TECHNICAL ANALYSIS ON VERGNET HYDROPUMPS FOR USE IN GHANA

DOCUMENT BASED ON FIELD EXPERIENCE

VERGNET SA

6, rue Henri Dunant

45140 Ingré

FRANCE

Phone: (33) 38 43 36 52

Fax : (33) 38 88 30 50

September 1994

IDENTIFICATION OF PUMPS RECOMMENDED FOR USE IN GHANA

VERGNET HYDROPUMPS

I- INTRODUCTION

As a standard model recommended for use in Ghana, VERGNET hydropumps represent a range of human powered pumps in total adequacy with the hydrogeological reality in most of the African countries.

With the same hydraulic transmission system and the same wearing parts, VERGNET hydropumps are :

- VHP 3C 30 - Down to 30 m depth

- VHP 4C 60 - Down to 60 m depth

- VHP 4D 100 - Down to 100 m depth

One system, three pumps are the VERGNET weapons to fight drout wherever people need water in quantity and quality.

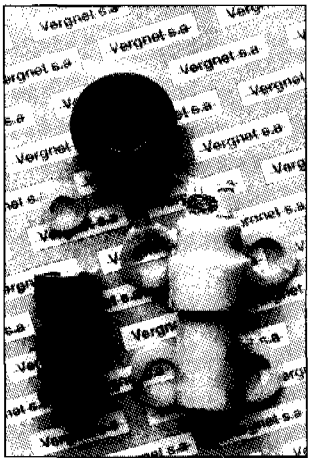
The principal aim of this document is to keep our partners in GHANA informed on the performances of the equipment they have chosen for the Rural Water Supply Project lead by GWSC in Central Region.

3C HYDROPUMP VERGNET

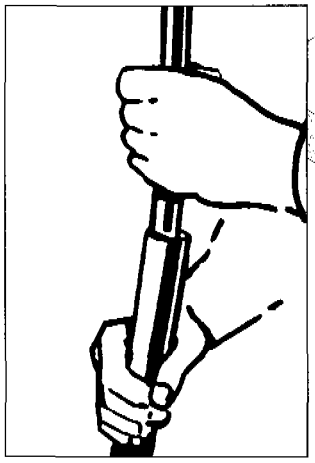
a direct action handpump for shallow and medium depth wells and boreholes

the "economic" pump

Standard Vergnet wearing parts

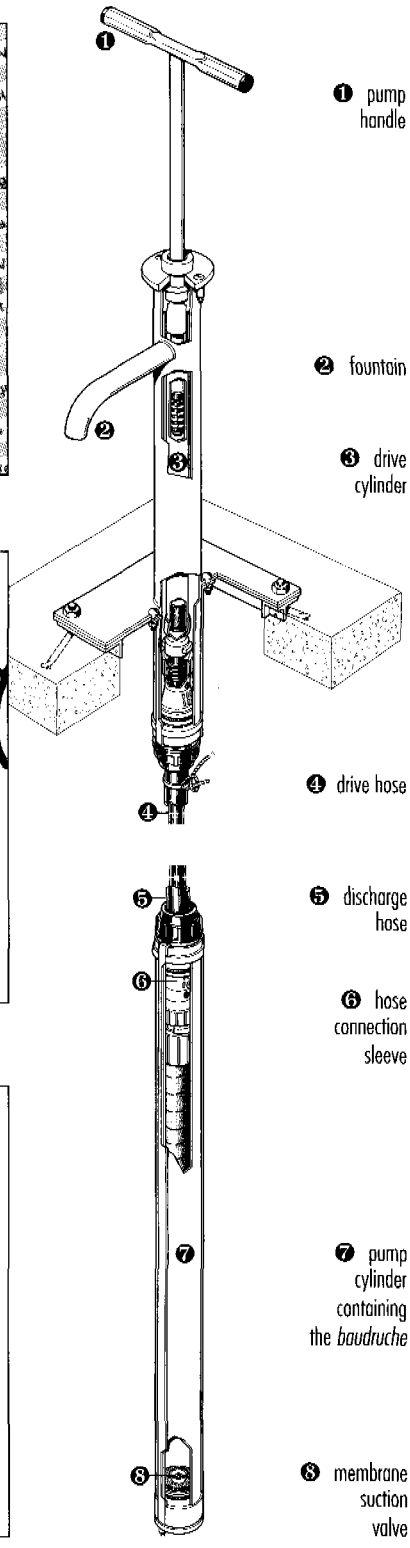


Coaxial drive and discharge hoses



Membrane valves

- **conical or flat ;**
- **perfectly water-tight ;**
- **low head loss.**



VERGNET HYDRAULIC DRIVE TECHNOLOGY, RELIABLE AND PROVEN.
(MORE THAN 35,000 INSTALLATIONS SINCE 1975)

1 Economic : the 3C Hydropump offers one of the lowest purchase and maintenance costs available

2 Reliable : the 3C Hydropump is guaranded against corrosion because it is made entirely from corrosion resistant materials

3 Light weight : the 3C Hydropump, installed at depth of 30 meters, weights less than 30 kg.
It is easy to install and maintain. Installation, extraction and maintenance operations require no special tools and can be performed by all.

4 Wearing parts : the model 3C is designed to use the same standard wearing parts used in the 4C and 4D Hydropumps. These parts are easily accesible at the surface and are available from Vergnet's network of more than 100 sales outlets in 30 countries.

The VERGNET 3C HYDROPUMP is a VLOM* pump *par excellence*

easy to install - easy to use - easy to maintain

(Village Level Operation and Maintenance)

3C HYDROPUMP VERGNET

a direct action handpump for shallow and medium depth wells and boreholes

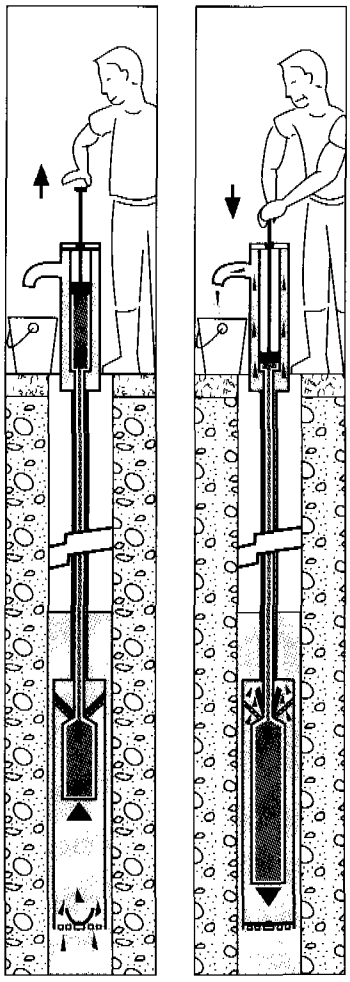
■ how the pump works

Suction :

The piston shaft rises, the *baudruche* contracts : water is sucked *into the stainless* steel pump cylinder

Discharge :

