EFFECT OF PRIME-MOVER AND MUDDY WATER ON THE LOW PRESSURE CENTRIFUGAL PUMP CHARACTERISTICS

BY

DR. A.A. NASSER(1), DR. ES.A. SALEM(2), DR.S.M. WEHABA(3),
DR. B.A. KHALIFA(4) & DR.A.M. EASA(5)

1. ABSTRACT:

The Nile irrigation follows the cannal irrigation system in which the water is distributed by scheme of shifts, logically, for low water level in the channel, the pureness of water is changed, in addition to plant ristriction and seasonal clearing of channel .....etc. So, the Nile irrigation is continuously subjected to changes in its pureness specially during pump operation.

Therefore, the effect of water pureness on the pump performance and characteristics is considered major factor in service life of the irrigation pump. The service life of the system is an economical indicator which must be considered in the electrification of irrigation means.

This research aims at finding out the effect of water pureness, prime mover and type of suction pipe on the pump performance.

---

(1) Abdel-Hady Abdel-Bary Nasser, Prof. Dr., Head of Production Engineering & Machine Design Department, Faculty of Engineering & Technology, Menoufia University.

(2) Esam Ahmed Salem, Prof. Dr. Faculty of Engineering, Alexandria University.

(3) Saad Mohamed Wehaba, Prof. Dr., Head of Power Engineering Mechanics, Faculty of Engineering & Technology, Menoufia University.

(4) Basyouni Ahmed Khalifa, Asst. Prof. Dr., Faculty of Engineering & Technology, Menoufia University.

(5) Ahmed Mahmoud Easa, Dr. Eng., Lecturer Faculty of Engineering & Technology, Menoufia University, Production Eng. & Machine Design Department.

2. INTRODUCTION:

The performance of the pump (discharge, manometric head and efficiency) depends on nemerous factors that affect either positively or negatively the pump efficiency. Not only the type of pumped fluid (1)*, but also the pumping system and suction systems can decrease the pump efficiency due to the occurence of cavitation phenomena.

In the case of centrifugal pumps the additional effects of the pumped fluid can render critical speed calculations meaningless (2)*.

The prime-mover type has a large effects on the pump characteristics and performance.

3. EXPERIMENTAL WORK AND PROCEDURE:

In order to have a clear picture of the effect of different parameters on the performance characteristics of centrifugal pump, an experimental station was designed and constructed in the Faculty of Engineering and Technology, Shebin El-Kom, Menoufia University.

The experimetnal set up provides the facility of studying the effect of:

i - Fluid property,
ii - Suction conditions,
iii- Type of prime-mover.

on the performance of the centrifugal pump.

The basic components of the experimental station are; pumping set, delivery tank, suction tank and measuring devices.

The pumping set consists of, pump, prime mover, suction pipe, delivery pipe, control valves and filters.

The pump used is a low head centrifugal pump of the following specifications; head 8 mt. water, R.P.M. 1450 and the capacity 250 m^3/hr.

Two types of prime-mover were used:

i- An electric motor of the following specifications; speed 1450 r.p.m and out put power = 10 HP.

ii- Diesel engine specifications are; speed 1450 r.p.m by using a conical pulleys system and power = 10 horse power.

The suction and delivery pipes have the same diameter (15 cm.) and same length (4.5 mt.).

Two different materials was used for suction pipe, rubber and steel, the suction pipe ends with a filter and non-return valve.

The valves used in the pumping see are:

i- Non-return valve in the suction pipe, and two regulating valves, one in the delivery pipe to regulate the discharge and the other on the suction side to study the effects of manometric suction head.
The suction tank dimensions are; width 1.8 mt, length 8 mt and dept 4 mt.
The delivery tank dimensions are; height 2mt, length 1.76 mt, and width 1.76 mt.

3.1 Measuring Devices:

The suction and delivery manometric heads were measured by two calibrated pressure gauges of Bourden type.

The orifice up-stream and down-stream pressures were measured by two calibrated pressure gauages of the previous type.

The pump speeds was measured by a calibrated speed transducer PHILIPS type (PR 9373). The pump speed was changed using a system of pullies as shown in Fig. (1). To calculate the shaft horse-power of the pump, it is necessary to measure the torque on the shaft. A calibrated torque transducer PHILIPS type (PR 9380 R/50) was used.

3.2 Experimental Procedure:

1. Before runs were made the pumping station was checked throughly for leaks.

2. To draw the performance curves of the pump (H-Q, S.HP -Q and η -Q), the following procedure was carried out at certain speed.

   a- Suction valve was open while the delivery valve was closed.,

   b- Start the pump,

   c- Open gradually the delivery valve.

   d- Record the following reading:

   H_{m_s} = manometric suction head,
   H_{m_d} = manometric delivery head,
   H_1 = orifice up-stream pressure,
   H_2 = orifice down-stream pressure,
   N = r.p.m.,
   T = Torque.

To have another set of performance curves, change the speed by the pullies system and repeat the previous procedure.

For the performance of the pump using muddy water, the mud was added to the water in the ratio $\frac{1}{40} - \frac{1}{20}$ by weight.

To find out the effects of prime mover on the pump performance, the diesel engine replaces the electric motor and the previous steps was repeated.

The tests were repeated at variable r.p.m, namelly at 1350, 1550, 2350, 2700 and 3000 r.p.m.

4. DISCUSSION AND CONCLUSIONS

4.1 Punp Performance Using Drinkage Water and Electric Motor:

The relation between the capacity (Q) and the total head(H) at different speeds (1350, 1550, 2350, 2700 and 3300 r,p.m.) is presented graphically in figures (1_b & 2). It is clear from the figure that the capacity (Q) decreases with the increase of total head and speed up to 1550. The capacity (Q) reached its maximum value when the pump operates at the main speed of 1550 r.p.m while the total head takes a small value compared with that at higher speeds. The total head increases with the increase of R.P.M. The capacity (Q) is considered to be the most important element in calculating the cost of irrigation per/ feddan (time required to irrigate one feddan depends on the capacity of the pump).

The effect of the capacity (Q) on the shaft horse power is illustrated in figures (3 and 4). It is clear from the figures that the shaft horse power increases with the increase of the capacity (Q). This increase in shaft horse power is due to the increase of the water delivered and consequently increasing the load on the impeller blades. The shaft horse power also increases with the increase in the R.P.M. The maximum shaft horse power occurs at the speed of 3300 R.P.M. The following table gives the values of the shaft horse power at different speeds and at average capacity of 150 mt^3/hr.

Speed R.P.M.	1350	1550	2350	2700	3300
Shaft horse power-horse	6.2	9.8	18	25.5	30.2

The relation between the capacity (Q) and the pump efficiency (η) at different speeds is shown in figures (5 and 6). From this figures it is clear that the efficiency increases with the increase of the capacity (Q) at the same speed while it decreases with the increase of the speed at the same capacity. The following table represents the efficiency at different speeds and at the average capacity of 150 mt^3/hr.

Speed	1350	1550	2350	2700	3300
Efficiency % age	66	55	18	11	9

4.2. Pump Performance Using Diesel Motor:

The relation between the capacity (Q) and the total head (H) for different speeds using diesel motor and drinkage water is shown in the figures (7 and 8). The total head (H) decreases with the increase in the capacity (Q) while it increase with the increase in the speed at the same capacity. The total head reaches the largest value when the pump operates at 3300 r.p.m. The total head using electric motor has a values less than that obtained when using diesel motor. The following table gives the total head for different speeds at the average capacity 150 mt^3/hr. when using electric and diesel motor.

Speed R.P.M. / Prime-mover	1350	1550	2350	2700	3300
E.M.	8.08	9.06	10.04	11.08	12.10
D.M.	8.27	9.28	10.28	11.29	12.30

The relation between the capacity (Q) and the shaft horse power at different speeds is shown in figures (9 and 10). The shaft horse power increases with the increase of the capacity (Q) and the speed. The values of the shaft horse power obtained by the use of diesel motor is larger than that obtained using electric motor.

