 04 78 72 12 11

"RISERLESS"
A pumping assembly without riser pipe.



Casing corrosion and bacterial contamination are the most frequent problems occurring in water wells.
The use of a riserless system guarantees permanent water quality without extra cost during operation.

The assembly is composed of an inflatable packer connected to the submersible pump which is lowered with a cable or a pipe.
Once the packer is inflated, the casing is used as a production column .The part of the casing located between the packer and the surface is always pressurized by water eliminating the risk of external contamination.

- **Efficient protection against bacterial contamination**
- **Long term protection against casing corrosion**
- **Fast set up and maintenance**
- **Fully compatible with standard submersible pumps**

SITE REPORTS AND EXAMPLES OF USE

South West of France

• Mineral water well belonging to an International Group.

Supply of a 143 mm OD single packer, all 316 stainless steel , equipped with a 2" center pipe (OD = 60,3 mm), food grade certified rubber, rubber length = 500 mm.
Complete riserless assembly with cable sealing stuffing boxes, inflation adapters and connections for the submersible pumps.

BELGIUM

- Net of groundwater circulation wells of 50 meter depth, 264 mm ID casing for in-situ soil rehabilitation (Pharmaceutical company)
- Geological formations : sand and clay
- Application: pumping with a submersible pump in a zone isolated by a 220 mm OD Geopro single packer. The outer cover of the packer is made of viton and all metal parts are completely stainless steel made.

SITE REPORTS AND EXAMPLES OF USE

Abu Dhabi

- Rorary drilling in 8 1/2" reamed to 12 ¼" for deep aquifer exploration, 4000 feet deep.
- Sedimentary formation with several artesians aquifers.
- Application: sampling different aquifers using a ZI type Geopro double packer (OD = 170 mm) under mud column . Water sampled by reducing the mud column weight

Results : location of a drinkable water aquifer verified at 810 m deep.

Menorca

- 150 m of 12 1/4" (311mm) borehole for drinkable water supply
- Karstic formation
- Pumping water with a submersible pump from a zone isolated by a Geopro inflatable packer.

Results : Elimination of turbity and drastic reduction of the nitrate percentage making the water drinkable.

Chile

- 12 1/4" boreholes in a lithium mine
- Selective pumping of water from different boreholes using a double packer

Supply of a complete 170 mm double packer to fit the submersible pump.

SITE REPORTS AND EXAMPLES OF USE

Poland – Krakow Area

• Thermal water production saturated with H2S

Supply and installation of a casing annulus packer, all stainless steel, OD = 210 mm to be mounted on a PVC riser pipe (OD = 165 mm). Rubber length = 1 meter.
The annulus between the PVC pipe and the center pipe of the packer is sealed using injection of epoxy resin.
For this permanent installation, the packer is equipped with a non return valve and it is inflated with water.

SPAIN – Palma De Mallorca

• water sampling with a MP 1 pump in a 3" piezometer.

Supply of a MP 1 pump assemblied to a 56 mm OD single packer .
Thanks to the inflatable packer, the sampling zone is isolated. The time for testing is reduced and the water sample is representative .
This single packer assembly can be easily transformed into a double packer configuration if a specific zone must be tested.

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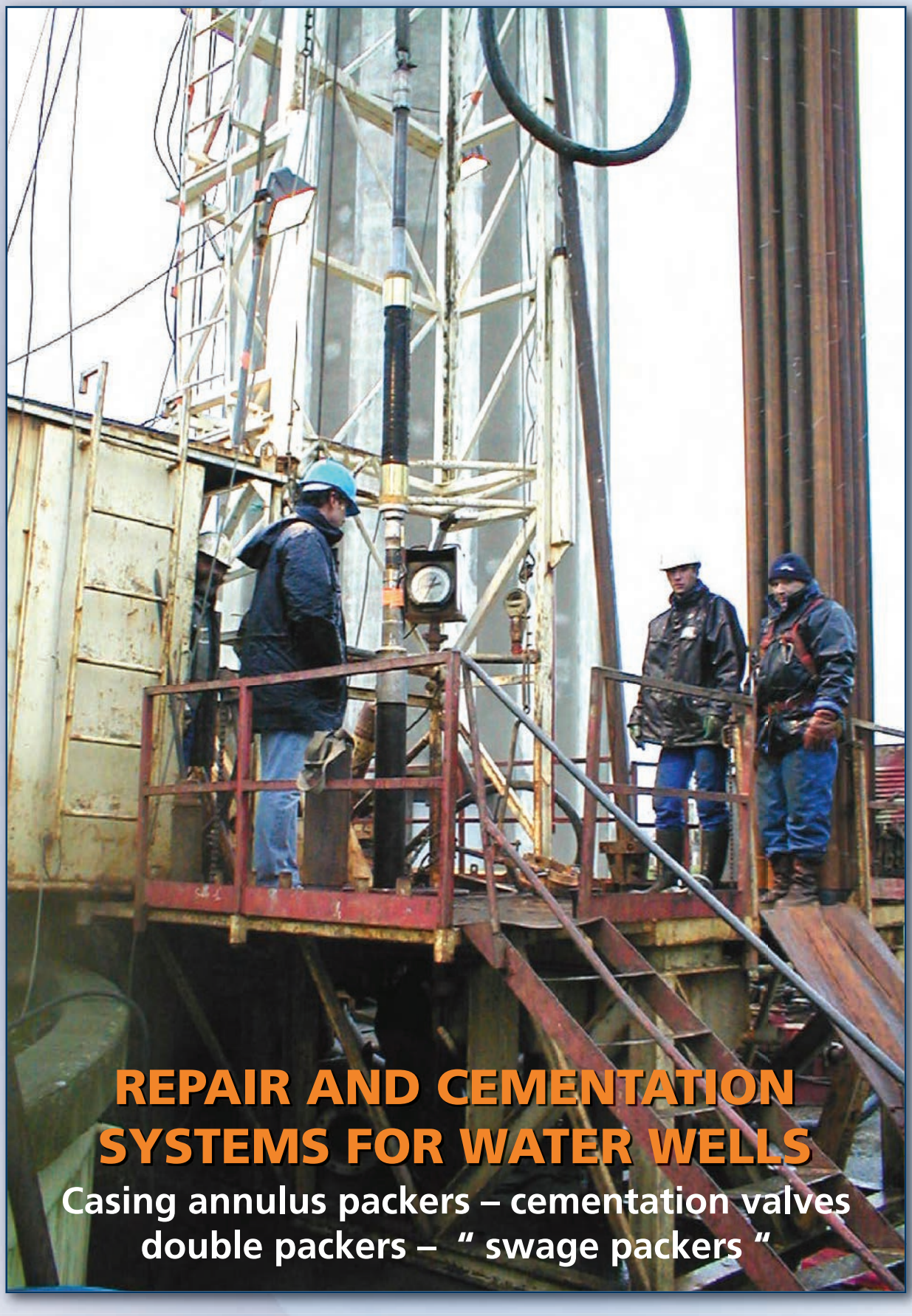

REPAIR AND CEMENTATION SYSTEMS FOR WATER WELLS

Casing annulus packers – cementation valves double packers – " swage packers "

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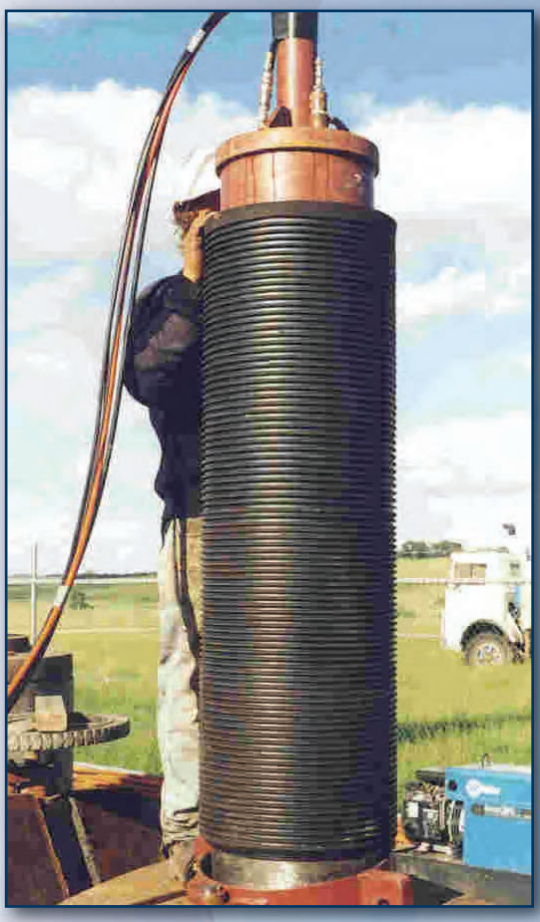
"SWAGE PACKER"

A repair system for water wells



Corrosion of the casing is a very common and frequent problem in water wells.