The piston shaft descends, the *baudruche* extends : water is forced out of the pump cylinder to the surface



discharge valve closed

the *baudruche* contracts

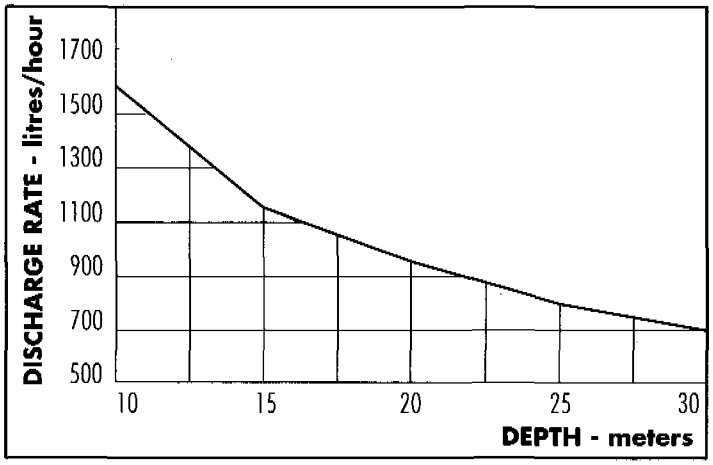
intake valve open

discharge valve open

the *baudruche* extends

intake valve closed

■ performances



■ technical specifications

■ **Type of pump :**
direct action, hydraulic drive handpump
■ **Maximum pumping depth :** 30 meters
■ **Minimum borehole diameters :**
for 1 pump : 3"
for 2 pumps : 5"
for 3 pumps : 6"
■ **Fountaine :**
stainless steel (or galvanized iron)
weight : 10kg
hydraulic drive cylinder :
stainless steel
inside diameter : 30mm
wall thickness : 1,5mm
cylinder length : 611mm
■ **Drive shaft :**
stainless steel
shaft length : 665mm - stoke length : 450mm
diameter : 22mm
■ **Pump cylinder :**
stainless steel (or high density polyethylene)
length : 1 120mm
external diameter : 70 or 75mm
weigth : 5kg
■ **Baudruche :**
tube : rubber
end fittings : high density polyethylene
crimp rings : stainless steel
■ **coaxial hoses :**
high density polyethylene
drive hose :
diameter : 21/25mm
discharge hose :
diameter : 35,2/40mm
hoses' weight : 450gms/meter of installation depth
■ **Valves :**
water-tight
rubber membranes

6, rue Henri-Dunant - 45 140 INGRE (France)
Tel (33) 38 43 36 52 - Fax (33) 38 88 30 50 - Telex 780980F VERGNET

VERGNET

ANNEX 4

INTERAFRICAN COMMITTEE FOR HYDRAULIC STUDIES
ICHS

GENERAL SECRETARIAT
01 BP 369 - OUAGADOUGOU 01 (BF)
TEL. : 30-71-12 / 30-71-15
TELEX : ICHS 5277 BF

GOOD BEHAVIOUR ATTESTATION

Object : 30 Vergnet Hydropumps in the Yatenga area - BURKINA FASO.
Assessment by ICHS in 1990 October.

Thirty (30) Vergnet Hydropumps located in Yatenga province (Burkina Faso) have been checked up on October 1990 for the third time from their installation (4 years ago). This check has revealed a fairly good behaviour of this model of pump and peculiarly of their "baudruches" (Vergnet made baudruches) giving :

- a low yearly maintenance cost : 3125 F CFA/year/pump including 2230 F CFA of spare parts for a satisfactory service for the users,

- an average lifetime for main wearing parts (guide bushing, piston seals, lower stop ring, piston) between 17 and 36 months,

- an excellent quality of "Vergnet" baudruches which have shown no break, no change and no cracks (10% of the baudruches have been thoroughly examined). The baudruches have the same pumping rates from the beginning. From this, one can expect an average lifetime far longer than 5 years.

Nota : locations in use for this survey have been selected on very difficult to meet working criteria :

- high water depth : 30 to 50 m,
- high level of use : more than 8 hours per day.

Written in Ouagadougou , the 4th December 1990

The General Secretary

A. CISSE

ANNEX 5

EXTRAIT DU RAPPORT ANNUEL SNAPE
SUIVI EVALUATION
OCTOBRE 1992 - JUILLET 1993

50 premières pompes installées sur le projet CFD Guinée - Phase 1
entre Mai et Juillet 1988

COUTS DE MAINTENANCE

ACHAT DES PIECES

Circuit	Nombre pompe	Pièces d'usure	Autres pièces	TOTAL
1	10	150 000	105 000	255 000
2	1	15 000	-	15 000
3	13	155 000	82 000	277 000
4	22	330 000	30 750	360 000
5	4	60 000	27 000	87 000
	50	750 000	244 750	994 750

Moyenne par pompe pour les 4,5 ans = 20 000 F.G.
Moyenne annuelle par pompe = 5000 F.G.

MAIN D'OEUVRE

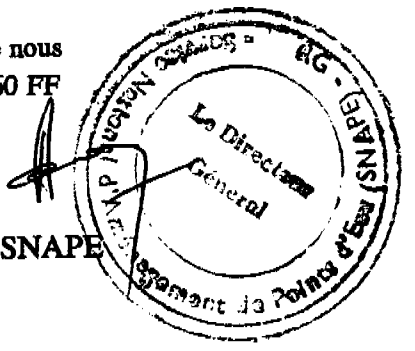
Circuit	Nombre pompes	Tournées trimestrielles			Interventions		TOTAL
		Nombre passage par pompes	Nombre total passage	Montant	Nombre	Montant	
1	10	16	160	160 000	11	22 000	182 000
2	1	13	13	13 000	-	-	13 000
3	13	14	182	182 000	9	18 000	200 000
4	22	16	352	352 000	32	64 000	416 000
5	4	15	60	60 000	3	6 000	66 000
			767	767 000	55	110 000	877 000

Moyenne par pompe pour 4,5 ans = 18 000
Moyenne annuelle par pompe = 4 000

Ainsi, en additionnant les moyennes annuelles, le coût d'entretien d'une pompe nous revient à environ 9 000 F.G.; le coût arrondi à 10 000 FG équivaut environ à 60 FF

* 1 FF = 170 F.G.

Certifié conforme
Amadou DIALLO
Directeur Général du SNAPE



ANNEX 6

O. C. S. D.

ORGANISATION CANADIENNE POUR LA SOLIDARITE ET LE DEVELOPPEMENT

PROJET REFUGIÉS

(PARTENAIRE OPERATIONNEL DU HAUT COMMISSARIAT AUX REFUGIES)

TEL. SIEGE: 61.09.73
PROJET: 61.32.27

SIEGE B.P.973
PROJET B.P.950

N°95/92/OCSD-PR

Bangui, le 10 octobre 1992

/) TTESTATION

Pour approvisionner en eau potable les réfugiés soudanais dans la région de Mboki, le HCR a eu à installer 5 hydro pompes vergnet en novembre 1991. Ce matériel a été soumis à des conditions intensives d'utilisation, 20 heures par jour en moyenne. Après 10 mois de fonctionnement sans relache seules les pièces d'usures situées au niveau de la pédale sont à remplacer.

Suite à cette expérience positive le HCR à décidé de poursuive son programme d'équipement de puits avec la même pompe qui donne totale satisfaction aux milliers d'utilisateurs.

OCSD PROJET REFUGIES ★ LE CHEF DE PROJET ★ HCR BP 950 BANGUI -RCA

OCSD PROJET REFUGIES ★ CHEF DE PROJET ★ HCR BP 950 BANGUI -RCA

Serge SAINT-LOUIS
Logisticien et Agent Chargé
de l'Approvisionnement Projet Réfugiés
OCSD/HCR

ANNEX 7

MAINTENANCE COSTS OF THE VERGNET HYDROPUMPS

ON THE "HELVETAS MALI" PROJECT

Abstracts of Daniel WEGMANN'S report

Consultant
Haldenstrasse 135
8055 ZURICH
SUISSE

12 January 1992

ANNEX 5

VERGNET HYDROPUMPS INSTALLED IN THE PROJECT AREA BETWEEN 1980 AND 31 AUGUST 1991 : 797

AGE OF THE PUMPS :

BETWEEN 1 AND 11 YEARS

FUNCTIONNING RATE :

AROUND 90 %

ANNUAL AVERAGE MAINTENANCE COST/ PER VERGNET HYDROPUMP :

5872 FCFA (including 4840 FCFA of spare parts)

RELIABILITY OF THE FIGURES :

- several lists and files kept by UMF (Maintenance & Training Unit)

- provision of certain parts and services free of charge goes over 15% maximum the above figures

CONCLUSIONS

THE VERGNET HYDROPUMP IS A VERY RELIABLE PUMP

The maintenance cost has gone down between 1987 and 1993 (a better reliability of the "baudruche").