The following table represents the percentage increase in the shaft horse-power using diesel motor compared to electric motor.

Speeds	1350	1550	2350	2700	3300
% age increase in shaft horse-power.	0.20	0.16	0.20	0.30	0.10

Figures (11 & 12) show the relation between the capacity (Q) and efficiency (η) using diesel motor, drinkage water and running at different speeds. From this figures, it can be seen that, for the same capacity (Q), the effficiency ( ) decreases with the increase of speed, and it is become very small at 3300 r.p.m.

The efficiency in case of diesel motor is smaller than the obtained in case of using electric mtoro. The following table represents the efficiency when using different types of prime movers (electric and diesel motor), different speeds and drinkage water.

Speed R.P.M. / Prime mover	1350	1550	2350	2700	3300
E.M.	66	55	18	11	9
D.M.	52	47	15	8	6

4.3. Pump Performance Using Muddy Water:

i - Mud ratio $\frac{1}{40}$ by weight

Figures (13 & 14) illustrates the relation between the capacity and total head (H) using muddy water, electric motor and different speeds. From this figures, it is clear that, as the capacity (Q) increases the total head (H) decrease. Both the capacity (Q) and total head (H) takes a small values in this case compared with the results using drinkage water and the same prime mover. The mud in water affects largely the pump performance because the specific gravity of water become larger than the drinkage water and the dynamic effect of mud on the impeller blades.

The same behavior was noticed at different speeds, but the total head increases with the increase of the speed. This increase takes a different increasing ratioes for the different speeds.

Figures (15 & 16) shows the relation between the capacity (Q) and shaft horse-power (S.HP). From this figures, It can be seen that as the capacity (Q) increases the shaft horse-power increases and as the speed increases for the same capacity (Q), the shaft horse-power increase, this increase takes a large value at a speed of 3300 r.p.m.

The following table reprsents the variation of the speed with the shaft horse-power ratio for muddy water and drinkage water.

R.P.M. ITEM	1350	1550	2350	2700	3300
$\frac{\text{S.HP muddy *}}{\text{S.HP d.w. **}}$	1.09	1.05	1.01	1.04	1.10

* $S.H.P_m$ = Shaft horse-power in case of muddy water,
**$S.H.P_d$ = Shaft horse-power in case of drinkage water.

Figures (17 and 18) represents the relation between the capacity (Q) and the efficiency (η) using muddy water of mud ratio 1/40 by weight, electric motor and different speeds. From this figures, it is clear that as the capacity (Q) increases the efficiency (η) increases for different speeds. But the efficiency (η) decreases as the speed increase. The decrease in efficiency (η) is due to the increase in shaft horse power results from changing the mud ratio in water.

The following table represents the efficiency (η) of the pump under study using drinkage water, mud water 1/40, electric motor and different speeds.

R.P.M ITEMS	1350	1550	2350	2700	3300
drinkage W.	66%	55	18	11	9
Mud water $\frac{1}{40}$	52%	46	15	8	7

4.4. Pump Performance Using Muddy Water:

ii- Mud ratio $\frac{1}{20}$ by weight.

Figures (19 & 20) shows the relation between the capacity (Q) and total head (H) using mud water $\frac{1}{20}$, electric motor and different speeds. This figure shows that, As the capacity (Q) increases the total head (H) decrease, and for the same capacity (Q) and different speeds, As the R.p.M. increases the total head (H) increases. But the values of the total head (H) in this case has a small value compared with that of using drinkage water and the same elements. Generally, The same behaviour was noticed at different speeds, but the capacity (Q) decreases with the increase of R.P.M. and reaches to the smallest value at 3300 R.P.M. The total head increases as the R.P.M increase and takex a max. values at R.P.M 3300. It is also noticed that, both the capacity (Q) and total head values in this case takes a small values compared with that of using electric motor and the same elements according to the decreasing of water pureness and its effect on the pump performance.

4.5. A comparison of Pump Performance Using Different Prime-Movers and Drinkage Water:

Figures (2 to 20) shows the relation between the capacity (Q) and total head (H), using different prime-movers, different speeds and drinkage water. From these figures, it is clear that for the same capacity (Q) the total head increase using diesel motor.

From the relation between the discharge (Q) and shaft horse power at the previous figs. It is noticed that, the shaft horsepower increases when using diesel motor according to the increase of the inertia force of the system (fly wheel and engine0. Thus the shaft horse-power increases with the increase of speed for diesel motor than the case of using electric motor.

4.6. Comparison of Pump Performance Using Different Types of Prime-Movers and Different Mud Ratioes:

Figures (1_b, 2, 7, 8, 13, 14,19,20,25,26,31 and 32) shows the relation between the capacity (Q) and total head (H) using different speeds, different prime-movers and different types of water pureness. From this figures, it is noticed that, As the mud ratio increases the total head decreases for the same capacity (Q). The following table represent the total head (H) values for the mean capacity (Q) of the pump, different degree of water pureness and different speeds using electric motor:

R.P.M ITEM		1350	1550	2350	2700	3300
Drinkage water		8.060	9.06	10.04	11.08	12.10
Mud Water	$\frac{1}{40}$	8.075	8.085	9.015	9.15	11.08
	$\frac{1}{20}$	8.070	8.075	8.10	8.15	8.30

Generally, and from the table, the increase of mud ratio, decreases the total head while the increase of R.P.M. increases the total head (H) for the same capacity (Q).

Figures (3, 4, 9, 10,15,16,21,22,27,28,33 and 34) shows the relation between the capacity (Q) and the shaft horse-power for different water pureness, different speeds and different prime-movers. From this figures it is clear that, for the same capacity (Q):

- The increase of mud ratio in water increases the shaft horse--power,'this increase had a different ratioes.
- The increase of the speeds, increases the shaft horse-power by different ratioes.
- When using diesel motor the shaft horse-power increases by different ratioes for various speeds comparing with using electric motor mud diesel motor for different degree of water pureness.

The following table represents the (S.HP) values for various types of water pureness, different type of prime-movers, and different speeds at the average discharge (150 m^3/hr.).

R.P.M. ITEMS		1350	1550	2350	2700	3300
E.M.	P.W.	6.50	9.40	17.20	24.10	29.20
	M.V. $\frac{1}{40}$	7.10	10.00	17.40	25.00	32.20
	M.W. $\frac{1}{20}$	7.50	10.70	18.20	25.80	34.70
D.M.	P.W.	8.90	9.80	18.20	25.00	30.80
	M.W. $\frac{1}{40}$	9.90	11.30	18.90	25.80	32.90
	M.W. $\frac{1}{20}$	10.90	12.20	19.90	26.60	35.60

Figures (5, 6, 11, 12, 17, 18, 23, 24, 29 and 30) shows the relation between the capacity (Q) and the efficiency (η) for different types of prime-movers, various degree of water pureness and different speeds. From this figure it is noticed that:

- As the capacity (Q) increases, the efficiency (η) increases for the different prime-movers, various degree of water pureness and different speeds.

- In case of using diesel motor, the efficiency of the pump decreases comparing with the case of using electric motor for the same water pureness and for different speeds.

- As the mud ratio increases, the efficiency (η) decreases for the same prime-mover and different speeds. But the efficiency has a small value when using diesel motor, and it has a smallest values when using mud ratio $\frac{1}{20}$ and diesel motor for different speed. The following table represent the efficiency values for different prime-movers, various degree of water pureness and for different speeds.

ITEM	R.P.M.	1350	1550	2350	2700	3300
E.M.	D.W.	66	55	18	11	9
	M.W. $\frac{1}{40}$	60	48	16	9	7
	M. $\frac{1}{20}$	55	43	14	7	5
D.M.	D.W.	52	47	15	8	6
	M. $\frac{1}{40}$	45	37	13	7	5
	M. $\frac{1}{20}$	37	30	11	4	3

4.7. CONCLUSION:

From the previous discussion, the following conclusion can be drown:

i - The pump efficiency (η) decreases as mud ratio increases.
ii - Using a diesel engine instead of electric motor decreases of the pump efficiency (η).