The "swage packer" method allows to carry out quickly and efficiently a local repair or a complete re-lining of water wells without compromising the existing production capacity of the well.

The method consists of using a high pressure inflatable packer to permanently deform a stainless steel tube, covered partially or completely with rubber, so that it seals against the existing casing .

Benefits include :

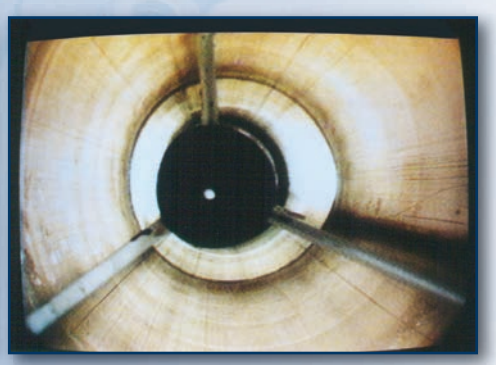
- **Fast repair with ligth equipment.**
- **Initial diameter of the well preserved**
- **Permanent mechanical seal**
- **Compatible with proven grouting techniques.**

Before Re-lining

Camera inspection of a corroded well.

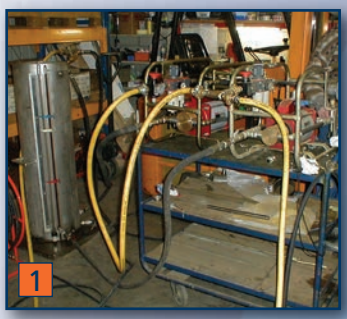
After Re-lining

Surface view of a relined well.



Camera inspection of a relined well.

Steps in the repair of a casing when using a « SWAGE PACKER »



Before any site intervention, the casing well should be carefully brushed away to eliminate as much as possible all dirt and debris from the casing. Furthermore the casing ID should be callipered to guarantee a good final swage results.

1 - Check-up.

The equipment necessary for the intervention is completely checked-up.

2 – Calibration in the workshop.

The pipe expansion under pressure is calibrated in order to accurately control the volume of water and pressure required to reach the diameter of the old casing.

3 – Running of the "swage packer" and new tubing.

The "swage packer" and the new tubing are lowered into the well. The length of this assembly will depend on the length of the corroded area in the old casing. If the length of the repair is short, the assembly can be lowered using only the high pressure packer without a crane.

4 – Running of the high pressure packer and swaging.

Once the new tubing is positioned, it is swaged step by step with the high pressure packer.

5 – Verification of the new liner.

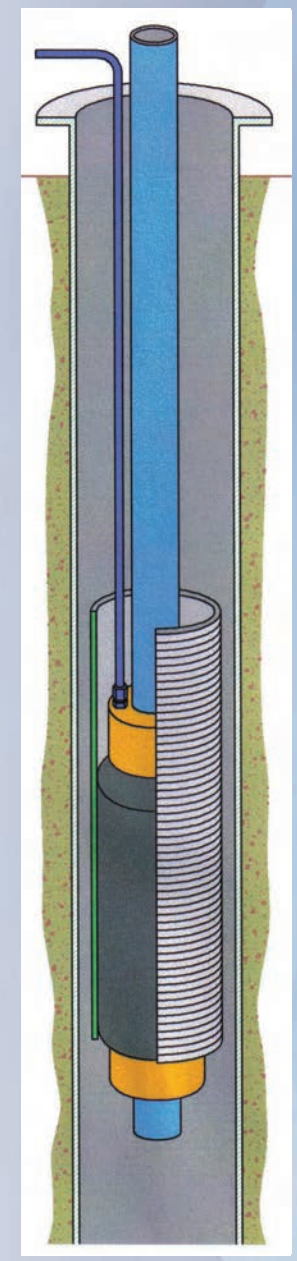
When the swage operation is completed, the new swaged pipe is checked again with a down the hole camera for video inspection.

Example of site intervention operated by Geopro

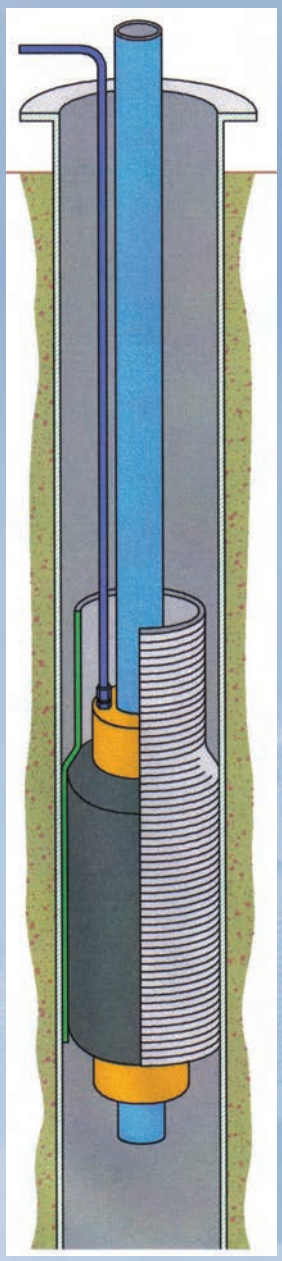
Inner diameter of the corroded casing	323mm
Initial Inner diameter of the new liner	264mm
Inner diameter of the liner after swaging	315mm
Casing Diameter loss	8mm
Outer diameter of the high pressure packer	246mm
Swage pressure	150 bar
Total length repaired	55 meter

Due to the very low diameter loss, our customer has been able to continue using an 8"pump in this relined well.

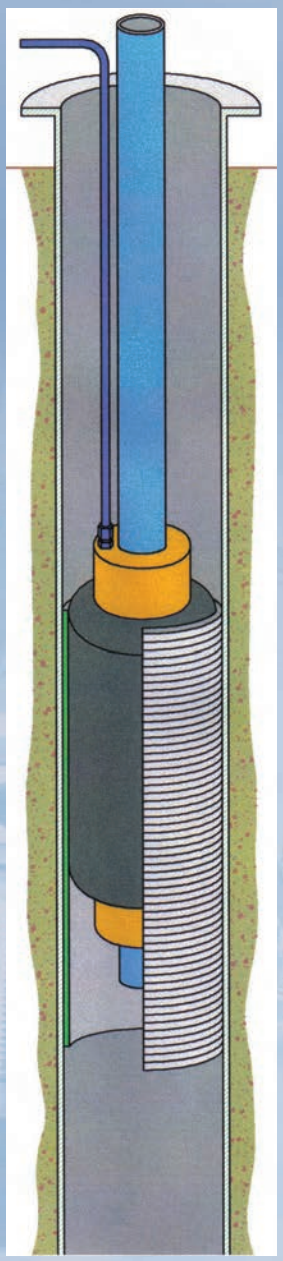
LOCAL REPAIR WITH A « SWAGE PACKER »



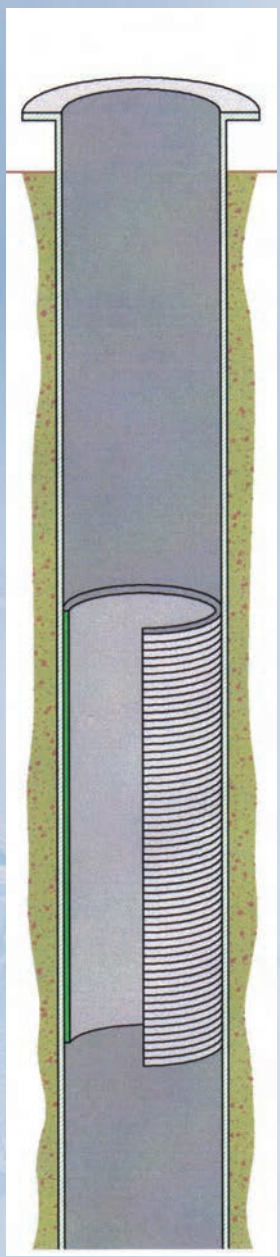
Running of the ´swage packer[a] to the level of the corroded area in the well by means of the high pressure packer inflated at low pressure