NB : If we take the example of a daily water drawing of 4m3 over eight months of the year, we get around 1000 m3 for a cost of 6 000 FCFA i.e. 6 FCFA/m3.

Even it this cost had to be tripled (regular maintenance, replacement of wearing parts within the constructor's recommended time), the cost of the m3 would remain less than 20 CFA.

ANNEX 8

SOCIÉTÉ DE DÉVELOPPEMENT DU COTON DU CAMEROUN

SOCIÉTÉ DE DÉVELOPPEMENT AU CAPITAL DE 4.529.400.000 F C.F.A.

N° 034/91/DG/ADP/AA/NAM

Garoua, le 11 Mars 1991

A Monsieur le Directeur
Vergoet S.A.

Monsieur,

Suite à votre demande du 25/02/91, veuillez trouver ci-joint les éléments de réponse à votre questionnaire :

Pays : CAMEROUN

Région : NORD

Projet : SODECOTON

Nombre de pompes installées : 150
Nombre de pompes Vergoet : 100
Période installation : de 1980 à 1990
Coût d'entretien annuel : de 3 000 à 10 000 F.CFA/an.
Nombre d'interventions annuelles moyennes : 20 pour 100 pompes
Type de maintenance : Technicien du Projet
Vente pièces détachées : Magasin Projet
Mode paiement des pièces : Facturation suivant intervention

Fait à Garoua, le 11 Mars 1991

Le Chef de Projet,

A. ABAKAR

SODECOTON DIRECTION GEN. RALE

SIÈGE SOCIAL GAROUA
B.P. 302
Tél. : 27.15.56 et 27.10.80 - Télex : 7617 KN

DÉLÉGATION DE YAOUNDÉ
B.P. 304
Tél. : 22.19.72 - Télex : 8525 KN

DÉLÉGATION DE DOUALA
B.P. 1699
Tél. : 42.46.03 - Télex : 5738 KN

ANNEX 9

Republic of Niger
Ministry of Animal Resources and Hydraulics
Department of Hydraulic Infrastructures
Maintenance Department

Pump maintenance in the Tillabery area

Pump maintenance project in the Liptako CAF Financing

Bruno METRAL

SEPTEMBER 1988

4.1.3.VERGNET HYDROPUMP MAINTENANCE COST

- the study was completed in March 1987

- it concerns 498 pumps located in the whole area. The pump age varies between 4 and 7 years.

- we have eliminated the pumps that were out of order for more that one year without being repaired.

The details of the parts changed on each pump were given by the villagers.

As no expenditure was registered, the study data may be underestimated.

The table hereunder shows the annual expenditure on the repair of these pumps. These figures correspond to the purchase of parts and the remuneration of the caretakers which itself is very low.

5 pumps caused an expenditure of more than 75 000 FF with a maximal value of 89 850 FF.

2 pumps caused an expenditure of 110 000 FF.

< 10 000 FF	10 to 25 000 FF	26 to 50 000 FF	51 to 75 000 FF	76 to 100 000 FF
337 pumps	97 pumps	48 pumps	9 pumps	5 pumps
68%	19%	10%	2%	1%

Total number of pumps studied : 498

Considering that the pump never breaks down, the only parts to be changed are the wearing parts (1 piston, 4 piston seals, 1 guide bushing, 2 lower stop rings). They are replaced annually and represent an annual expenditure of 12 000 FF.

68% of the pumps have an annual maintenance cost lower than 10 000 FF which confirms that the replacement of the parts is not being done as it should be.

Many pumps are functionning with completely worn out parts resulting in a lessening of the flow.

As the villagers rarely do preventive maintenance it is only when the pump stops completely that parts are replaced.

Annex 10

EVALUATION THEMATIQUE DE L'INTEGRATION DES FEMMES DANS LE DEVELOPPEMENT RURAL

Rapport de mission concernant le projet Hydraulique villageoise dans le département de Zinder, Niger

B M B
Management Consulting for Development B.V.
Tilburg, Pays-Bas

en association avec

FEMCONSULT
Consultants en matière de Femmes et Développement
La Haye, Pays-Bas

Auteur: Sophie de Groote

novembre 1990

Les conclusions de la mission d'évaluation ne sont pas similaires à celles du projet danois en ce qui concerne l'utilisation de la pompe "à pied". En effet, selon l'enquête effectuée par ce projet dans quatre villes de plus de 1.500 habitants situées dans la même zone que le projet FED, les femmes préfèrent les pompes "à main" aux pompes "à pied", car le mouvement de pompage de ces dernières est jugé indécent. La mission d'évaluation a, au contraire, révélé que la pompe "à main" n'est pas appréciée, car les femmes estiment que son utilisation rappelle trop le mouvement du pilage du mil et développe de façon trop importante les muscles des bras.

Il est certain qu'il y a eu un mouvement de pression anti-pompe "à pied". Ce mouvement a touché non seulement certaines villageoises, mais aussi les femmes fonctionnaires, qui prétendent que la pompe "à pied" est responsable d'avortements spontanés. Sur le terrain, la consultante n'a rencontré aucune femme se plaignant de ce type de pompe. Celle-ci est critiquée uniquement par les villageoises touchées par le projet danois et par les femmes de l'administration. Le "lobby" anti-pompe "à pied" est probablement né de la conjonction de rumeurs - fondées ou pas - sur le risque d'avortements spontanés dus au pompage et sur la concurrence que peuvent se livrer les fabricants de pompes. Toujours est-il que les femmes du projet FED préfèrent les pompes "à pied" même si elles ont déjà utilisé des pompes "à main".

ANNEX 10

Report on :

Integration of women in rural development.

Mission report concerning the village hydraulic project in the department of Zinder, Niger.

The conclusions of the evaluating mission are not similar to those of the Danish project in as far as concerns the use of a "foot" pump. It is a fact, that the results of the study made in 4 towns of more than 1500 inhabitants situated within the FED Project area, show that women prefer the hand pump to the foot pump as the movement of the latter is judged as being indecent. However, the mission results revealed that the hand pump is not appreciated, as the movement, being similar to that used in grinding and crushing mill, develops, in a manner too important, the arm muscles.

It is certain that there has been a lobby of anti foot pump protagonists. This movement influenced not only villagers but also women civil servants, who alleged that foot pumps provoked mis-carriages. In the field, the consultants did'nt encounter any woman complaining about the foot pump. This pump is only criticised by the villagers affected by the Danish project and the women civil servants. The anti foot pump lobby is probably a creation of rumours - fonded or not - on the risks of mis carriage due to pumping and fruit of competition amongst the pump manufacturers. In any case, the women in the FED project, preferred the foot pumps, even when they had always used hand pumps previously.

Annex 11

MINISTERE DE L'AGRICULTURE
ET DES RESSOURCES ANIMALES

SERVICE NATIONAL D'AMENAGEMENT
DES POINTS D'EAU (SNAPE)

SERVICE ANIMATION ET MAINTENANCE

Objet: Baudruche Verget:

Je soussigné SADIGA CAMARA Chef service Animation et Maintenance certifie n'avoir enrregistré aucune casse de baudruche sur les projets CCCE phase I et II.

Phase 1:	492 pompes	01/1988 - 03/1990
Phase 2:	485 pompes	03/1990 - 04/1992

Fait pour servir et valoir ce que de droit.