REFERENCES

1. RAYLEIGH, F, MURRAY, J.L. Calculation and selection of dynamic properties of Journal bearings suitable for high speed applications computer aided design conf. IEE April, 1974, Southampton.

2. PROHL, M.A., A general method of calculating critical speeds flexible rotors. It of APPL. Mechs. Trans. ASME, Vol. 67. 1945.

3. ENDERBY, J.A. A mercury shirling speed programme. D.E.G., Dept. No. 40(R).

4. WELDON, R. Boiler feed pump design for maximum availability, Advanced class boiler feed pump converntion, Mech G, 1970.

5. LUND, J.W., ORCUTT, F.C., Calculations and experiments on the unbalance response of a flexible rotor, ASME Trans, Eng. for Inds. Nov. 1967.

6. BS 4675:1971. Recommendations for basis for comparative evaluation of vibration in machinery.

7. LUMAKIN, A.A., BEDGER, F.S., Determination of critical speed of a pump rotor with reference to forces arising in the seal gaps, Steam and Gas Turbine Engineering (Mash G 12, 1957, No. 5).

8. BLACK, M.F. Effects of hydraulic forces in annular pressure seals on the vibrations of centrifugal pump rotors, J 1, Mech. Eng. Sci. Vol. 11 No. 2. 1969.

9. BLACK, H.F., BROWN, R.D., FRANCE, D. JENSSEN, Theoretical and experimental investigation relating to centrifugal pump rotor vibrations. Vibrations in rotating systems conf. IMechE. February, 1972.

10. R.D. BROWN, Vibration Phenomena in large centrifugal pumps, Fluid Machinery Group Conf., 16-18 Sept. 1975.

11. PIMKUS, O., Experimental investigation of resonant ship. Trans. ASME July 1956, pp. 975.

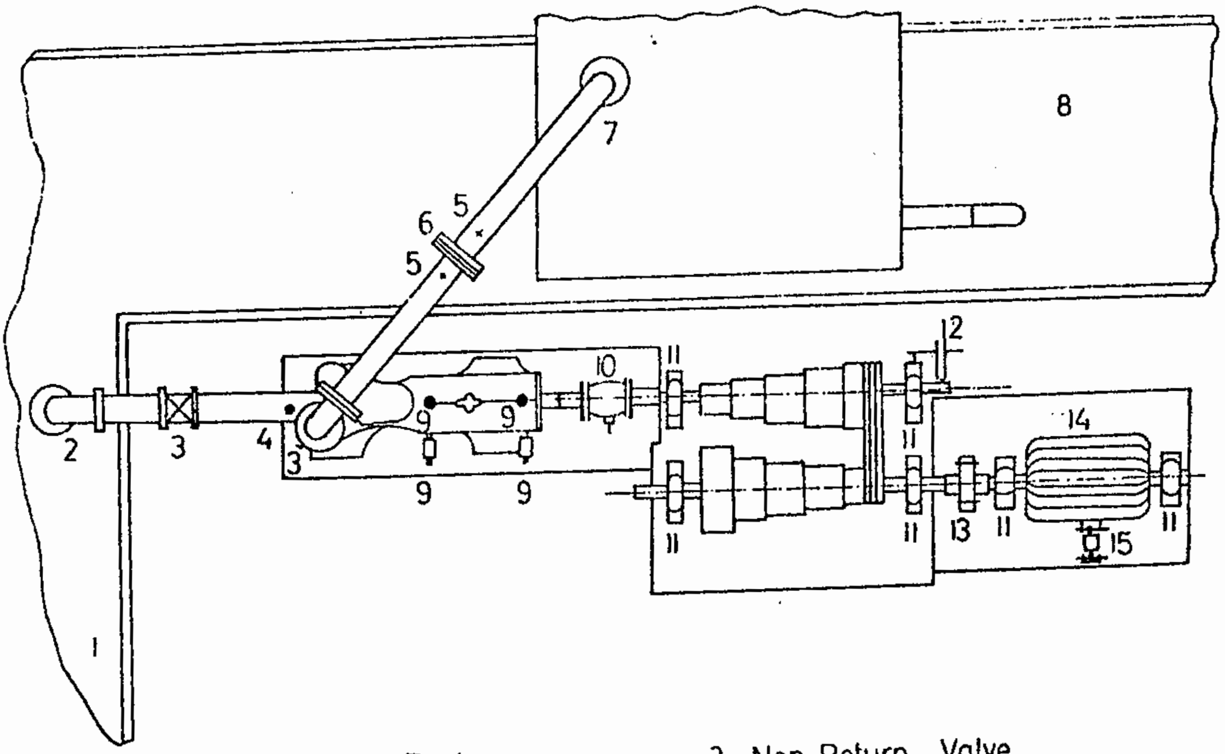
12. BLACK, H.F. LOCH, N.E., Computation of lateral vibration and stability of pump motors computer aided design of pumps and fans, Conf. IMechE Newcastle 1973.

13. STEPANOFF, A.J. Centrifugal and axial flow pumps theory design and application, 1957, Wiley, New York.

14. UCHIDA, N, Imiaichi, K. TOCHIAKT, S. Radial forces on the impeller of centrifugal pump. Vull of ISME, Vol. 14 No. 76, 1971.

15. KARAASSIK and CARTER, Centrifugal pumps 1975.

16. KNAPP, R.T., DALY, J.W. and HAMMITT, F.G. Cavitation, (Mc Graw Hill 1970).



1 _ Main Supply Tank.
3 _ Suction Valve.
4 _ Vibration Transducer.
6 _ Orifice Meter.
8 _ Main Supply Tank.
10 _ Torque Transducers.
12 _ R. P. M. Transducers.
14 _ Electric Motor.

2 _ Non Return Valve.
3\` _ Delivery Valve.
5 _ Orifice Pressure Measuring.
7 _ Delivery Tank.
9 _ Vibration Transducers.
11 _ Bearing.
13 _ Rigid Coupling.
15 _ Force Transducer.

Fig. (1a) Station Under_Study.

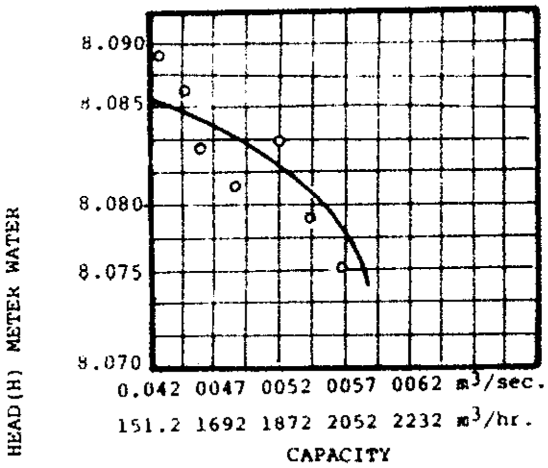


FIG (1) (H-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R.P.M. 1550.

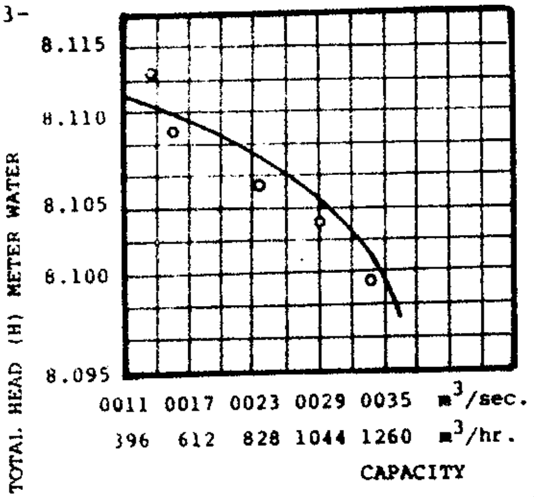


FIG. (2) (H-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R.P.M.

