



USAID | EGYPT
FROM THE AMERICAN PEOPLE



الشركة القابضة
لمياه الشرب والصرف الصحي

دليل أعمال تشغيل و إدارة محطات مياه الشرب

مقتبس من البرنامج التدريبي لمشغلي
محطات تنقية مياه الشرب المستوى (د)

يونيو ٢٠١١



تم وضع هذا المرجع علي أساس المهارات و المعارف اللازمة لمشغلي محطات مياه الشرب و قد تم إعداده بواسطة مشروع دعم قطاع المياه و الصرف الصحي الممول من الوكالة الأمريكية للتنمية الدولية

دليل أعمال تشغيل وإدارة محطات مياه الشرب

مقتبس من البرنامج التدريبي لمشغلي

محطات تنقية مياه الشرب المستوى (د)

مشروع دعم قطاع مياه الشرب والصرف الصحي

مول من الوكالة الأمريكية للتنمية الدولية

.....

.....

.....()

.....

.....

.....

.....

.....

.....()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....()

.....

.....

.....

..... ()

..... (Shore Intake)

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

..... *

.....

.....

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....()

.....

.....

.....

.....

.....

.....

.....

.....

-

.....

-

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... (/)

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... ()

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

()

الفصل الأول

مشغلو محطات المياه

() :

:

•

•

•

•

•

•

•

.

)

.(

.

.

:

.

.

.

.

.()

.

.

.

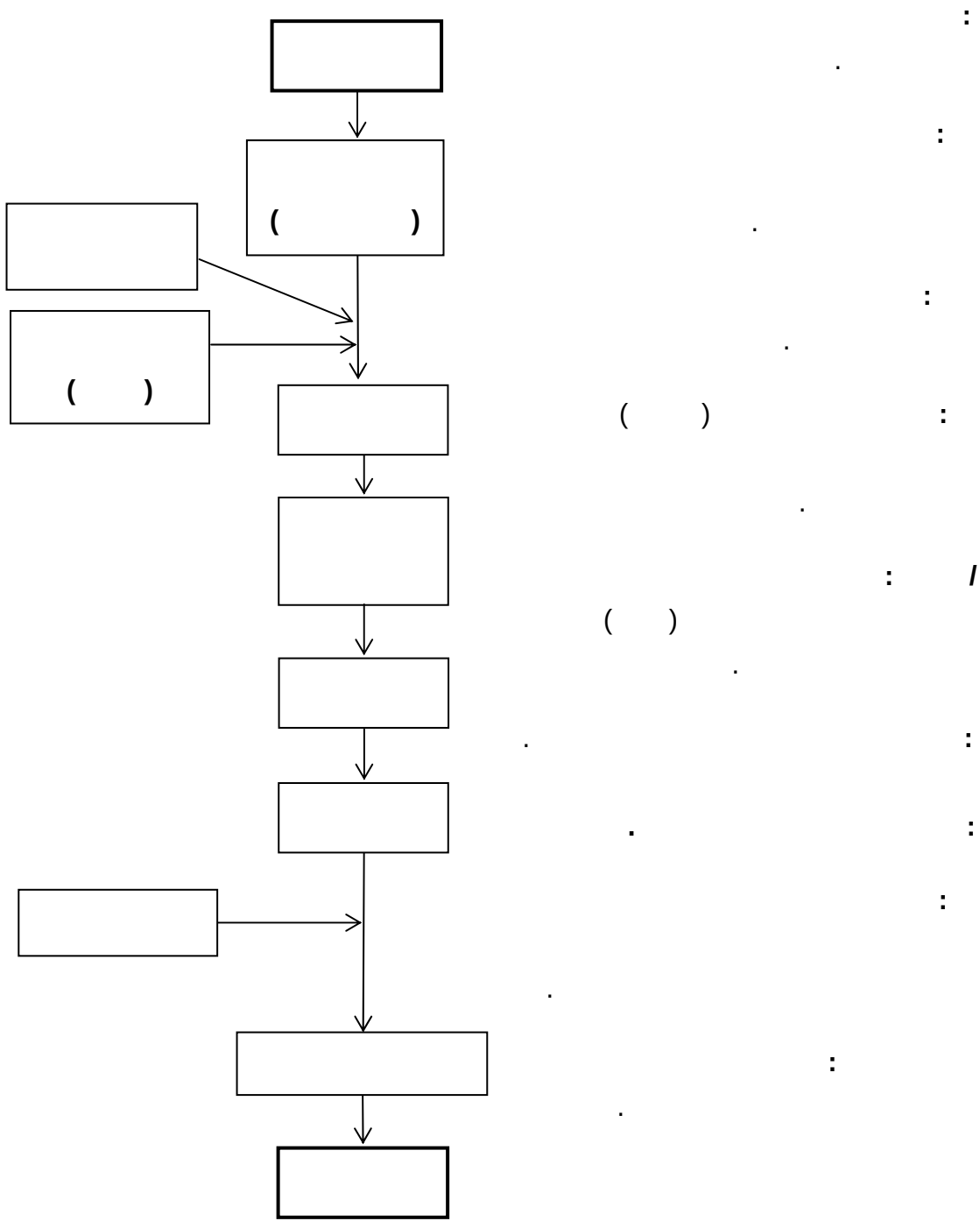
.