Conakry, le 18/9/92
LE CHEF DE SERVICE ANIMATION
ET MAINTENANCE

SADIGA CAMARA

Annexe 12

REPUBLIQUE DU TCHAD — Unité-Travail-Progrès

MINISTERE DES MINES, DE L'ENERGIE ET DU PETROLE
DIRECTION GENERALE

Direction de l'Hydraulique et de l'Assainissement

Direction du Projet

PROJET D'HYDRAULIQUE VILLAGEOISE ET PASTORALE DANS LA ZONE DES KOROS

ATTESTATION D'ESSAI D'HYDROPOMPE VERGNET 4D

Localité: MBALBITA (Logone Occidental, Sous-Préfecture de Moundou-Rural, Canton de Mbalkabra)

Date d'installation: 17/04/93

Profondeur d'installation: 66 m

Niveau statique: 74.6m/sol

Débit mesuré: (essai du 14/02/94)
650 l/h avec 2 jeunes filles pompant simultanément
570 l/h avec 1 femme seule
410 l/h avec 2 enfants se relayant

Après 10 mois d'utilisation, cette pompe donne entière satisfaction aux villageois pour son utilisation aisée.

Etablie à Moundou le 16/02/94

L'Ingénieur Conseil

B.R.G.M - 4S
Département EAU
B.P. 6009
45060 ORLEANS CEDEX

M. Frey

La Direction du Projet

D.H.A.
CHEF DU PROJET
DIRECTION DU PROJET CCCE

M. Ndiaset Omer Adam, DHA

ANNEX 13 2/2

BRGM
L'ENTREPRISE AU SERVICE DE LA TERRE

Moundou, le 12/05/93

M. Chabriais
Vergnet
6, rue Henri Dunant
45140 Ingré

Objet: Essais 4D
Projet Koros-Tchad

Monsieur,

Le 2ème prototype de la pompe 4D a été installé sur le forage de Mbalbita le 17/04/93(NS=74.6m/sol, prof.pompe:86 m) en remplacement de la pompe 4D mise en place en juin 1992.

*mesures effectuées le 12/05/93:

-enfant seul: 380 l/h
-deux enfants: de 430 à 630 l/h

-femme seule: 400 l/h
-deux femmes: 610 l/h

-homme seul: 550 à 625 l/h
-deux hommes: 640 l/h

On constate donc que les enfants peuvent se servir de la pompe et même obtenir un débit élevé.

Veuillez recevoir nos salutations distinguées.

L'Ingénieur-Conseil

BRGM - 4S
Département EAU
BP 6009
45060 ORLÉANS CEDEX

Frey Ch. BRGM

BRGM
Siège : Tour Mirabeau, 39-43, quai André-Citroën - 75739 Paris cedex 15, France
Tél. : (33) 1 40.58.89.00 - Télex : BRGM 780258 F - Télécopieur : (33) 1 40.58.89 33
R.C. 59 B 5614 Paris - SIRET : 58205614900419
Centre scientifique et technique : Avenue de Concyr, Orléans-La Source (Loiret) - B.P. 6009
45060 Orléans cedex 2, France
Tél. : (33) 38 64.34.34 - Télex : BRGM 780258 F - Télécopieur : (33) 38.64.35.18

PROJET SUIVI POMPE EXPERIMENTALE 2/2 - fiche 2/2

TYPE ....A.D. GRANDE PROFONDEUR..

VILLAGE : ANANGARE - 75 km d'ABIDJAN
SOUS PREFECTURE : ADIAKE

DATE D'INSTALLATION : ...21-01-94...
N° MARGELLE : .....
ANCIENNE POMPE : SEEE

ESSAI DEBIT	DATE	NIV.STA	COTE INST.	PROFONDEUR POITS	PROFONDEUR FORAGE	ESSAI DE DEBITS COUP.PR	TEMPS	CAPACITE	DEBIT l/h	OBSERVATIONS
1 - APRES INSTALLATION	21-01-94	75,20 m	81 m		121 m	44	75 Secondes	10 l	419	Moyenne 487 l/h
						43	68 Sec.	10 l	528	
						44	70 Sec.	10 l	514	
2 - RODAGE	28-01-94	75,20 m	81 m		121 m	41	65 Sec.	10	554	Moyenne 599 l/h
						39	61 Sec.	10	590	
						38	58 Sec.	10	620	
						37	57 Sec.	10	631	
3 - APRES RODAGE	17-02-94	75,20 m	81 m		121 m	36	54 Sec.	10 l/5m	666 l/h	Moyenne 643 l/h
						36	55 Sec.	10	654	
						36	58 Sec.	10	620	
						36	57 sec.	10	631	

DIRECTION DE L'EAU
Mr KPENAHI
Mr. KOUADIO EDOUARD.

POUR VERGNET S A
Mr BARNABE

OBSERVATIONS,

Il est nécessaire d'augmenter la longueur des tiges de scellement en même temps que les fourches à sceller
La pompe fonctionne bien. La prochaine visite est prévue dans quinze jours pour contrôler la remise en état de la margelle ~~en ciment~~ et la pose des manettes

Annexe 14

BURGEAP

ETUDE ET MISE EN VALEUR DES EAUX SOUTERRAINES

70, RUE MADEMOISELLE
75015 PARIS FRANCE
TÉLÉPHONE : (1) 47.34.06.65
TÉLEX BURGEAP 203522 F

CERTIFICATE OF CAPACITY

RURAL WATER SUPPLY PROJECT IN THE CENTRAL REGION (GHANA)
Ghana Water and Sewerage Corporation

Financing : Caisse Française de Développement

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700 WATER POINTS EQUIPPED WITH VERGNET HYDROPUMPS

Implemented through appropriate community participation programme maintained by the private sector to make potable water supply easy, cheap and sustainable.

RESULTS

Area mechanic :	**16 on the project trained at Vergnet Training Center**
Average pump down time :	**less than 24 hours**
Spare parts network :	**4 outlets in the Central Region implemented by VERGNET**
Pump functionning rate :	**94 %**
Vergnet hydropump maintenance cost after 3 years of use :	**¢ 2900 /pump /year (~4 USD)**
Average deposit in bank for maintenance :	**¢ 69000/pump (~90 USD)**
Replenishing of the system :	**63% of the villages**
Guinea worm cases :	**93% decline**

Written in Paris , on 12/9/94

To whom it may concern

Thierry BARBOTTE
Project Manager

II- TECHNOLOGY OPTION COMPONENTS
HANDPUMP VERGNET
VHP 3C 30

Description : The pump is a direct action design. It is hand operated. The displacement of the piston located at ground level is hydraulically transmitted to a rubber sleeve down in a stainless steel cylinder. The expansion and contraction of the sleeve pumps the water to the surface. The top cylinder is connected to the bottom pumping element via a flexible hose located inside the discharge hose. The pumping elements are made of rubber and stainless steel . No corrosion is possible in submersed parts, even if installed in groundwater containing high amounts of chloride.

Technical data :

Cylinder diameter (mm) : **30**
Maximum stroke (mm) : **450**
Discharge m3/h :
at 5 m head.....**1.6**
at 10 m head.....**1.6**
at 15 m head.....**1.4**
at 20 m head.....**0.9**
at 25 m head.....**0.9**
at 30 m head.....**0.8**
Pumping lift (m) :.....**0-30**
Population served at 10 m (n°) : **800**
Households (n°) : **80**
Water consumption (lpcd) : **15-20**

Materials :

Pump head.....Stainless steel
Pump handle.....Stainless steel
Pipes.....HDPE
Pumping element.....Rubber sleeve
Valves.....Rubber membrane

Maintenance and remarks :

Time for changing wearing parts and repriming .....: 5 mn
Time for assembly..... : 40 mn
Time for installation..... : 8 mn
Time to remove the pump.....: 10 mn

The pump is easy to install.It is totally VLOM. Intervention by the caretaker is allowed on above and below ground components. Depending on project policy.

Intervention for cleaning : depending on quality of borehole and water.

Suitable for local manufacture in the short run on some parts.