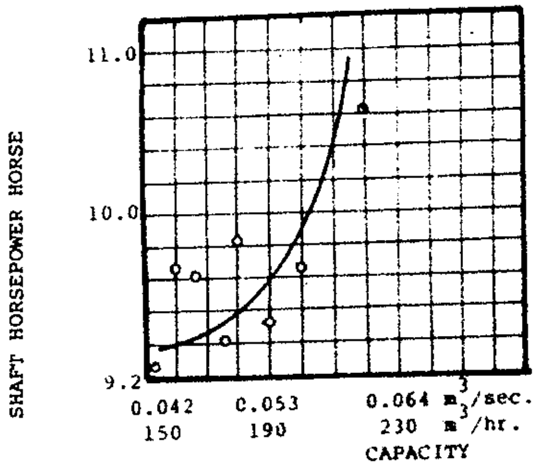


FIG. (3) (S.HP-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R,P,M 1550.

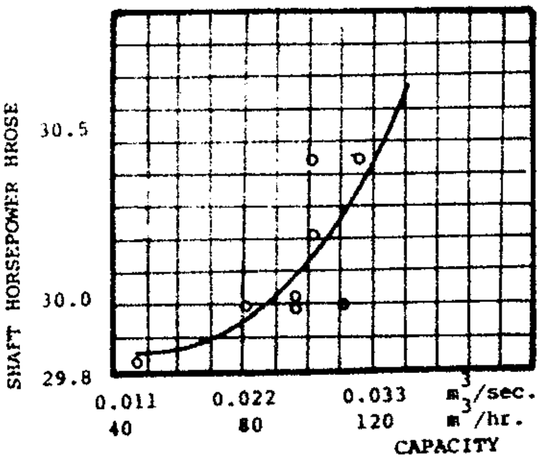


FIG. (4) (S.HP-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R.P.M. 3300.

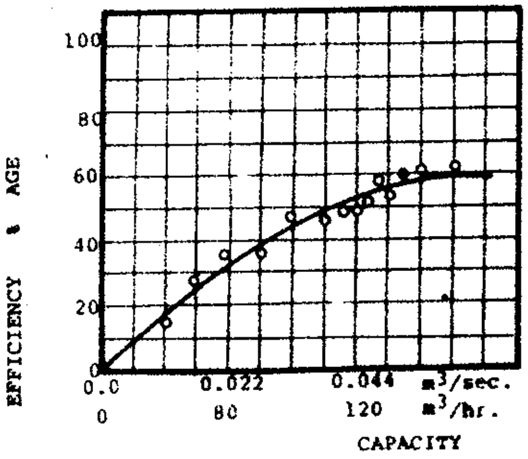


FIG. (5) (η-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R,P.M. 1550.

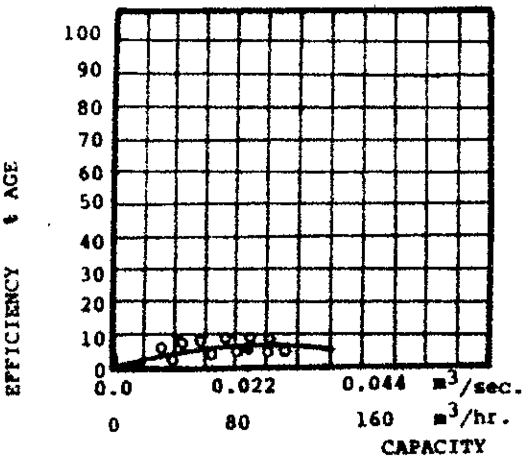


FIG. (6) (η-Q) RELATION FOR DRINKAGE WATER, ELECTRIC MOTOR AND R.P.M. 3300.

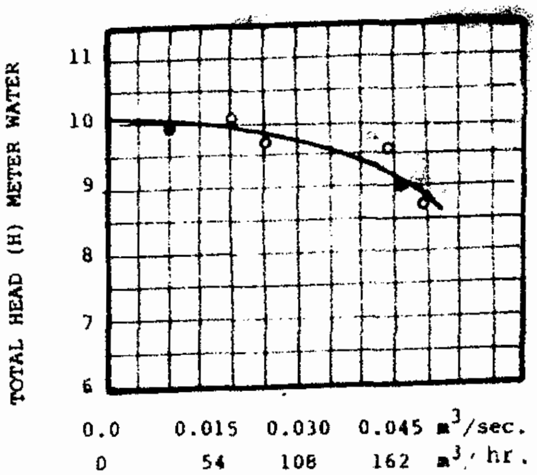


FIG. (7) (H-Q) RELATION FOR DRINKAGE WATER, DIESEL MOTOR AND R.P.M 1550.

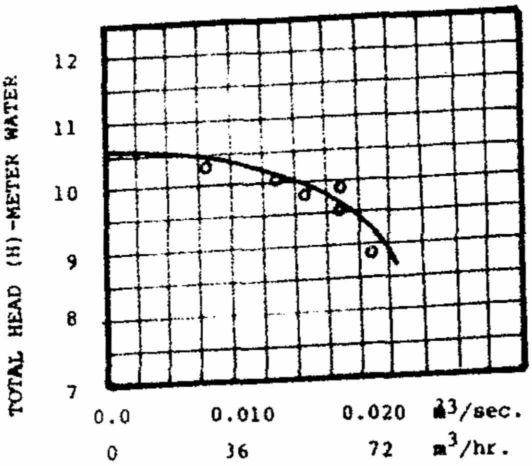


FIG. (8) (H-Q) RELATION FOR DRINKAGE WATER, DIESEL MOTOR AND R.P.M. 3300.

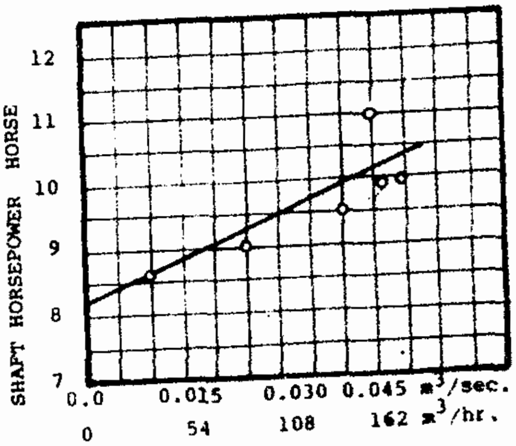


FIG. (9) (S.HP.-Q) RELATION FOR DRINKAGE WATER, DIESEL MOTOR AND R.P.M. 1550.

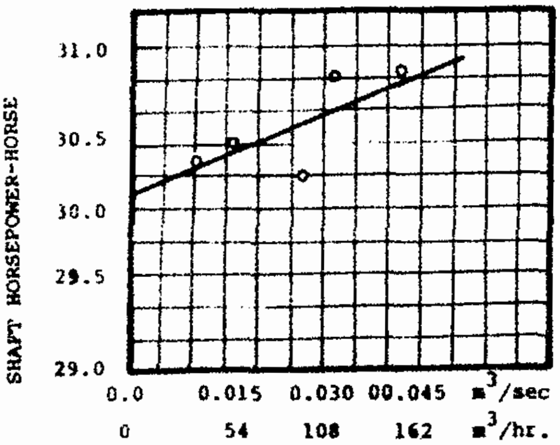


FIG. (10) (SHP-Q) RELATION FOR DRINKAGE WATER, DIESEL MOTOR AND R.P.M. 3300.