.

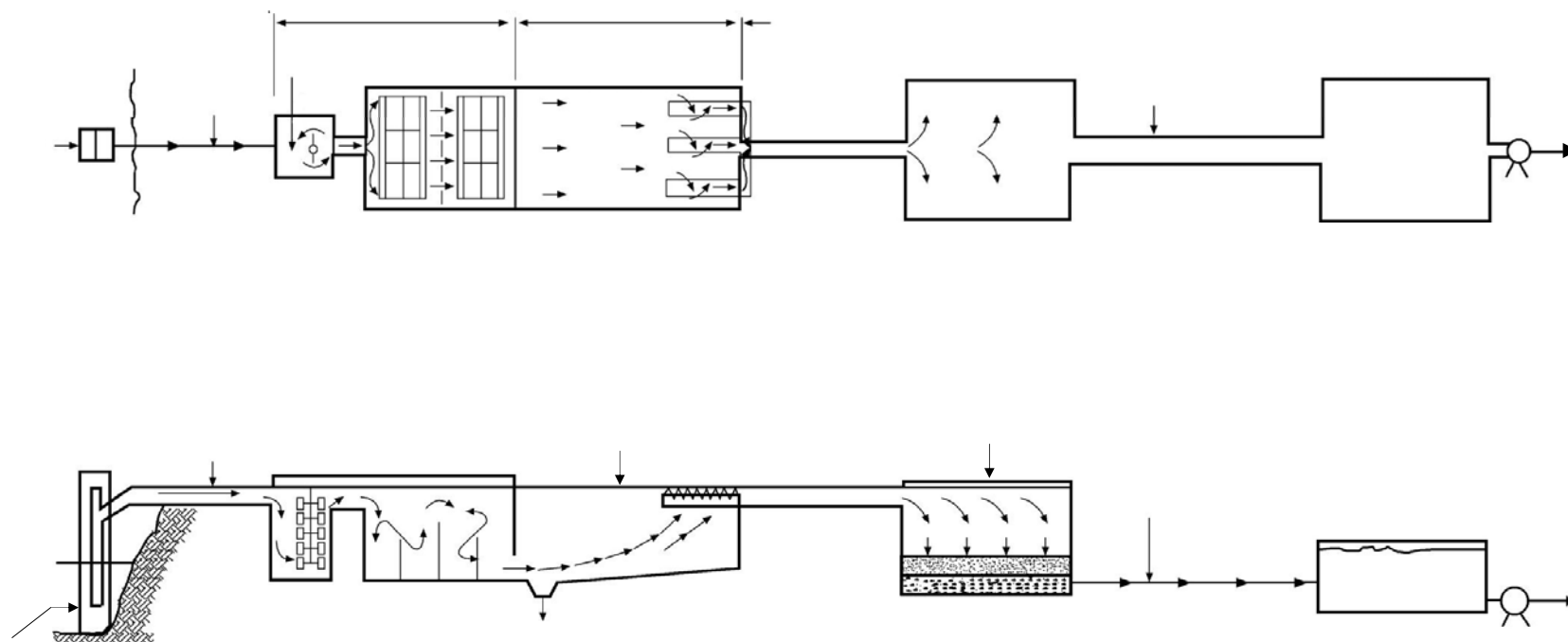
(-)