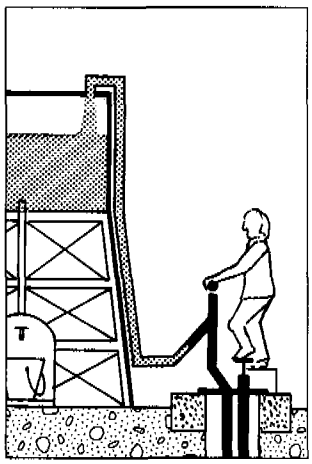
Estimated cost (USD) :

Typical CIF cost :	670
Estimated local cost :	290
Total installed cost :	960
Annual inspection :	10
Average annual spares :	17
Average annual repairs :	18
Average annual cost (without amortization) :	45
Estimated useful life (years):	17 years
Model (year) :	1991

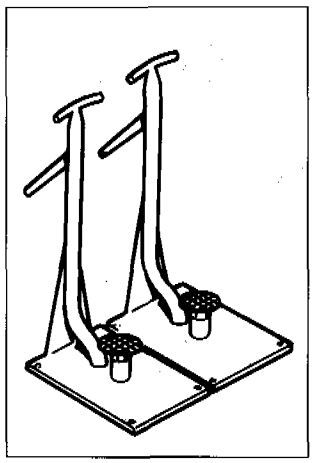
4C Hydropump VERGNET

specifications

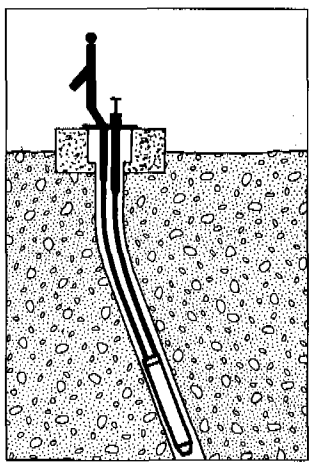
Water tower supply

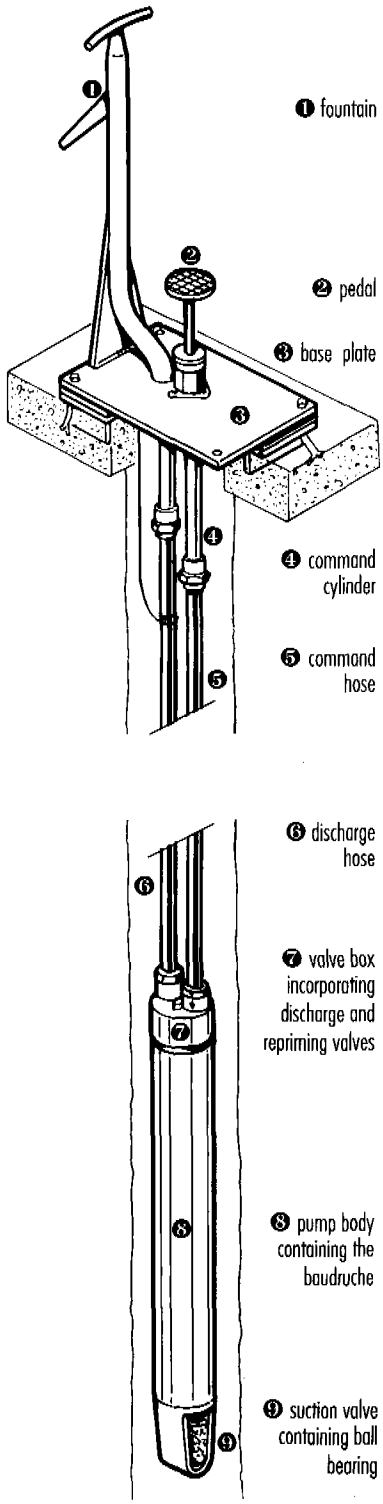


Several pumps on the same borehole



A vertical borehole is not obligatory





An original technology, tested and proven on 35 000 water points for over 15 years

1 Designed so as to be installed and maintained with ease, the 4C hydropump is a true VLOM pump (Village Level Operation and Maintenance).

2 The pumps light weight (60 kg at 40 m) allied to the use of polythene hoses, means that installation takes only two people 30 minutes, without the need for any lifting equipment.

3 All wearing parts are to be found at ground level and are accessible with ease using the tool supplied with the pump.

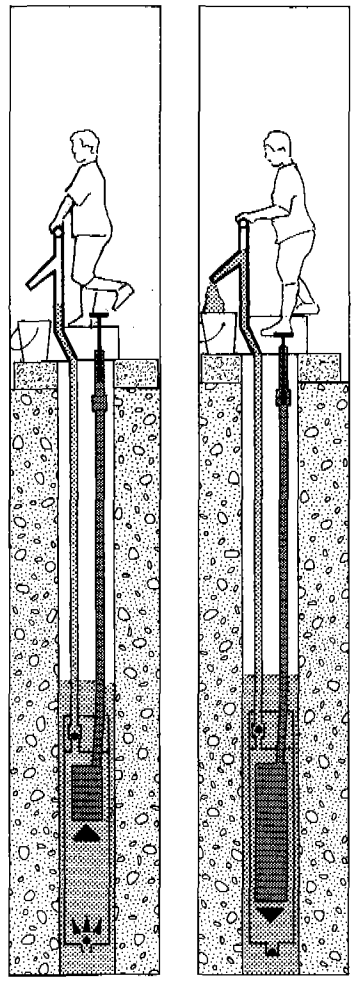
4 An average annual maintenance cost of $30 to 40, is the lowest on the market.

5 The VERGNET hydropump is tofally resistant to corrosion due to the use of rust proof materials.

how the pump works 4C HYDROPUMP

Suction :
The pedal rises, the baudruche *contracts : water* is sucked inside the stainless steel pump cylinder

Discharge :
the pedal drops, the baudruche *extends and forces* the water within the cylinder, out to the surface.



discharge valve closed

baudruche contracts

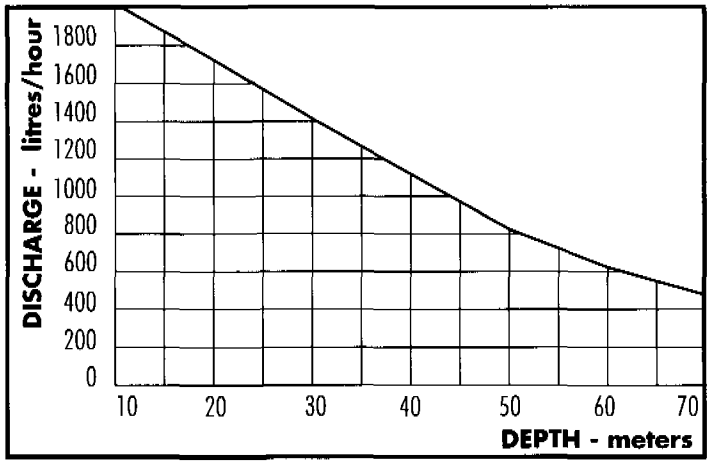
intake valve open

discharge valve open

baudruche extends

intake valve closed

performances



Type of pump :
hydraulic command, foot pump
Maximum depth :
70 meters from the dynamic level
Minimum bore hole diameter :
for 1 pump : 4"
for 2 pumps : 5"
for 3 pumps : 6"
Weight of the fountain : 18 kg
Command cylinder of the fountain (stainless steel) :
inside diameter : 30 mm
thickness of cylinder : 6 mm
length of cylinder : 480 mm
Command piston (stainless steel) : pedal
length : 532 mm
diameter : 22 mm
Pump cylinder (stainless steel) :
overall length : 1 400 mm
exterior diameter : 90 mm
weight : 11 kg
Baudruche :
length when not in use : 760 mm
Severe quality control tests enable us to offer a guarantee of 3 years on an equipment that will last, statistically, for over 8 years.
Hose :
high density polythene.
command hose :
exterior diameter : 32 mm
interior diameter : 23 mm
discharge hose :
exterior diameter : 32 mm
interior diameter : 26 mm
weight :
0,72 kg for 1 meter of command hose and 1 meter of discharge hose
valves :
valves containing ball bearing of either a synthetic or stainless steel material.
the three valve actions :
the suction or intake valve, to be found at the bottom of the cylinder. The discharge and repriming valves are to be found in the valve box at the top of the cylinder.
Strainer : the VERGNET pump body is delivered with a standard polythene strainer.
The fountain is attached to the base plate with brass screws.