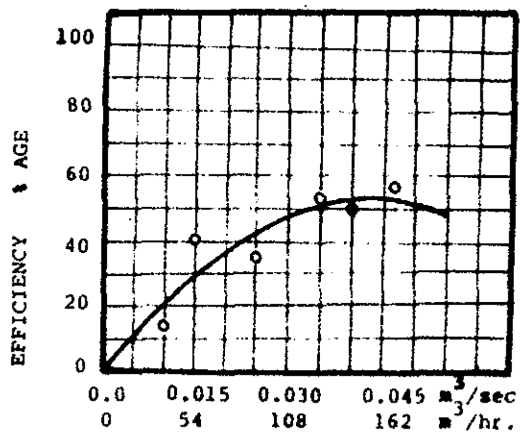


FIG. (11) (η-Q) RELATION FOR DRINKAGE WATER DIESEL MOTOR AND R.P.M 1550.

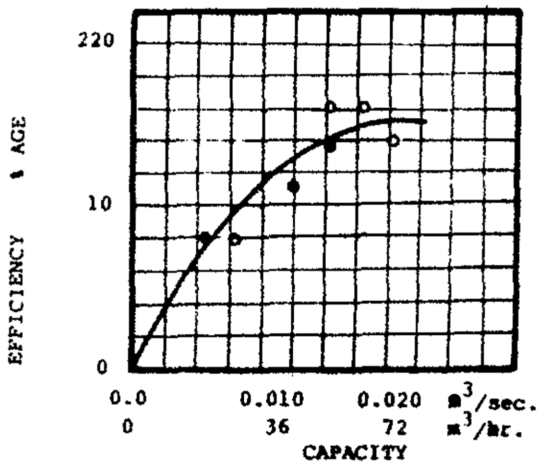


FIG. (12) (η-Q) RELATION FOR DRINKAGE WATER DIESEL MOTOR AND R.P.M. 3300.

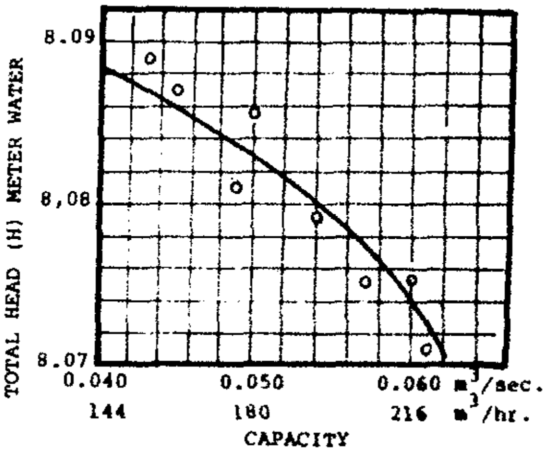


FIG. (13) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{40}$ EL ELECTRIC MOTOR AND R.P.M. 1550.

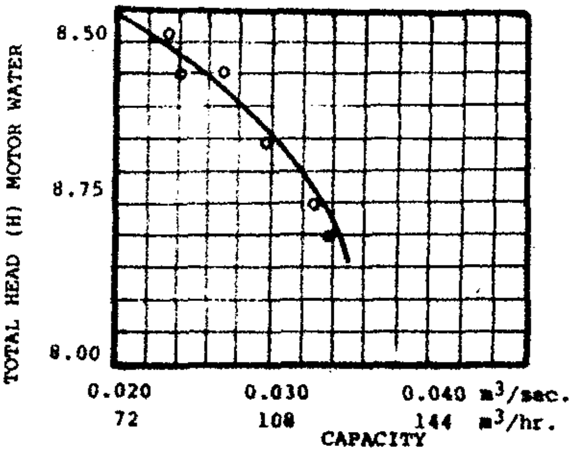


FIG. (14) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{40}$,ELECTRIC MOTOR AND R.P.M 3300.

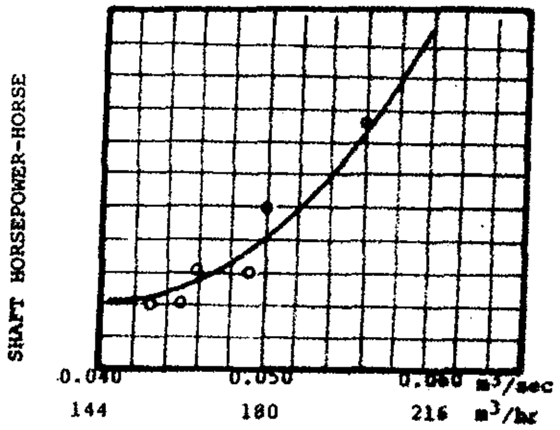


FIG. (15) (S.HP-Q) RELATION FOR MUDDY WATER $\frac{11}{40}$ ELECTRIC MOTOR AND R.P.M 1550.

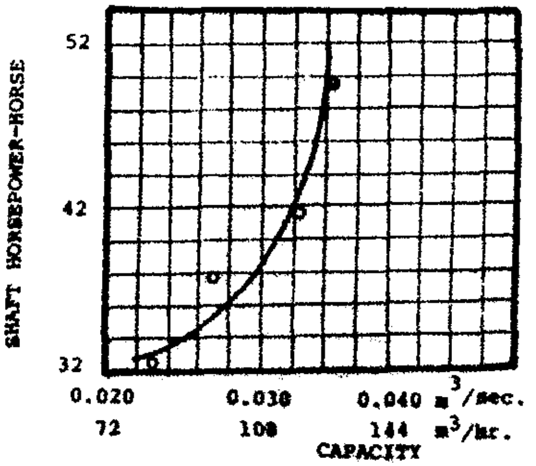


FIG. (16) (S.HP-Q) RELATION FOR MUDDY WATER $\frac{1}{40}$ ELECTRIC MOTOR AND R.P.M 3300.

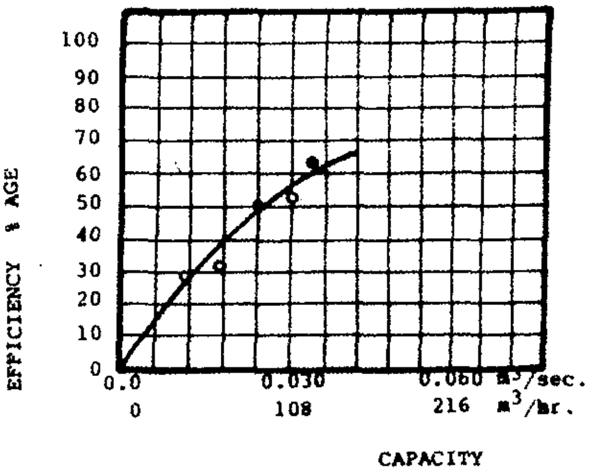


FIG. (17) (η-Q) RELATION FOR MUDDY $\frac{1}{40}$ ELECTRIC MOTOR AND R.P.M 1550.

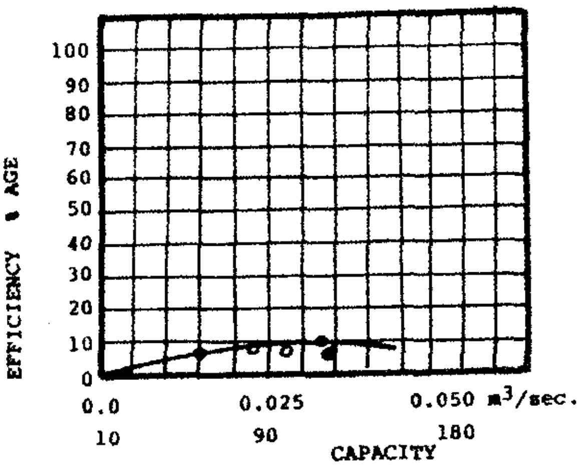


FIG. (18) (η-Q) RELATION FOR MUDDY WATER $\frac{1}{40}$ ELECTRIC MOTOR AND R.P.M. 3300.