Swaging of the "swage packer" by inflation of the packer to high pressure

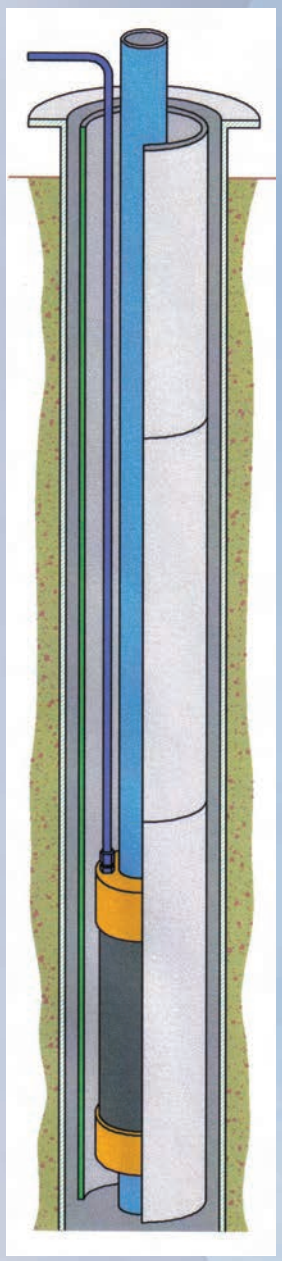


Continue swaging in several steps as necessary

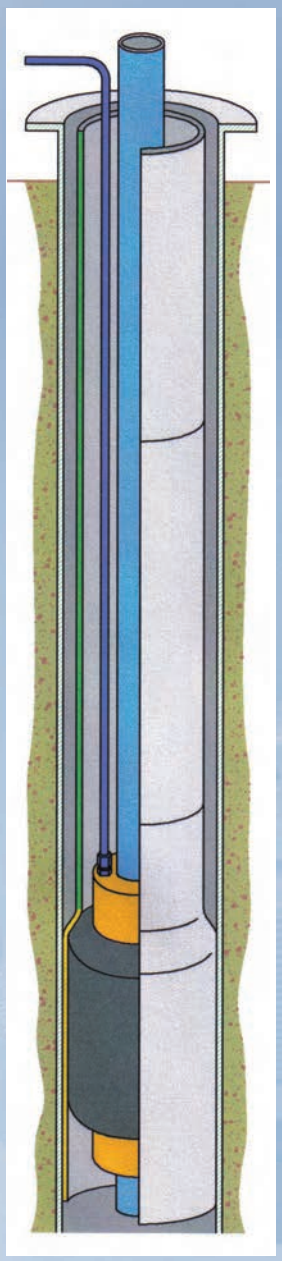


Repair complete

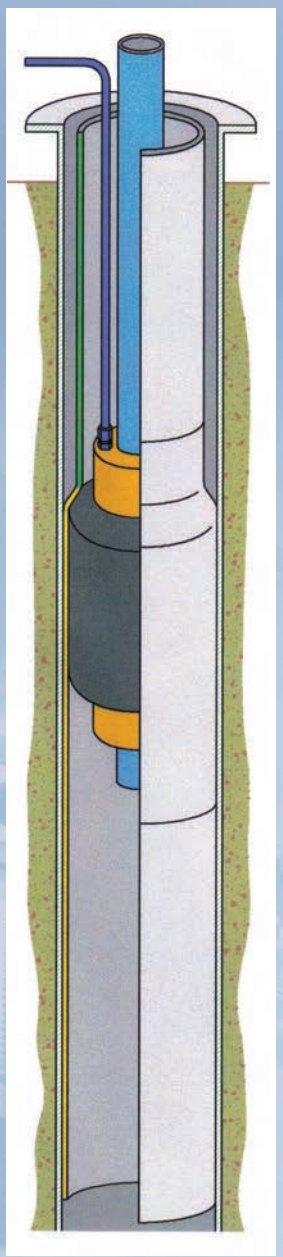
RE-LINING WITH SWAGE PACKER WITHOUT CEMENTING



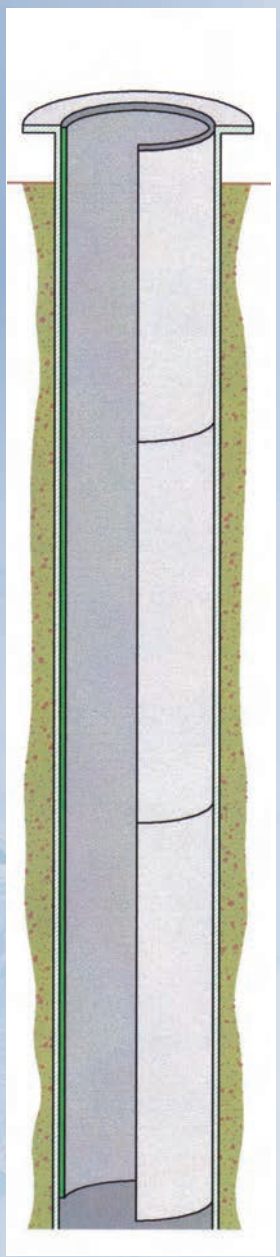
Setting of the new liner and run in of the high pressure packer.



Swaging of the new liner by inflation of the high pressure packer.



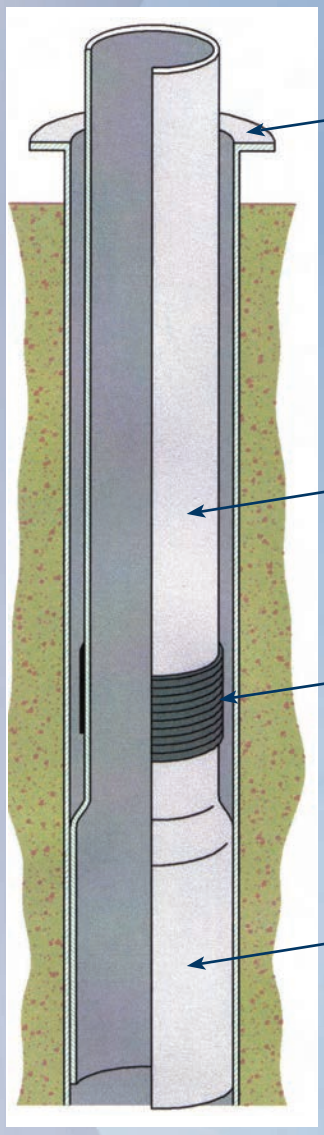
Continue swaging to surface.



Re-line complete.

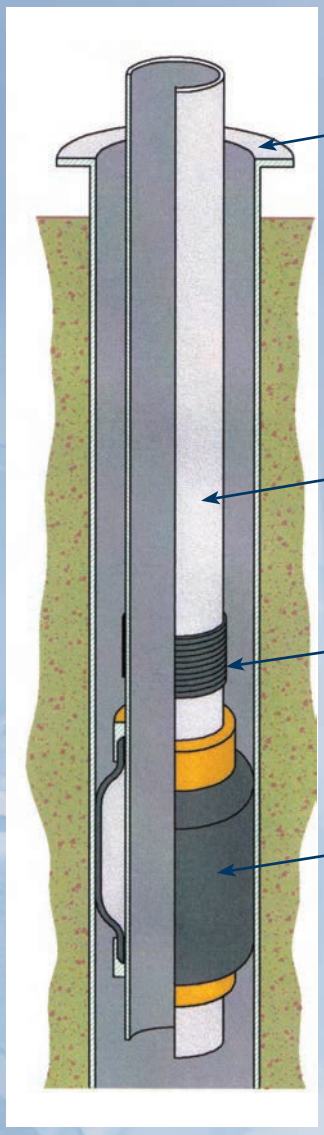
The different methods to plug a casing foot for the cementation

The Swage Packer



The swage packer method is preferably used when the diameter of the new liner should be as close as possible to the ID of the old casing usually to keep the same submersible pump. In this case, the small clearance between the old and the new pipe doesnít allow the use of a casing annulus packer.

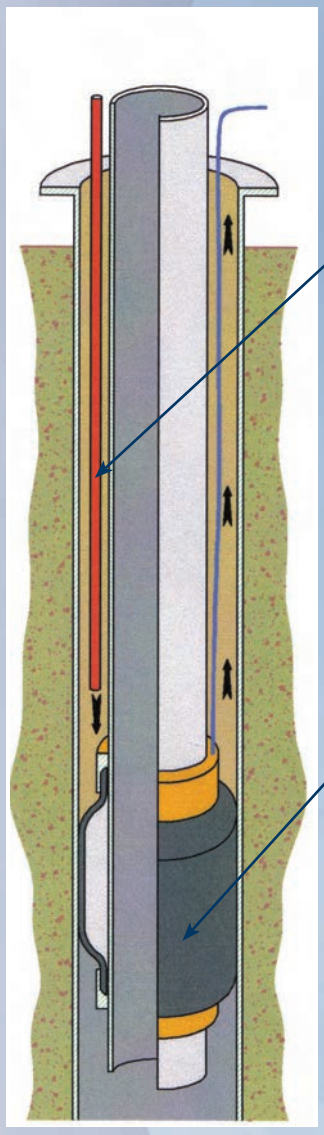
The casing annulus packer



The casing annulus packer will be used when the equipment of the well (pump) allows a diameter reduction of the well. Moreover, when the annulus between the two pipes is too large, the expansion capacity limit of the new pipe (around 18% of the initial diameter) makes the use of swage packer difficult or impossible.