6, rue Henri-Dunant - 45 140 INGRE (France)
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VERGNET

August 1992

III- TECHNOLOGY OPTION COMPONENTS
FOOTPUMP VERGNET
VHP 4C 60

Description : The pump is foot operated. The displacement of the piston located at ground level is hydraulically transmitted to a rubber sleeve down in a stainless steel cylinder. The expansion and contraction of the sleeve pumps the water to the surface. The top cylinder is connected to the bottom pumping element via a flexible hose. The pumping elements are made of rubber,brass and stainless steel . No corrosion is possible in submersed parts, even if installed in groundwater containing high amounts of chloride. In very high corrosive areas, stainless steel end caps are installed on rubber sleeve.

Technical data :

Cylinder diameter (mm) : **30**
Maximum stroke (mm) : **330**
Discharge m3/h :
at 10 m head.....**2.4**
at 20 m head.....**2.1**
at 30 m head.....**1.6**
at 40 m head.....**1.1**
at 50 m head.....**1.0**
at 60 m head.....**0.7**
Pumping lift (m) :.....**0-60**
Population served at 30 m (n°) :.....**800**
Households (n°) : **80**
Water consumption (lpcd) : **15-20**

Materials :

Pump head.....Galvanized steel
Pedal.....Mild steel
Pipes.....HDPE
Pumping element.....Rubber sleeve
Valves.....Brass

Maintenance and remarks :

Time for changing wearing parts and repriming .....: 2 mn
Time for assembly..... : 20 mn
Time for installation..... : 4 mn
Time to remove the pump.....: 5 mn

The pump is easy to install.It is totally VLOM. Intervention by the caretaker allowed on above and below ground components. Depending on project training sessions
Intervention for cleaning : depending on quality of borehole and water.
Suitable for local manufacture in the short run on some parts.

Estimated cost (USD) :

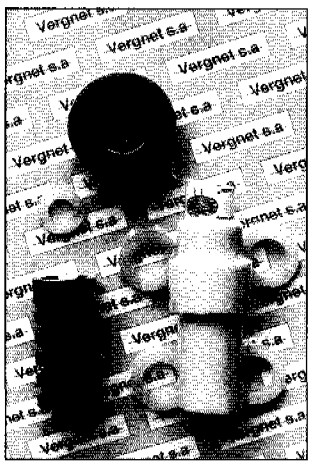
Typical CIF cost :	1077
Estimated local cost :	333
Total installed cost :	1410
Annual inspection :	10
Average annual spares :	17
Average annual repairs :	18
Average annual cost (without amortization) :	45
Estimated useful life : (years)	17
Model (year) :	1976

4D HYDROPUMP VERGNET

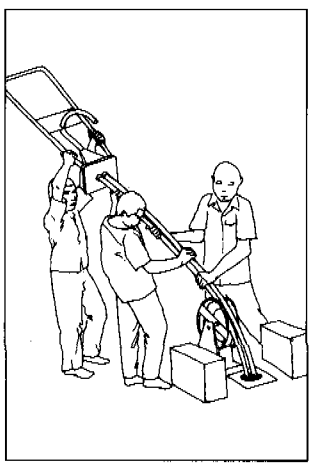
a multioperator footpump for great depth wells and boreholes

the "great depth" pump

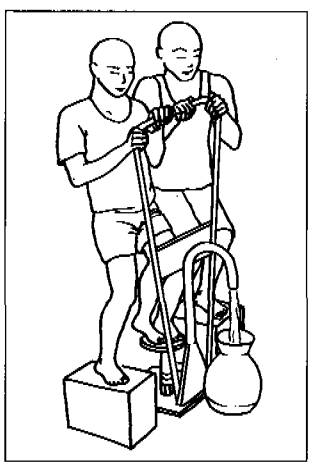
Standard VERGNET wearing parts

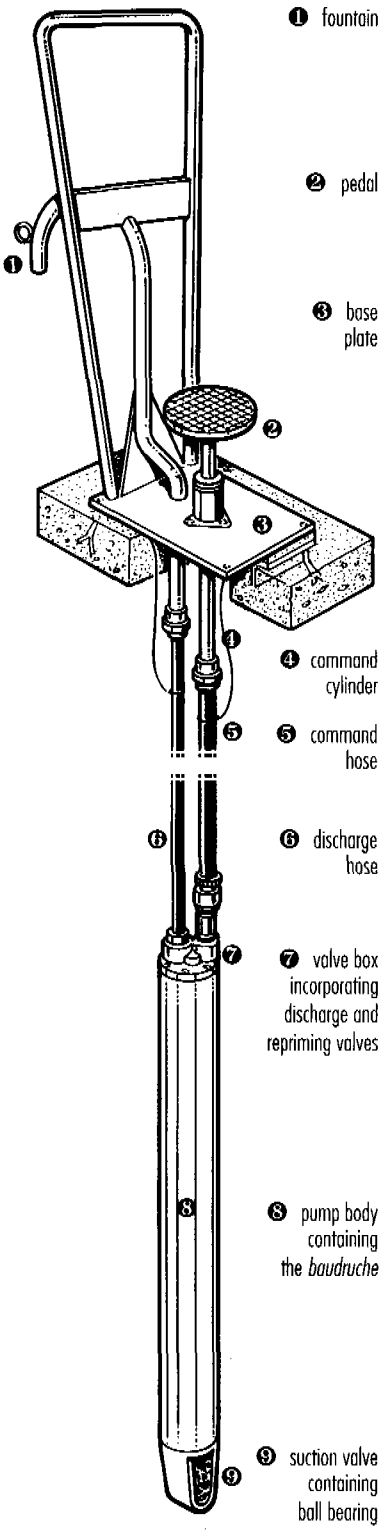


Simple extraction system



Two operator'driven pump





VERGNET HYDRAULIC DRIVE TECHNOLOGY, RELIABLE AND PROVEN SINCE 1975, PARTICULARY WELL ADAPTED FOR GREAT DEPTH.

1 The absence of rigid-rods permits pumping to great depths, down to 85 m, with excellent efficiencies.

2 It is now possible to exploit deep boreholes with satisfactory flow rates, thanks to the possible operation by two operators and the use of leg power which develops twice as much energy as arm power.

3 Similary to all hydropumps, the wearing parts are standard, located at ground level and thereby easily accessible.

4 Delivered with its extraction system, the 4D Hydropump is simple to install and to maintain : assembly and dis-assembly is entirely manual.

5 The 4D Hydropump, totally corrosion resistant, is equiped with reinforced pipes and components thus ensuring an exceptionnel reliabality.