(-)

.



(-)



(-)

:

()
()

.

.

.()

.

)

(

,

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

)
(

.

.

.

.

.

الفصل الثاني

المياه ومصادرها

()

:

•

•

” ”

•

•

•

•

•

•

•

•

•

•

•

•

•

.

.

.

.

:

—

.

—

.

—

.

:

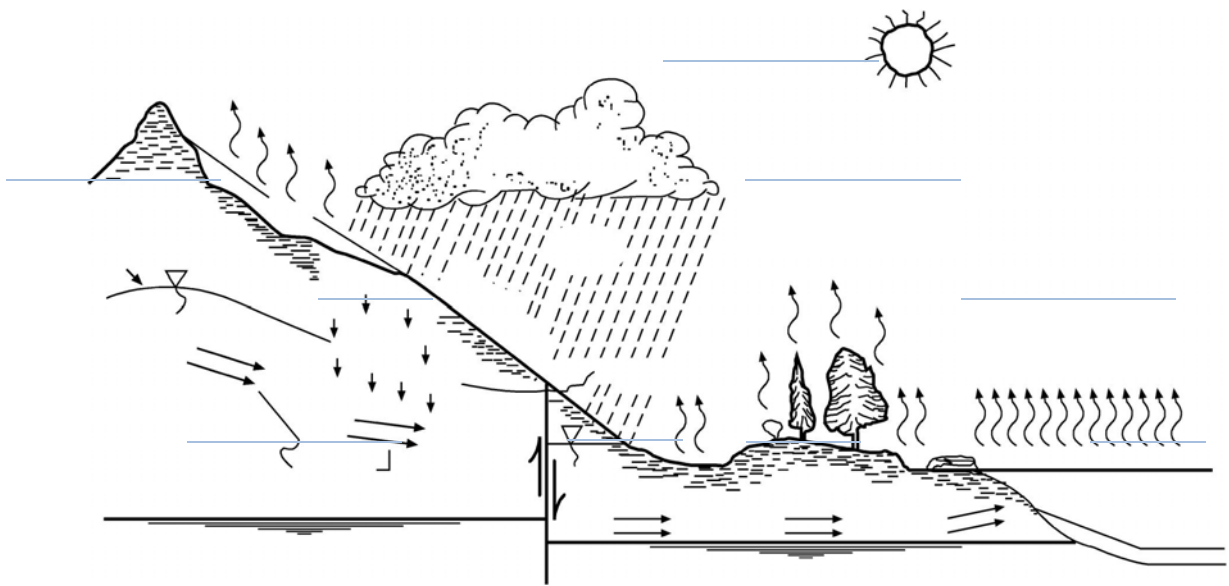
:

.

.

.

(-) .



(-)

%

%

%

:

.

.