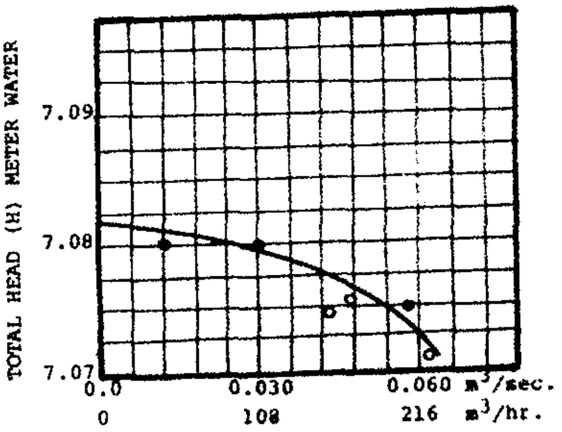


FIG.(19) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC MOTOR AND R.P.M. 1550.

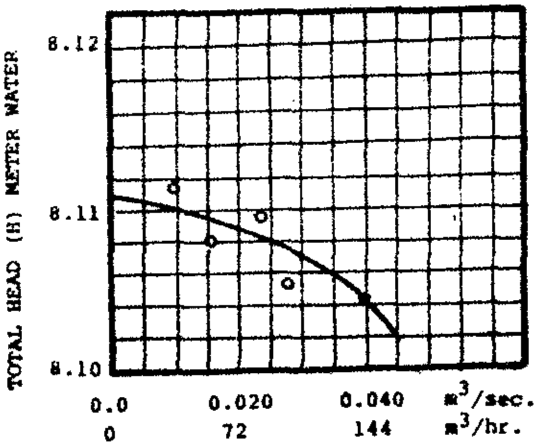


FIG. (20) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC MOTOR AND R.P.M. 3300.

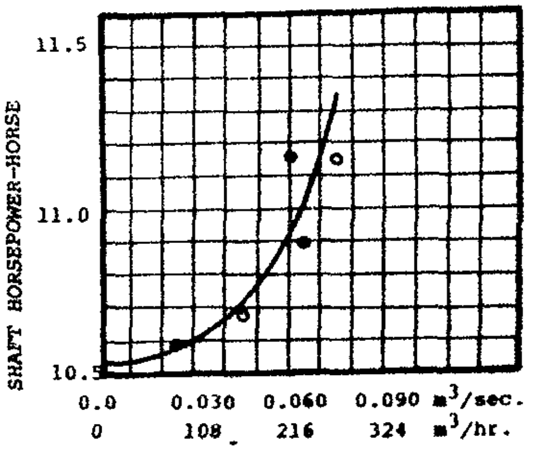


FIG. (21) (SHP-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC AND R.P.M 1550.

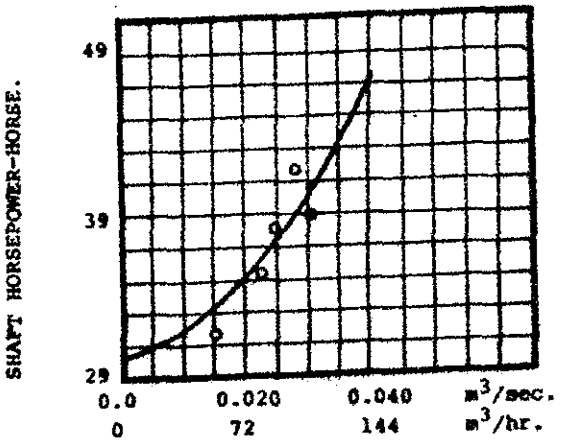


FIG. (22) (SHP-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC MOTOR AND R.P.M. 3300.

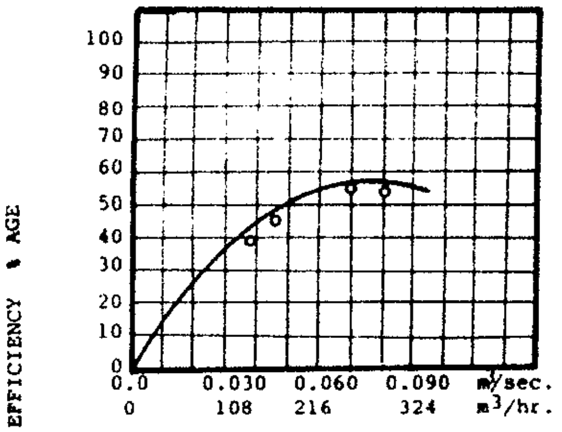


FIG. (23) (η-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC MOTOR AND R.P.M. 1550.

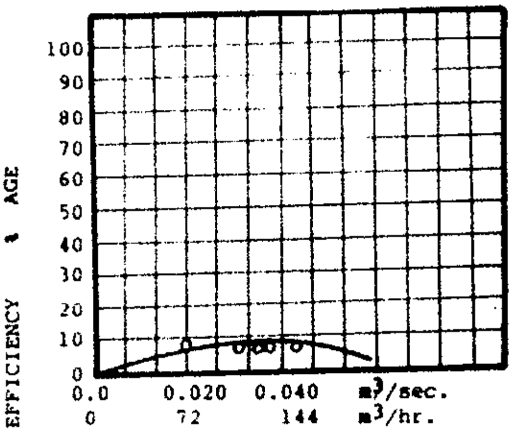


FIG. (24) (η-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ ELECTRIC MOTOR AND R.P.M. 3300.

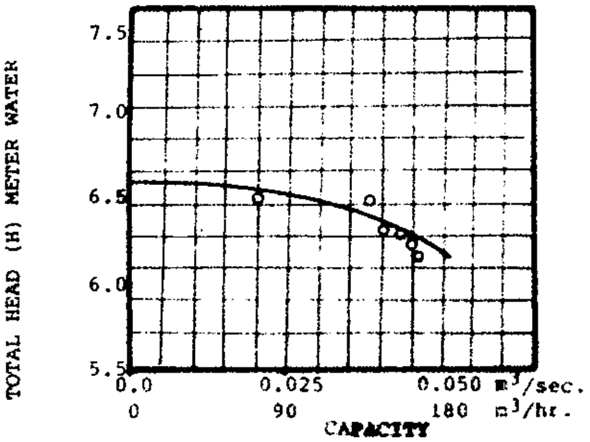


FIG. (25) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ DIESEL MOTOR AND R.P.M. 1550.

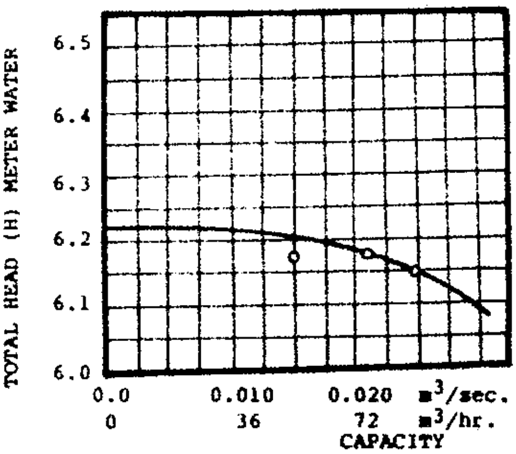


FIG. (26) (H-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ DIESEL MOTOR AND R.P.M. 3300.

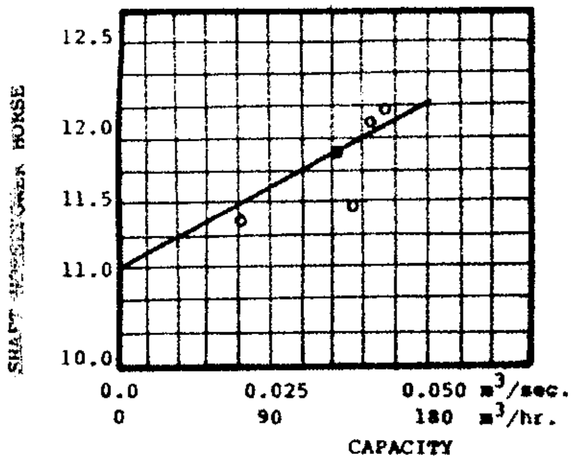


FIG. (27) (S.HP-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ DIESEL MOTOR AND r.p.m. 1550.