The VERGNET 4D HYDROPUMP is the VLOM* great depth pump.

easy to install - easy to use easy to maintain

*(Village Level Operation and Maintenance)

4D HYDROPUMP VERGNET

a multioperator footpump for great depth wells and boreholes

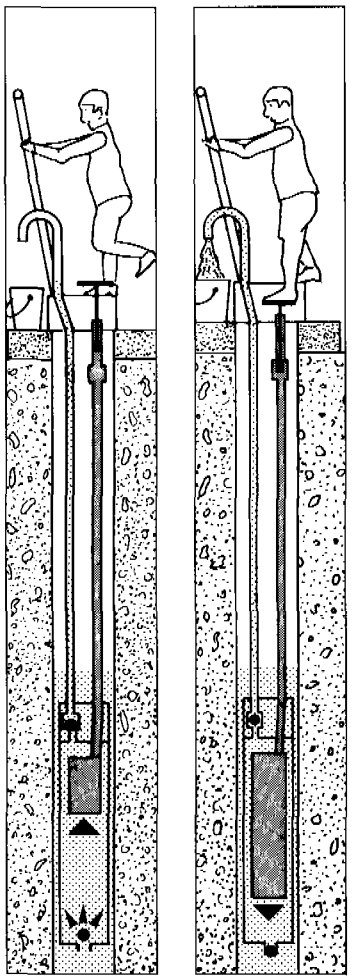
■ how the pump works

Suction :

The piston shaft rises, the *baudruche* contracts : water is sucked into the stainless steel pump cylinder

Discharge :

The piston shaft descends, the *baudruche* extends : water is forced out of the pump cylinder to the surface



discharge valve closed

the baudruche contracts

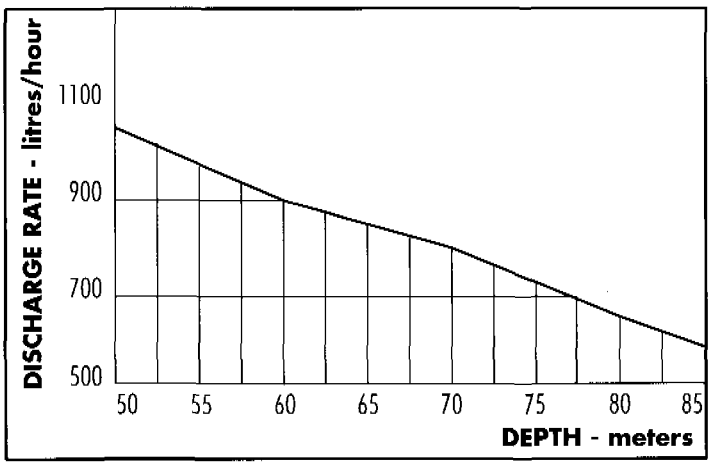
intake valve open

discharge valve open

the baudruche extends

intake valve closed

■ performances



■ technical specifications

■ **Type of pump :** hydraulic drive multioperator footpump

■ **Maximum pumping depth :**
85 meters from the dynamic level
100 meters from the immersion level

■ **Minimum borehole diameters :**
for 1 pump : 5"
for 2 pumps : 6"

■ **Fountaine :**
galvanized iron
weight : 21kg

hydraulic drive cylinder :
galvanized iron
inside diameter : 30mm
wall thickness : 6mm
cylinder length : 610mm

■ **Drive shaft :**
galvanized iron
shaft length : 650mm
diameter : 22mm

■ **Pump cylinder :**
galvanized iron
length : 2 320mm
external diameter : 90mm
weight : 15kg

■ **Baudruche :**
length when not in use : 1 590mm. Severe quality control tests offer a guarantee of 3 years on an equipment that will last, statistically, for over 8 years.

■ **Hoses :**
high density polyethylene

drive hose:
external diameter : 40mm
inside diameter : 21,2mm

discharge hose :
external diameter : 32mm
inside diameter : 26,4mm

hoses' weight : 1,175kg pour 1 meter of command hose and 1 meter of discharge hose

■ **Valves :** valves containing ball bearing of either a synthetic or stainless steel material

the three valves actions:
The suction or intake valve, to be found at the bottom of the cylinder. The discharge and repriming valves are to be found in the valve box at the top of the cylinder.

■ **Strainer :** the VERGNET pump body is delivered with a standard polyethylene strainer. The fountain is attached to the base plate with brass screws.

6, rue Henri-Dunant - 45 140 INGRE (France)
Tél (33) 38 43 36 52 - Fax (33) 38 88 30 50 - Telex 780980F VERGNET

VERGNET

IV- TECHNOLOGY OPTION COMPONENTS
DOUBLE FOOT PUMP VERGNET
VHP 4D 100

Description : The pump is double foot operated. The displacement of the piston located at ground level is hydraulically transmitted to a rubber sleeve down in a stainless steel cylinder. This model is based on VHP 4C 60 with larger dimensions suitable for great depths.The expansion and contraction of the sleeve pumps the water to the surface. The top cylinder is connected to the bottom pumping element via a flexible hose. The pumping elements are made of rubber, brass and stainless steel . No corrosion is possible in submersed parts, even if installed in groundwater containing high amounts of chloride.

Technical data :

Cylinder diameter (mm) : 30
Maximum stroke (mm) : 430
Discharge m3/h :
at 50 m head.....1.0
at 60 m head.....0.9
at 70 m head.....0.8
at 80 m head.....0.8
at 90 m head.....0.7
at 100 m head.....0.6
Pumping lift (m) :.....0-100
Population served at 30 m (n°) :.....400
Households (n°) : 40
Water consumption (lpcd) : 15-20

Materials :

Pump head.....Galvanized steel
Double pedal.....Mild steel
Pipes.....HDPE
Pumping element.....Rubber sleeve
Valves.....Brass

Maintenance and remarks :

Time for changing wearing parts and repriming .....: 2 mn
Time for assembly..... : 50 mn
Time for installation..... : 10 mn
Time to remove the pump.....: 15 mn

The pump is easy to install.It is totally VLOM. Intervention by the caretaker allowed on above and below ground components. Depending on project training sessions
Intervention for cleaning : depending on quality of borehole and water.
Suitable for local manufacture in the short run on some parts.

Estimated cost (USD) :

Typical CIF cost :	1645
Estimated local cost :	345
Total installed cost :	1990
Annual inspection :	10
Average annual spares :	17
Average annual repairs :	18
Average annual cost (without amortization) :	45
Estimated useful life (years):	18
Model (year):	1992

V- GENERAL COMMENTS ON VERGNET HYDROPUMPS

1) International specifications.

The design of Vergnet hydropumps used to be the property of VERGNET SA (FRANCE). But now it is in the public domain.

2) Ease of installation.

All VHP can be installed with three tools. The installation is very easy due to HDPE pipes.

3) Ease of repair and VLOM.

The pump is very easy to repair. The tools required for maintenance can be transported on a bicycle.
Two levels of maintenance are recommended :

- above ground level part
- below ground level part

However, depending on projects philosophy, village communities can be trained for maintenance on both above and below ground part of VHPs.
Anyway, VERGNET recommends two levels of maintenance because balanced decentralized maintenance is based on the three following elements :

- village communities
- spare parts outlets
- area mechanics who are skilled to repair sooner and better

because they are in charge of 40 or 50 pumps.
Those informations are based on a field experience in GHANA (Rural Water Supply Project in Central Region, GWSC).

4) Reliability and abrasion resistance

The life time of the wearing parts (guide bush, piston rings, lower stop ringswhich re the same for the three models of pump) is between 12 and 18 months depending on the daily pumping time. Quality has been considerably improved.
If rubber sleeves used to give problems in the past, the average time life is now around eight years.Less than 1% failure hzs been declared since 1986

5) Corrosion resistance

The use of stainless steel, brass, and plastic downhole components make it suitable for use in corrosive water. The aluminium endcups in high corrosive areas are now replaced by stainless steel ones to avoid risks of of premature corrosion.

6) User preference

VHPs discharge rates have been SGS homologated. They are good in both low and high lift applications.
The foot operation is unusual but ergonomically good. The information from the field has always shown an interest from the villagers for this system.

7) Cost of pump and spare parts

The cost of the pump is similar to the other pumps with better performances.
Spareparts costs are moderate. Statistics in Ghana are available on cost of maintenance after three years of use. It is around 4 USD.
However, over ten years, it is estimated between 30 and 40USD/year.
Taken into account the gradual local manufacture and the improvements on the pump components, the cost is expected to decrease in the future.