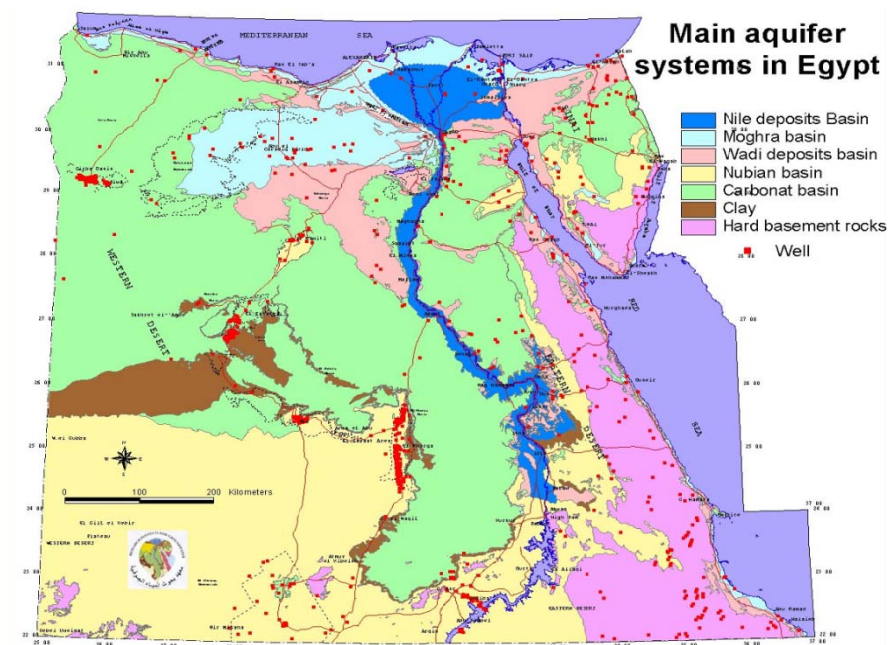
.

.

.

.

(-)



(-)

.

(Phreatic Aquifer)

.

.(Leaky Aquifer)

()

.(Confined Aquifer)

.

.

■

■

8

■

•

■

■

■

■

■

□

□

•

•

■

■

■

■

•

•

■

■

■

■

□
□

•

•

■

□

□

■

•

•

■

■

(pH)

■

)

pH (pH

■

■

■

■

■

■

■

■

■

$$\cdot \left(\quad \right) \cdot$$

١٠٠ :
()
()
(
.
pH ()
.
.
.
.
.
.
()
.

- ١٠٠ :
- -
 -

:

.

.

.

.

:

:

.

•

.

•

.

.

.

()

.

.

.

() :

:

•

•

•

(Screening)

(Intake)

(Raw

.Water Low Lift Pumps)

()

$$(\quad)$$

•

•

 $(\quad)$

●

●

●

●

●

●

●

•

■

■

■

●

●

■

■

■

■

●

●

●

■

●

8

●

■

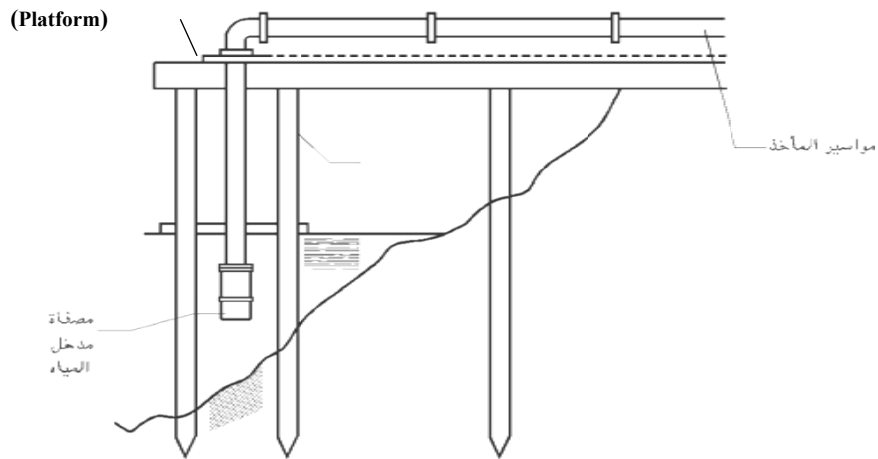
)