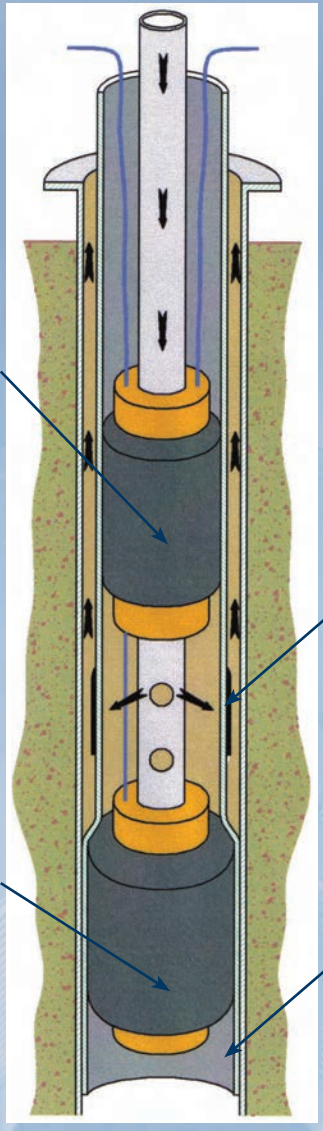
The different methods of cementation

Casing annulus packer and injection rod



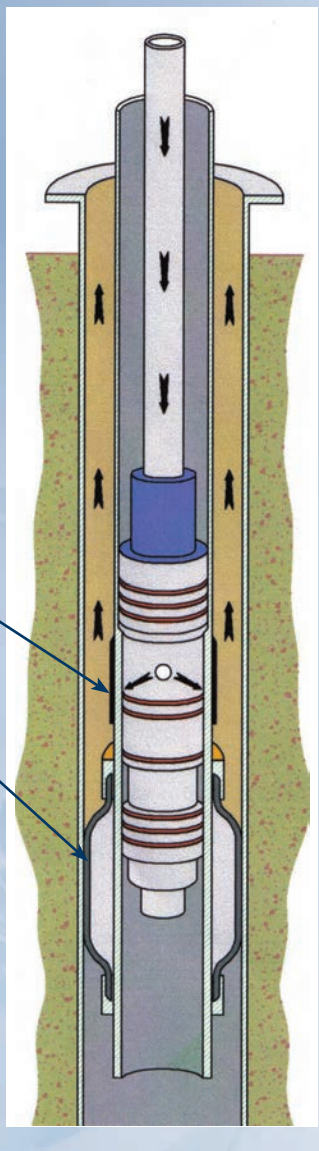
Cementation with an injection rod in the annulus.

Swage packer Cementing valve and double packer



Cementation of the annulus with a double packer through a cementation valve. In this case , both swage packer and casing annulus packer can be used. The deflation of the upper packer only, allows the circulation of water to clean the new liner and remove the cement.

Casing annulus packer Cementing valve and cementation tool



Cementation of the annulus with a special cementation tool through a cementation valve. This method is very cost efficient when several similar wells are to be repaired at the same time.

These three methods are fast and efficient .They do not require any hydraulic filling (gravels, bentonite...), and avoid long drilling and cleaning operations after the cementation. The production pump can be quickly reinstalled.

CEMENTATION AND REHABILITATION TOOLS

Double packer

The double packer is a "tool" made up of two dilatable elements.
Assembled on a central tube. It can be used for several applications:

- inflation of a casing annulus packers
- cement grouting
- water circulation into the new casing.

Dilatable elements can be inflated simultaneously or separately.

Connections on the packer are adapted to the rods used for running the system.

This is available in
different lengths and diameters.

Casing annulus packer

The casing annulus packer is composed of a thin dilatable element

Assembled onto a tube with the same diameter as the casing to be repaired. It is used to isolate a cementing zone from the lower part ofthe well. This packer is installed at the toe of the new casing under the cementation valve.

Usually the casing annulus packer is directly connected to the new casing. In case of a repair with PVC tubes, the packer is slipped on the tube ("Slip On" Version) and it is fixed and sealed to the PVC pipe using epoxy resin

CEMENTATION AND REHABILITATION TOOLS

Cementation valve

The cementation valve is made up of a rubber "sleeve" vulcanized partially onto a tube with the same diameter as the new liner. This tube is perforated and the openings are located under the sleeve. The grout flows through these openings under pressure. The sleeve closes again as soon as the grouting pressure is released. In case of great depth repair, several valves of this type can be installed along the new liner. This allows cementing in several phases and avoids the risk of collapse of the pipe under the cement pressure.
The valve is installed just above the annulus packer or the swage packer.

The « Swage Packer »

The "Swage Packer" is a tube (carbon or stainless steel) covered entirely or partially with rubber.This tube is deformed (swaged) with a high pressure packer inside the old casing. It is often used when repair conditions dictate only a narrow clearance between the new and the old casing.

CEMENTATION AND REHABILITATION TOOLS

Cementation and inflation tool

The cementation and inflation tool can be used for a cementation job with a casing annulus packer and a cementation valve. In this case, there is no need to use a double packer.

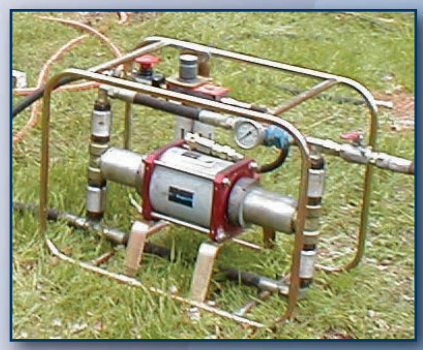
It is lowered with the drill string inside the casing. The casing annulus packer design allows accurate positioning of the tool.

Once the tool is in position, the inflation of the casing annulus packer is achieved through the rods. As soon as the required inflation pressure is reached and thanks to a system of shear pins and a sliding piston, the tool automatically shifts to the injection position. Injection is also achieved through the rods.

This type of tool allows a complete cementation job in only one operation and does not require the installation of several inflation or injection lines.

Complete casing packer system, cementation valve with inflation and cementation tool

CEMENTATION AND REHABILITATION TOOLS



PGP35-5 Grout pump

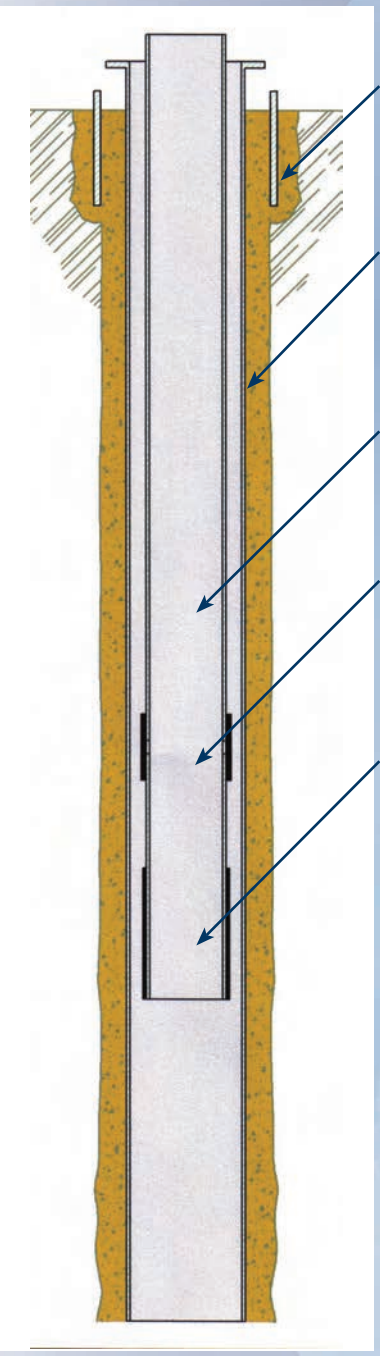
The PGP-35-5 portable grout pump is operated by air.
It is specially designed for injection under pressure of fluids like water, bentonite mud or cement slurry.
It functions on the principle of the ratio of different areas of two pistons. This ratio is 5/1 for the standard version for producing a maximum working pressure of 35 bar. Its weight and its small dimensions make it perfectly adapted to sites with difficult access and can avoid the movement of heavy equipment on the worksite