8) Suitability for local manufacture

If economically viable, 60% of the pump can be manufactured in Ghana.
In the mid run, a transfer of technology may enable a local company to manufacture 80% of the pump. In the aim of developing local capacity building VERGNET SA FRANCE and its agent AGROVETS LTD have become shareholders of TAMALE IMPLEMENT FACTORY. The existing structure should limit considerably the investment for tooling and begin to manufacture locally with lower costs.

9) Pumping lift.

VHP range with the same system, the same wearing parts can pump from 0 to 100 m.
VHP 3 C 30 : 0 TO 30 M.
VHP 4 C 60 : 0 TO 60 M.
VHP 4 D 100 : 0 TO 100 M.

ANNEX

1/ VERITAS	CERTIFICATE VHP 3C 30	29/11/93
2/ VERITAS	CERTIFICATE VHP 4C 60	04/05/94
3/ VERITAS	CERTIFICATE VHP 4D 100	12/04/94
4/ CIEH	4 VHP BURKINA	29/11/94
5/ SNAPE	GUINEA MAINTENANCE COST	1994
6/ OCSD	RCA 5 VHP	10/10/92
7/ HELVETAS	MAINTENANCE COST MALI	12/01/92
8/ SD COTON	MAINT COST CAMEROON	11/03/91
9/ FRENCH COOPERATION	MAINT COST NIGER	01/09/86
10/ BMB	WOMEN POSITION	01/11/90
11/ SNAPE GUINEA	CERTIFICATE SLEEVES	18/09/92
12/ DHA CHAD	VHP 4D 100 TESTS	16/02/64
13/ BRGM	VHP 4D 100 DISCHARGE RATES	12/05/93
14/ WAT ER AFFAIRS	VHP 4D 100 IVORY COAST	21/01/94
15/ BURGEAP GHANA	CERTIF CAPACITY RWSP	12/09/94

BUREAU VERITAS

Annex 1

Industry Branch

ATTESTATION - BV.OLN-4 93 045

The undersigned, BRULLE J.Yves, Inspector Level II of the Bureau VERITAS, acting within the scope of the general conditions of the Industrial Branch of Bureau VERITAS and upon request of the company : **VERGNET (45140) INGRE - FRANCE.**

Certifies having attend the discharge test of **A PUMP VERGNET TYPE HYDROPUMP 3C** on the site of the Company VERGNET at INGRE (45) - FRANCE on the SEPT, 09th 1993.

The maxima values recorded have been :

PUMP INSTALLED AT 16,75 METERS.

Static level :	5 meters	Max discharge :	1653 l/h
Static level :	10 meters	Max discharge :	1628 l/h
Static level :	15 meters	Max discharge :	1469 l/h

PUMP INSTALLED AT 31,75 METERS.

Static level :	20 meters	Max discharge :	942 l/h
Static level :	25 meters	Max discharge :	940 l/h
Static level :	30 meters	Max discharge :	857 l/h

It was been proceed to the maintenance and installation testing on this pump with the following results :

- Time of wearing parts changing and repriming (1 Person) : 5 minutes.
- Time of mounting the pump (1 person) : 40 minutes
- Time of installing and priming (1 person) : 8 minutes
- Time to pull out the pump (2 persons) : 10 minutes.

The integrality of the results of the tests performed on the SEPT. 9th, 93 is recorded on the enclosed tests report

ORLEANS, MAY 9, 1994

The Inspector of Bureau VERITAS
JY. BRULLE

BUREAU VERITAS REGISTRE INTERNATIONAL REGION OUEST

Annex : Tests report (4 pages)

Annex 2

BUREAU VERITAS

Industry Branch

ATTESTATION - BV.OLN-4 94018

The undersigned, BRULLE J.Yves, Inspector Level II of the Bureau VERITAS, acting within the scope of the general conditions of the Industrial Branch of Bureau VERITAS and upon request of the company : **VERGNET (45140) INGRE - FRANCE.**

Certifies having attend the discharge test of **A PUMP VERGNET TYPE 4D HYDROPUMP "GREAT DEPTH"** on the site of the Company FORACO at SALBRIS (41) - FRANCE on the April 1st, 1994.

The maxima values recorded have been :

PUMP INSTALLED AT 102 METERS.

Static level :	100 meters	Max discharge :	668 l/h
Static level :	90 meters	Max discharge :	716 l/h
Static level :	80 meters	Max discharge :	758 l/h
Static level :	70 meters	Max discharge :	788 l/h
Static level :	60 meters	Max discharge :	879 l/h
Static level :	50 meters	Max discharge :	1070 l/h

The pump was feet operated by 2 persons (1,74m/80kg and 1,80m/90kg).

It has been proceed to the maintenance testing on this pump with the following result

- Time of wearing parts changing : 2 minutes.

The integrality of the results of the tests performed on the April 1st, 94 is recorded on the enclosed tests report

ORLEANS, APRIL 14th, 1994

The Inspector of Bureau VERITAS
JY. BRULLE

BUREAU VERITAS REGISTRE INTERNATIONAL REGION OUEST

Annex : Test report - 4 pages

Head Office : 17 bis, Place des Reflets - La Défense 2 - 92400 Courbevoie - France - Tel : 33 (1) 42 91 52 91 - Telex : 611135 F

BUREAU VERITAS

Industry Branch

Annex 3

ATTESTATION - BV.OLN-4 94018/001

The undersigned, BRULLE J.Yves, Inspector Level II of the Bureau VERITAS, acting within the scope of the general conditions of the Industrial Branch of Bureau VERITAS and upon request of the company : **VERGNET (45140) INGRE - FRANCE.**

Certifies having attend the discharge test of **A PUMP VERGNET TYPE 4C HYDROPUMP** on the site of the Company VERGNET at INGRE (45) - FRANCE on the 04.05.94.

The maxima values recorded have been :

PUMP INSTALLED AT 32 METERS.

Static level :	10 meters	Max discharge :	2432 l/h	Discharge by kick : 0,714 l
Static level :	20 meters	Max discharge :	2083 l/h	Discharge by kick : 0,555 l
Static level :	30 meters	Max discharge :	1686 l/h	Discharge by kick : 0,416 l

PUMP INSTALLED AT 62 METERS.

Static level :	10 meters	Max discharge :	1636 l/h	Discharge by kick : 0,588 l
Static level :	20 meters	Max discharge :	1556 l/h	Discharge by kick : 0,500 l
Static level :	30 meters	Max discharge :	1310 l/h	Discharge by kick : 0,370 l
Static level :	40 meters	Max discharge :	1036 l/h	Discharge by kick : 0,333 l
Static level :	50 meters	Max discharge :	868 l/h	Discharge by kick : 0,263 l
Static level :	60 meters	Max discharge :	750 l/h	Discharge by kick : 0,238 l

The pump was feet operated by 1 person. Height and weight of operators are *mentionned* on joined report.

It has been proceed to the maintenance and installation testing on this pump with the following result

- Time of wearing parts changing and repriming (1 Person) : 2 minutes.
- Time of mounting the pump (1 person) : 20 minutes
- Time of installing at 32 meters and priming (2 persons) : 4 minutes
- Time to pull out the pump installed at 62 meters (2 persons) : 5 minutes.

Head Office : 17 bis, Place des Reflets - La Défense 2 - 92400 Courbevoie - France - Tel. : 33 (1) 42 91 52 91 - Telex : 611135 F

BUREAU VERITAS Industry Division

ATTESTATION - BV.OLN 4 94018/001

The integrality of the results of the tests performed on the MAY 4, 94 is recorded on the enclosed tests report

ORLEANS, MAY 8, 1994

The Inspector of Bureau VERITAS
JY. BRULLE

Annex : Test report (6 pages) - Technical data (1 page)