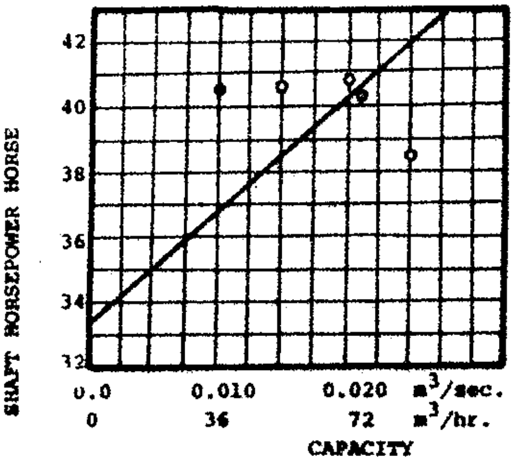
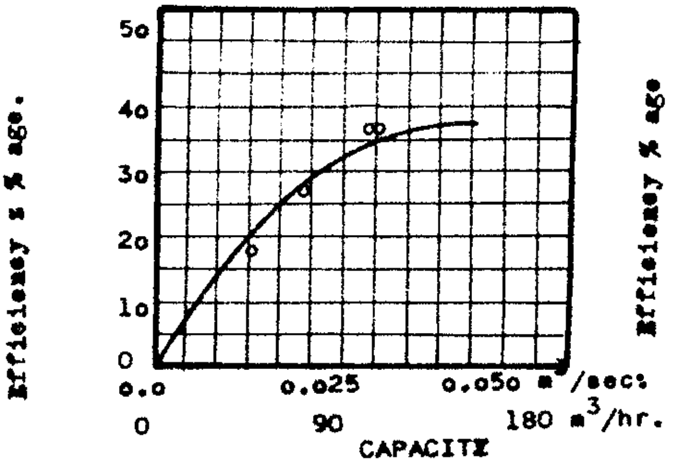


FIG. (28) S.HP.-Q) RELATION FOR MUDDY WATER $\frac{1}{20}$ DIESEL MOTOR AND R.P.M. 3300.



Fig(29)(Z-Q)-Relation for Muddy waler $\frac{1}{2o}$ Diesel Motor and P.P.M. 1550.

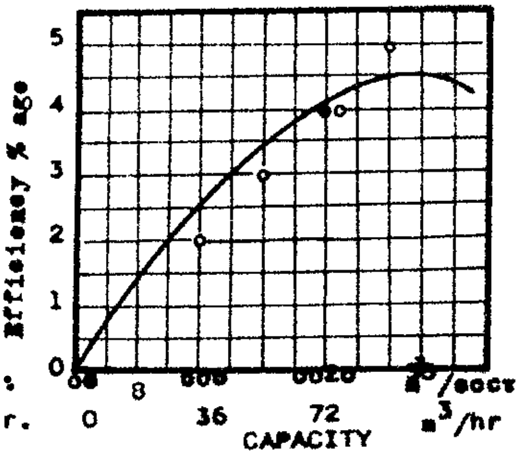


Fig.(30)(Z-Q)Relation for water $\frac{1}{2o}$ Diesel Motor and RPM 3300.

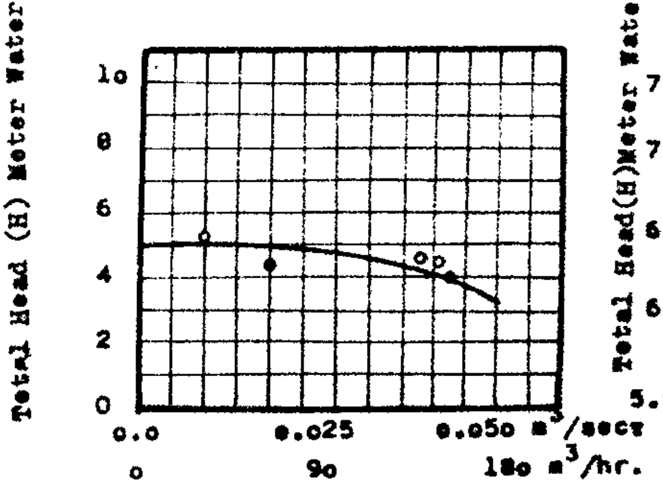


Fig.(31)(W-SHP)Relation for Muddy Water $\frac{1}{4o}$ Diesel Motor and R.P.M. 155o.

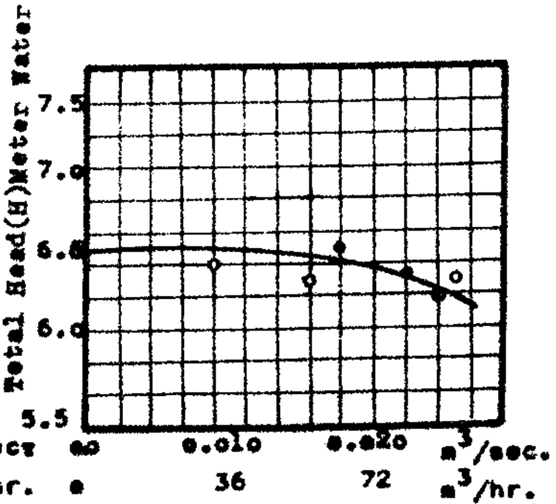


Fig.(32)(W-SHP)Relation for muddy Water $\frac{1}{4o}$ Diesel Motor and R.P.M. 3300.

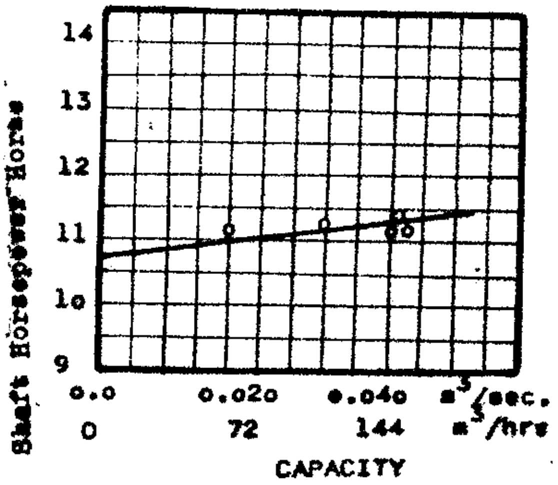


Fig.(33)(S.HP-Q) Relation for Muddy Water $\frac{1}{4o}$ Diesel Motor and R.P.M. 1550.

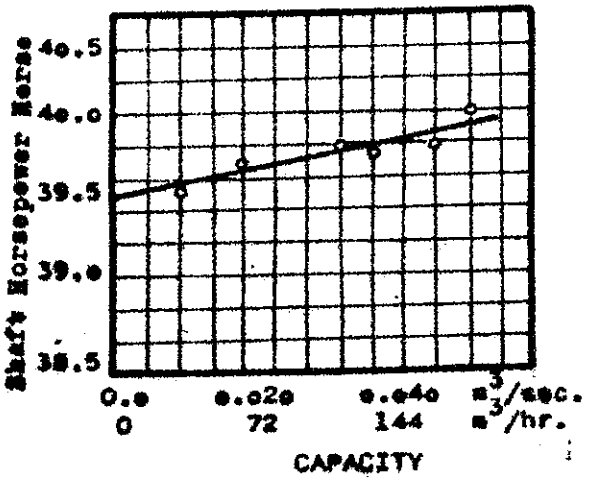


Fig.(34)(S.HP.-Q) Relation For Water $\frac{1}{4o}$ Diesel Motor and R.P.M. 33oo

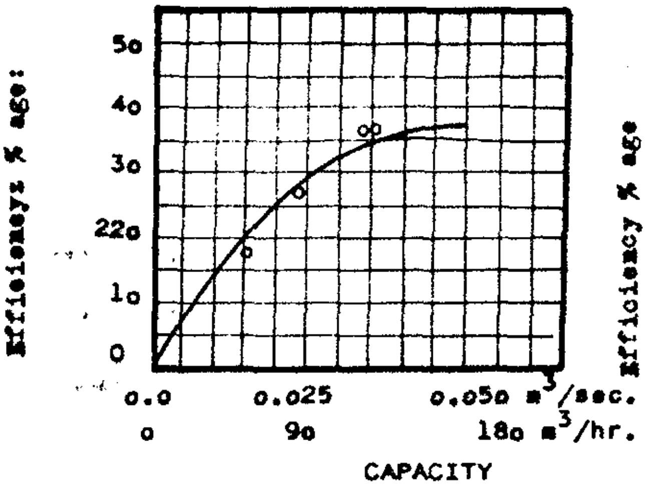


Fig.(35) η-Q Relation for Muddy Water $\frac{1}{}$ Diesel Motor and R.P.M. 1550.