Grout pressure:	0-35bar (with inlet air pressure of 7 bar)
Flow rate:	0-45l/min
injected fluids :	Water, bentonite mud, cement slurry
Dimensions:	700 x 500 x 400mm
Weight:	38Kg

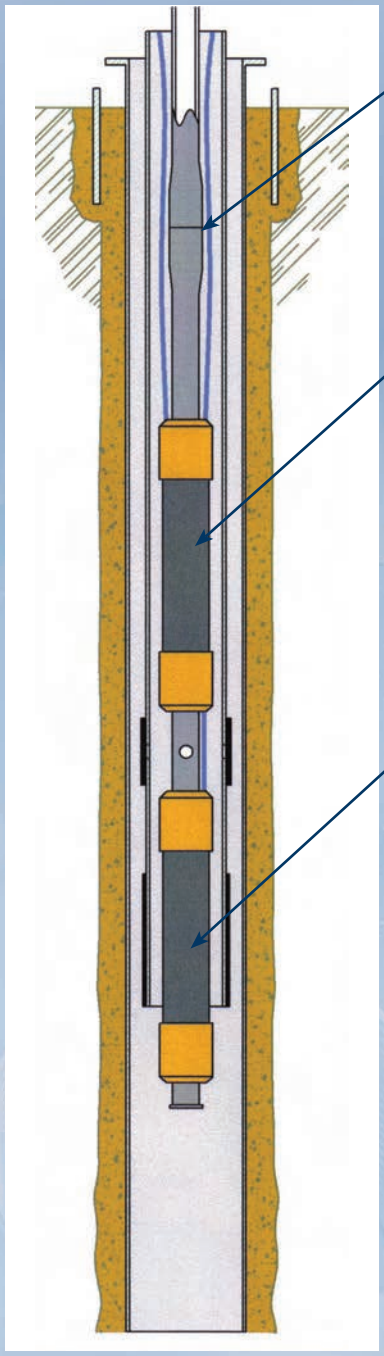
P-160 inflation pump

The inflation pump P-160, single or double acting, allows inflation of packers with water. It functions on the principle of the ratio of different areas of two pistons. The smallest ratio is 10/1 with a maximum output pressure of 70bar under an air inlet of 7bar.
Other higher ratios are available with output pressures up to 800 bar. This pump allows the maintenance of pressure without consumption of energy and starts again as soon as the pressure falls.
It is adapted perfectly for the inflation of packers in permanent installations.

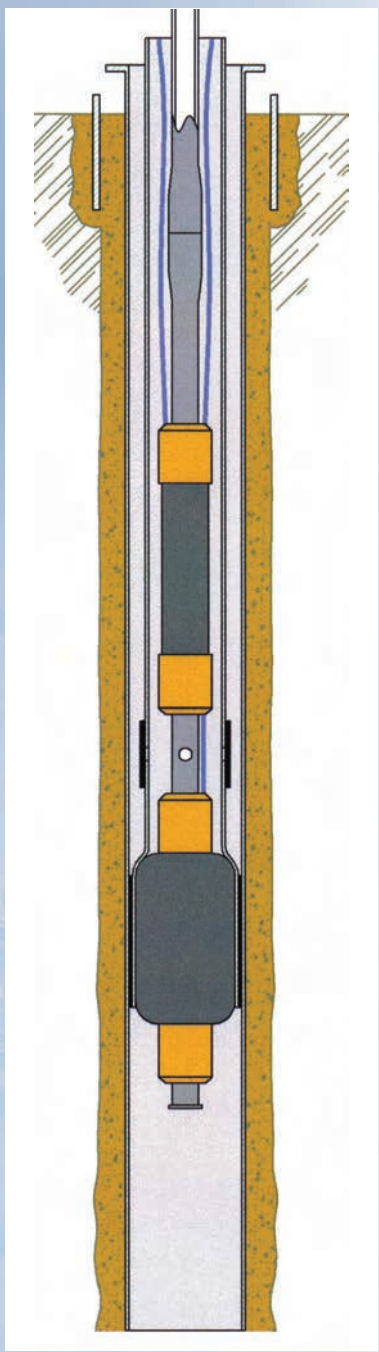
CEMENTATION OF A NEW LINER WITH "SWAGE PACKER", CEMENTATION VALVE AND DOUBLE PACKER



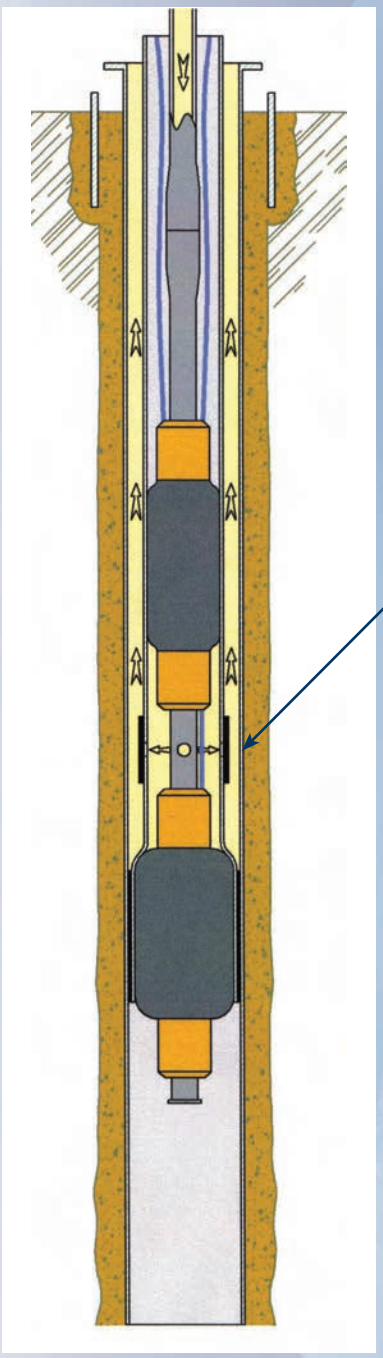
Installation of the new casing equipped with the cementation valve and "Swage Packer"



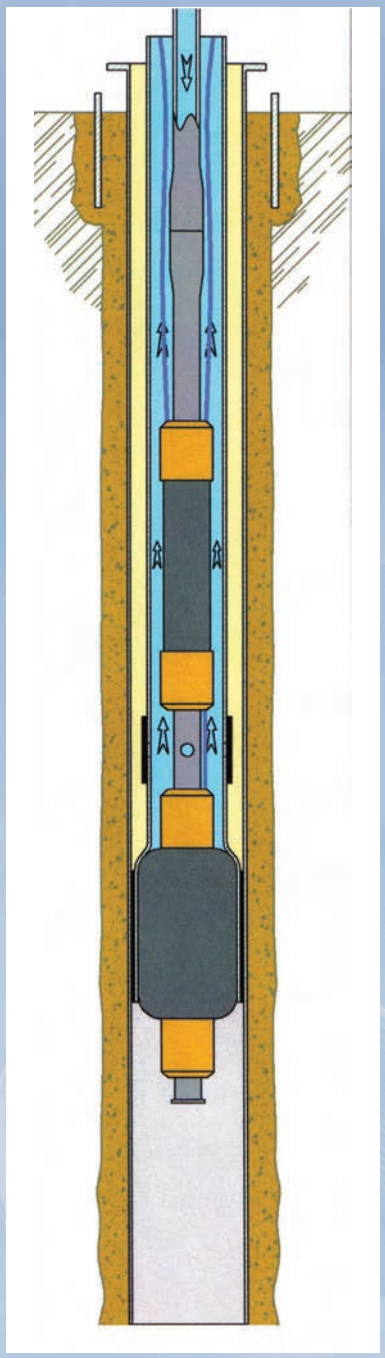
Lowering and positioning of the double packer



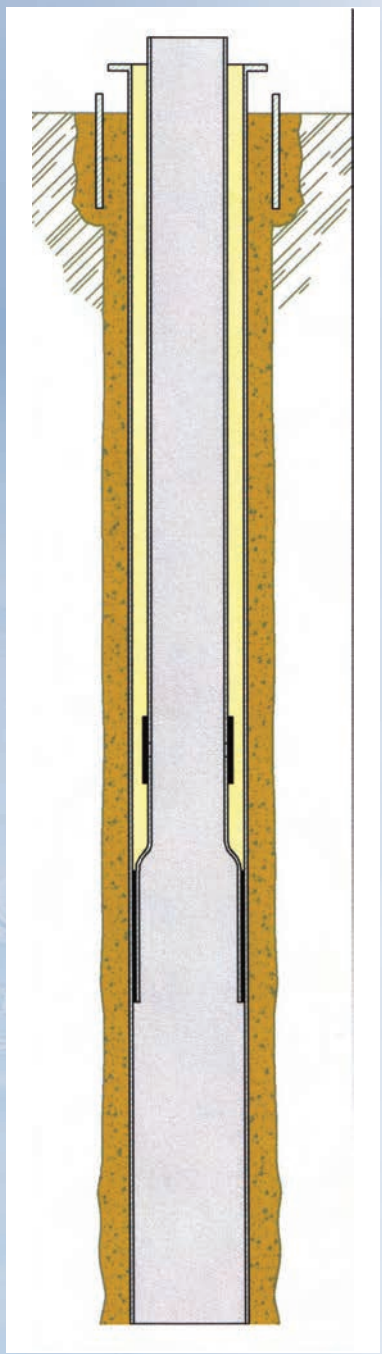
Swaging of the ´Swage Packer [a] through inflation of the high pressure packer



Lower packer remaining inflated, inflation of the top packer and injection through the cementing valve



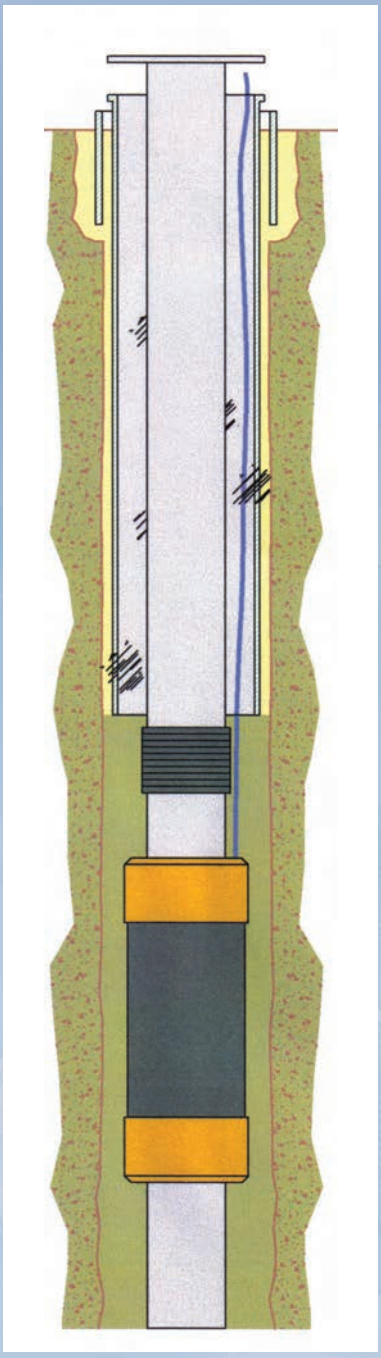
Deflation of the top packer and water circulation for the cleaning of the new casing.



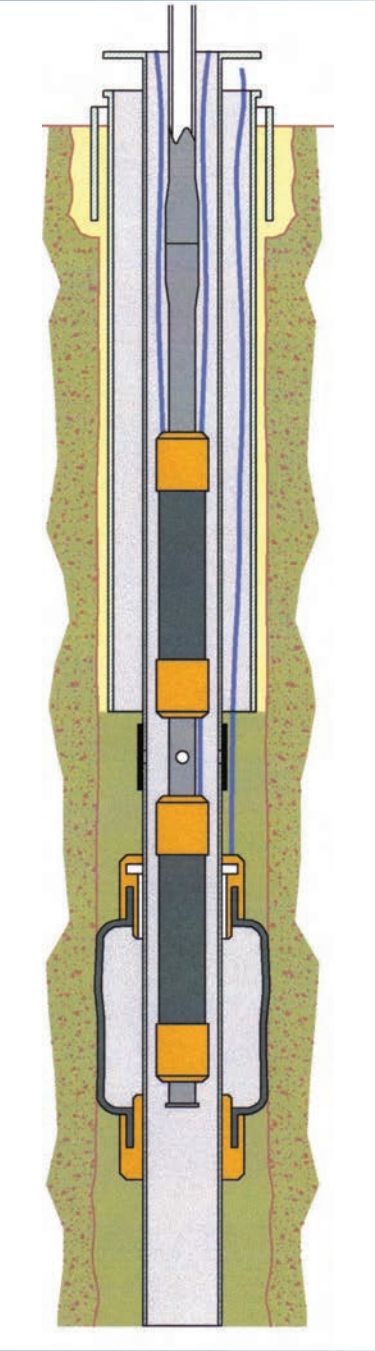
Repaired well after removal of the double packe

CEMENTATION OF A NEW LINER WITH CASING ANNULUS PACKER, CEMENTATION VALVE AND DOUBLE PACKER

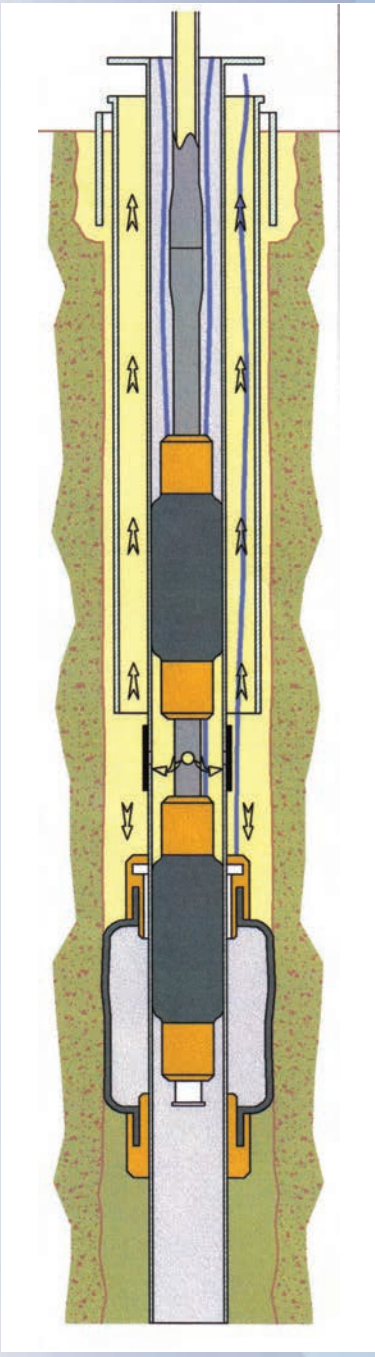
Corroded casing or poor cementation.



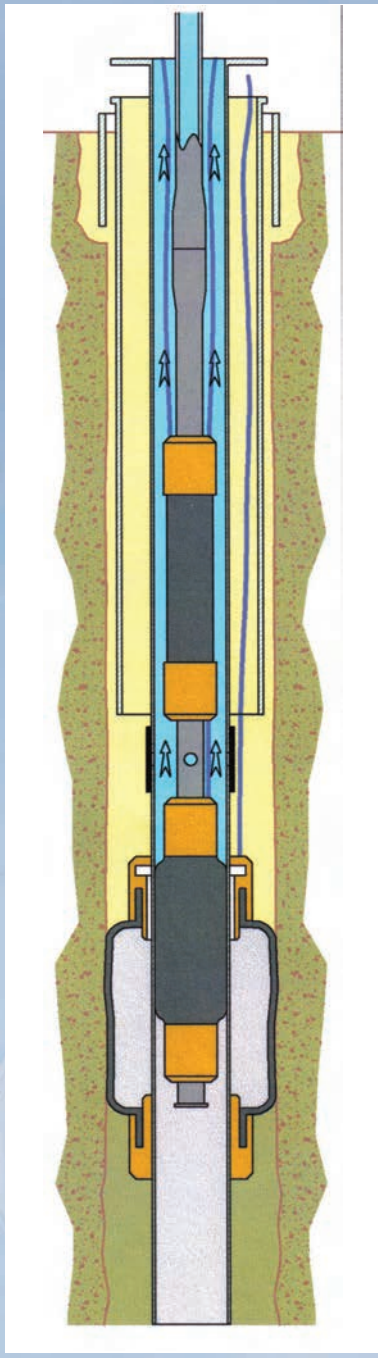
Installation of the new casing equipped with the annulus packer and cementation valve



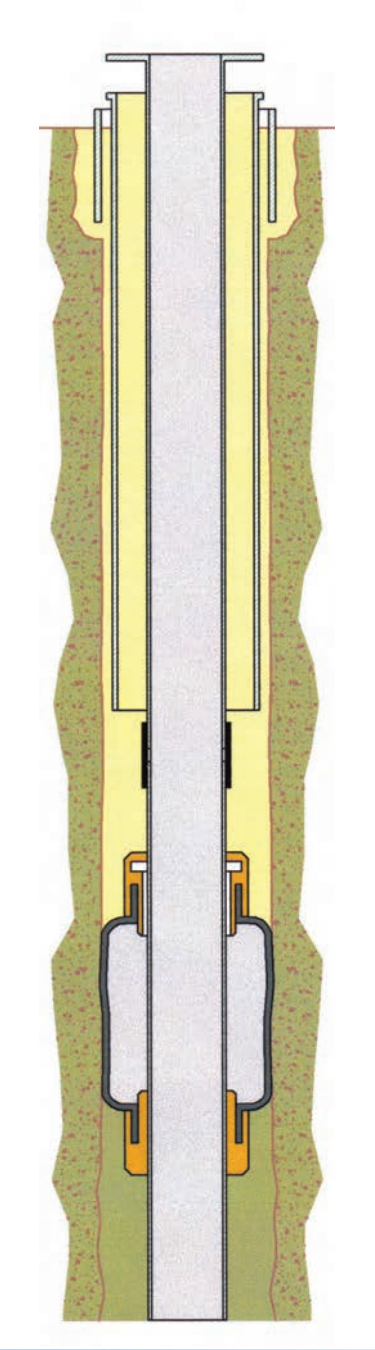
Inflation of the annulus packer and lowering of the double packer.