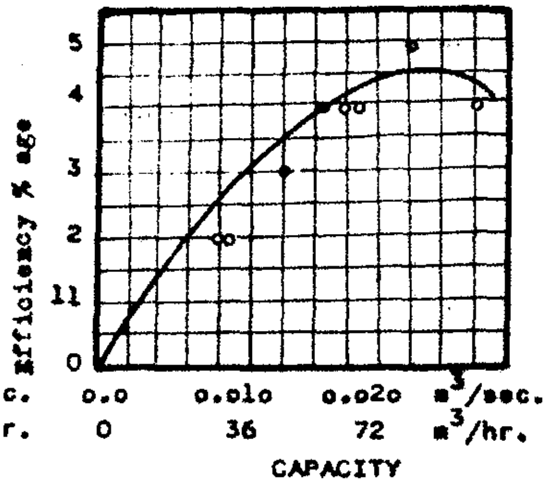


Fig.(36)(η-Q) Relation for Muddy water $\frac{1}{20}$ Diesel Motor and R.P.M.3300

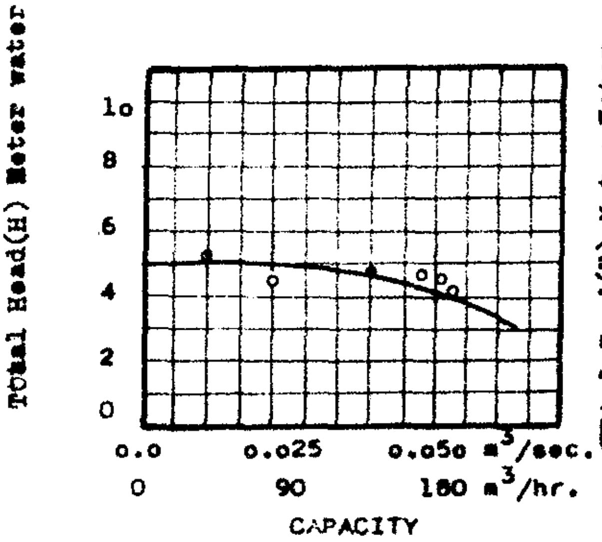


Fig. (37) H-S-H Relation for Muddy water $\frac{1}{40}$ Diesel Motor and R.P.M. 1550.

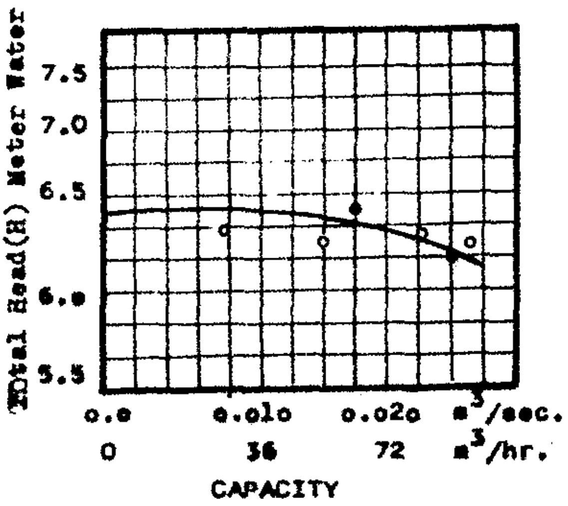


Fig.(38) H-S-H Relation for Muddy Water $\frac{1}{40}$ Diesel Motor and R.P.M.33oo.

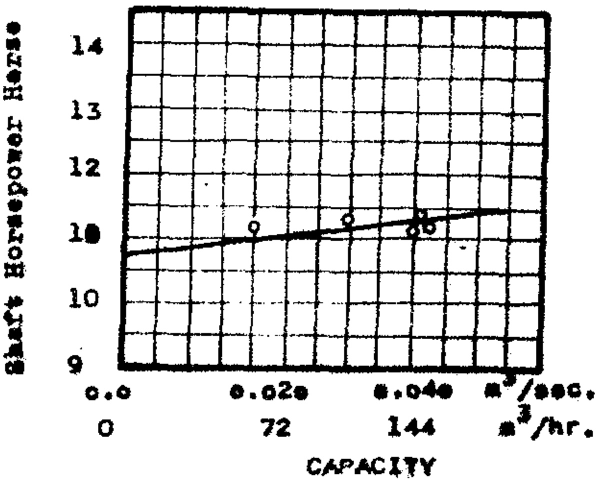


Fig.(39) H-S-H Relation for Muddy Water $\frac{1}{4o}$ Deesel Motor and R.P.M. 1550.

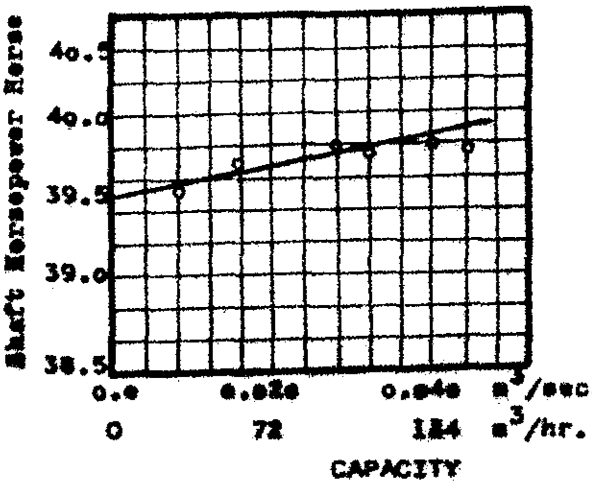


Fig.(40) H-S-H Relation for Muddy Water $\frac{81}{4o}$ Diesel Motor and R.P.M.33oo.

تاثير نوع مصدر الطاقة ودرجة نقاء المياه على اداء المضخة الطارده المركزية المنخفضة العلو

أ٠د٠ عبد الهادى ناصر ، أ٠د٠ عصام سالم ، أ٠د٠ سعد وهيبه
د٠ بسيونى خليفة ، د٠ احمد محمود عيسى

تتم عمليات الرى فى مصر بنظام الدورات وهذا يودى بالتالى الى ارتفاع وانخفاض مستوى المياه فى القنوات مما يودى الى تقهد نسبة الطين فى مياه الرى ولقد تم فى هذه المقالة دراسة تاثير ذلك على اداء المضخة الطارده المركزية ذات الضغط المنخفض سواء كان ذلك باستخدام موتور كهرباء او محرك ديزل مراعين ان عدد القاتو والقدره متساوية لكلا النوعين ٠

وتستجارب معملية عديده عن تاثير نسبة الطين فى الماء او تقهد مصدر الطاقة على اداء المضخة ــ وقد اسفرات النتائج عنها يلى :ــ

١ ــ تقل كفاءة المضخة الطارده المركزية ذات الضغط المنخفض كلما زادت نسبة الطين فى الماء

٢ ــ تقل كفاءة المضخة باستخدام محرك الديزل بدلا من الموتور الكهربى ٠