Inflation of the double packer and injection through the cementation valve.

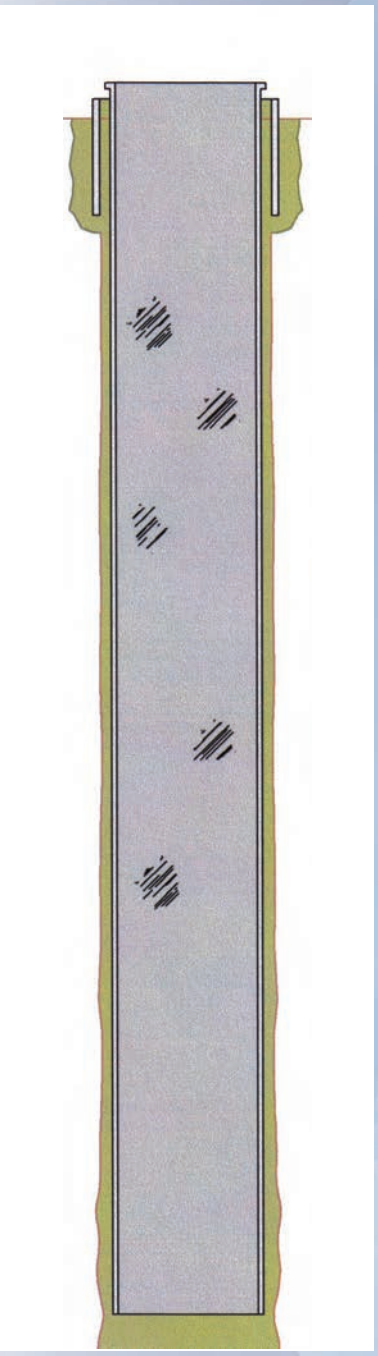


Release of the injection pressure and water circulation for the cleaning of the new casing.

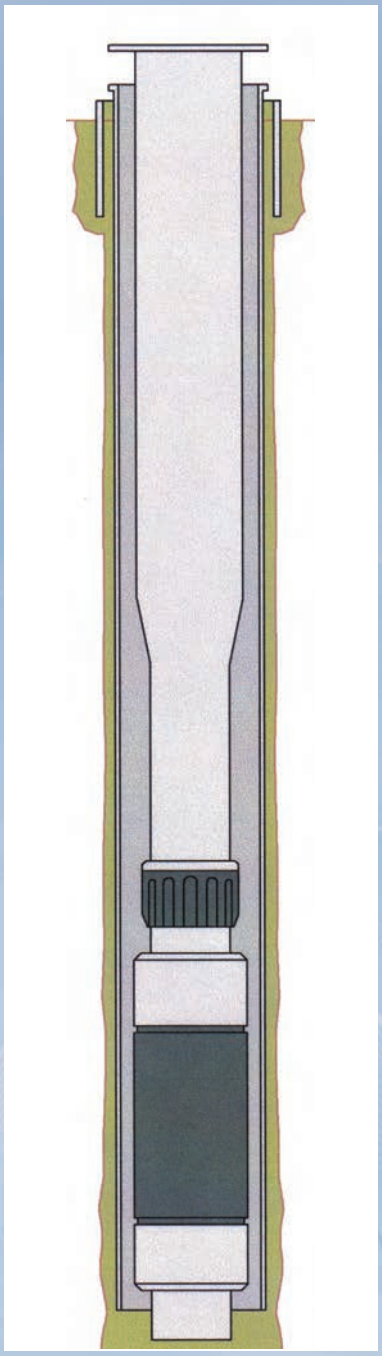


Complete repair after removal of the double packer.

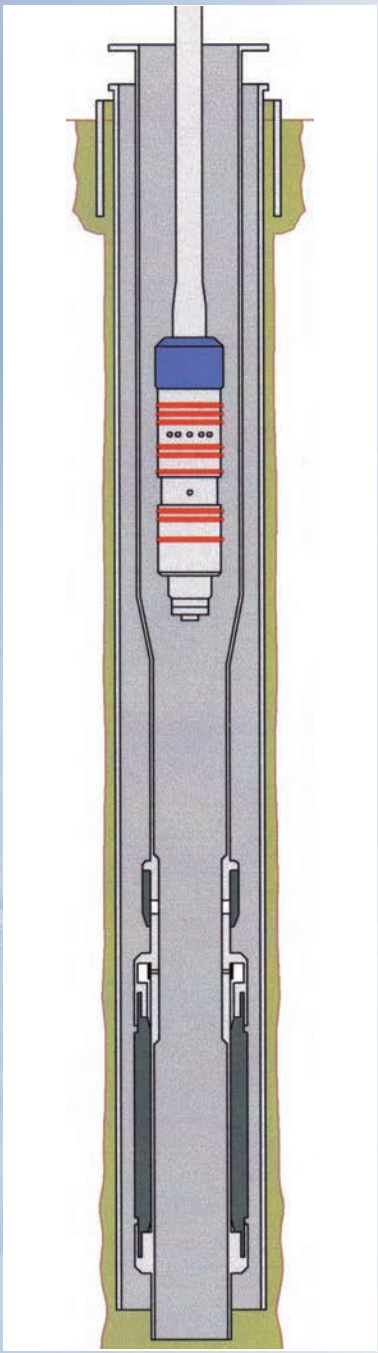
COMPLETE REPAIR OF A WELL AND CEMENTATION WITH A CASING ANNULUS PACKER, CEMENTATION VALVE AND CEMENTATION/ INFLATION TOOL



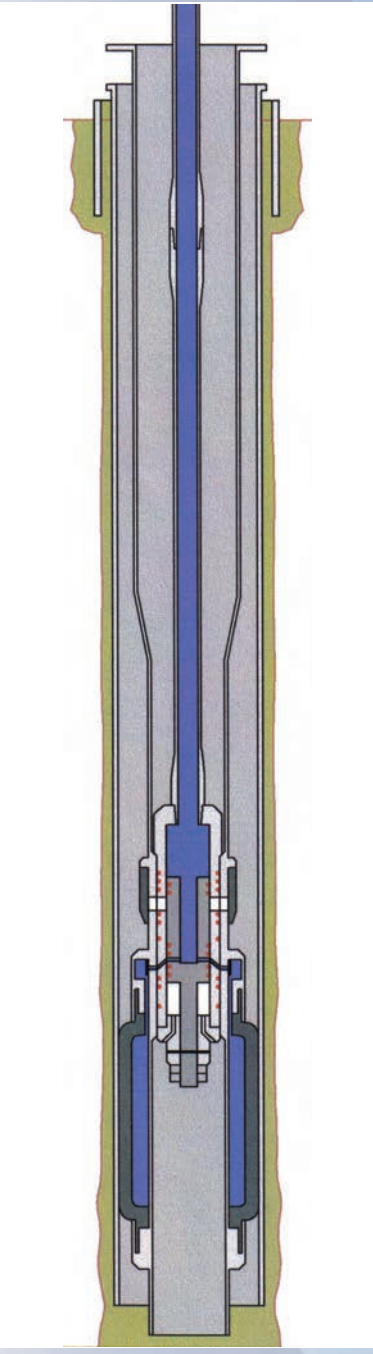
Corroded casing.



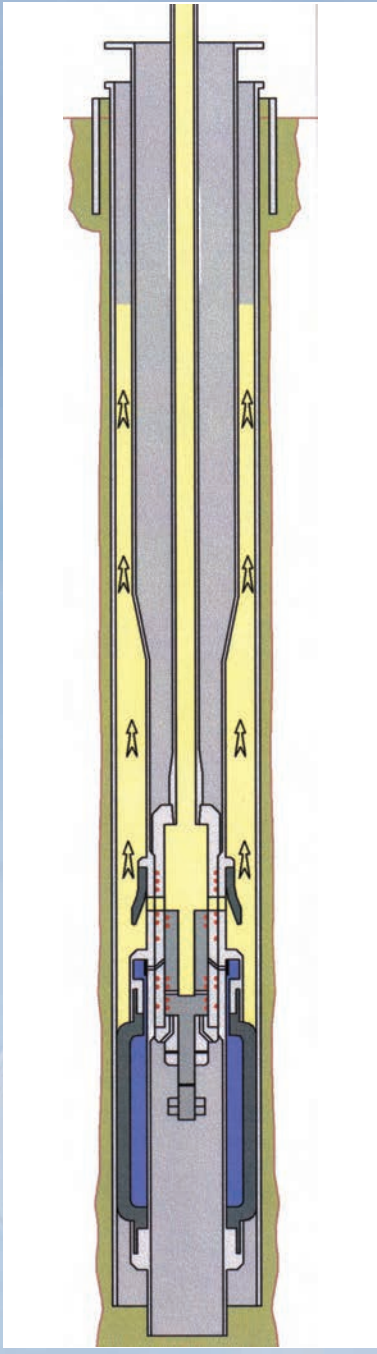
Installation of the new casing equipped with the annulus packer and the cementation valve.



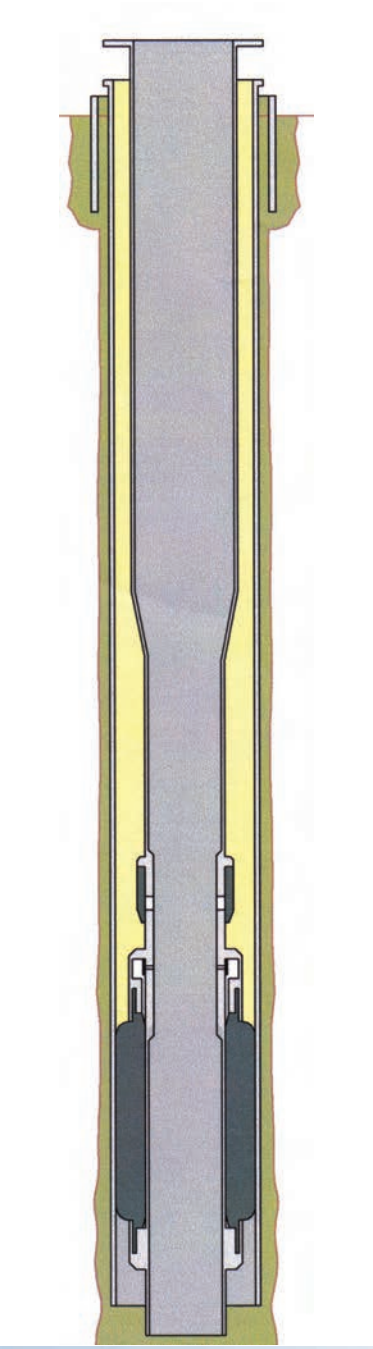
Lowering of the cementation / inflation tool on drill string inside the new casing.



Landing of the tool in the inflation position on the internal shoulder of the packer.
Inflation of the packer through the rods until the shearing of the pin.



Once the pin is sheared, the tool shifts to the injection position.
Injection by rods through the cementation valve.



Repaired well after removal of the tool.

SITE REPORTS - EXAMPLES OF REPAIR AND CEMENTATION JOBS

France - Area of Bordeaux

- Thermal well with casing of 9 5/8" corroded to a depth of 350m.
- Rehabilitation of the well by relining the old 9 5/8" casing with a new stainless steel casing of 7 5/8 '' (193,7 X 181mm) and cemented full length to surface.

- **Method: achievement of the suspended cementation with casing annulus packer of 203 mm OD, cementation valve and inflation/cementation tool (photo)**

- **Supply of the casing annulus packer, the cementation valve, the tool for inflation/cementation and technical assistance. Installation of the tool and cementation successfully achieved in less than two hours**

France - Area of Bordeaux

- Old water supply well, 260 meters depth; 9 5/8" casing up to 203 meters and open hole down to 260 meters; screen and 9 5/8 casing very damaged by corrosion.

- Rehabilitation of the well by relining the old 9 5/8" casing with a new stainless steel casing sealed at the bottom (206 mm diameter) and cemented full length to surface (200 mm diameter). Installation of a new screen.

- **Achievement with the "Swage Packer" method of the setting of the 206mm diameter stainless steel casing between 188 meters and 202 meters.**

- **Supply of cementation valves and installation of a double packer for the cementation job.**

EXAMPLES OF REPAIR AND CEMENTATION JOBS

East of France

- Old water well for industrial use (cement factory), 9 5/8" (245mm) casing very corroded up to 160 meters depth; 400 mm open hole below the casing.
- Rehabilitation of the well with a new stainless steel 6 5/8" liner combined with a cementation system.
- **Supply of a casing annulus packer with high expansion capability (400 mm) with a cementing valve. Supply also included a double inflatable packer for cement injection.**

France - Area of Bordeaux

Repair campaign on two old water wells, 13 3/8" casing, 57 meters and 72 meters deep both equipped with electric submersible pumps.
Rehabilitation of the complete well by relining the old casing with the "Swage Packer" repair method.
Swaging of a new stainless steel 10" casing. The 315 mm ID diameter after completion of the swaging operation allows reinstallation of the same 10" pump.

Inner diameter before rehabilitation	New casing Before swaging	Inner diameter after rehabilitation
323 mm	10" (Ø273 x 4.19mm)	315 mm

PRODUCTS AND SERVICES

Complete sets

In order to guarantee the compatibility of all the elements of the system and assemblies, **Geopro** provides complete sets ready for use.
These sets integrate the components such as:

- Inflatable packers
- Inflation hoses
- Inflation pumps
- Pressure transducers
- Cables and units of reading
- etc…

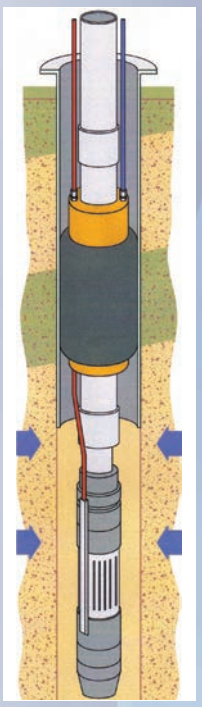
Rental

Within the framework of specific operations, **Geopro** can provide packers, inflation and injection pumps, mixers and accessories for rental.

Study, technical advice and assistance

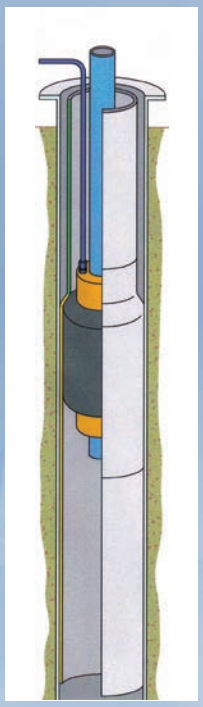
In order to offer to our customers the most appropriate tool for its application, **Geopro** can advise you in the choice of your system, carry out studies concerning this and assist you on site at the time of the implementation

INFLATABLE PACKERS FOR WATER WELLS APPLICATIONS



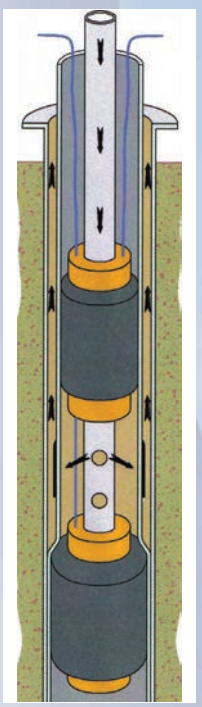
PUMPING

- Efficient protection against bacterial contamination.
- Long term protection against casing corrosion
- Selective pumping.



REPAIR
With "Swage Packer" system

- Fast repair with ligth equipment.
- Initial diameter of the well preserved.
- Permanent mechanical sealing.



CEMENTATION

- Fast set-up.
- Many possibilities of assemblies and suitable tools for each dimension and configuration of well.
- No restriction regarding the depth.

Others applications

- **ACIDIFICATION**
- **WELLS STIMULATION**
- **SCREEN REMOVAL**
- **HYDROFRACTURATION**
- **PLUG PACKERS**
- **Etc...**

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