.(

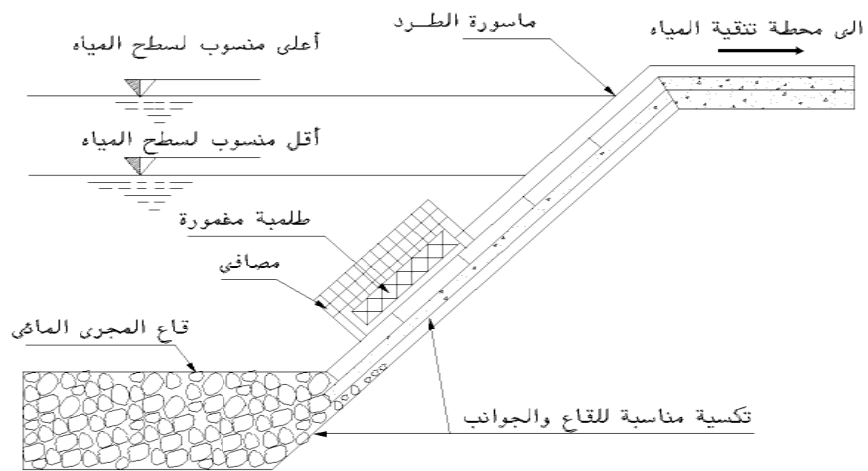
▪ ()

:(Pipe Intake) -

(-) (-)



(-)



(-)

- **:(Shore Intake)**

() .

.

-) (-)

(.

- **:(Submerged intake)**

.

-)

(-) (.

- **:(Emergency intake)**

.

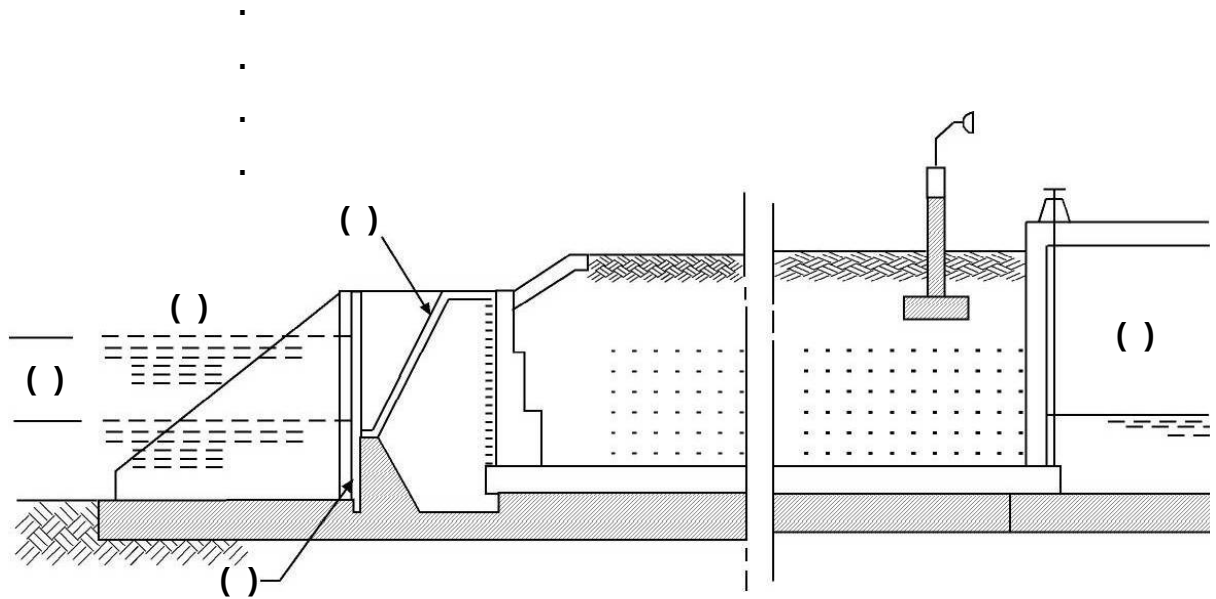
.

.

- **:(Tower Intake)**

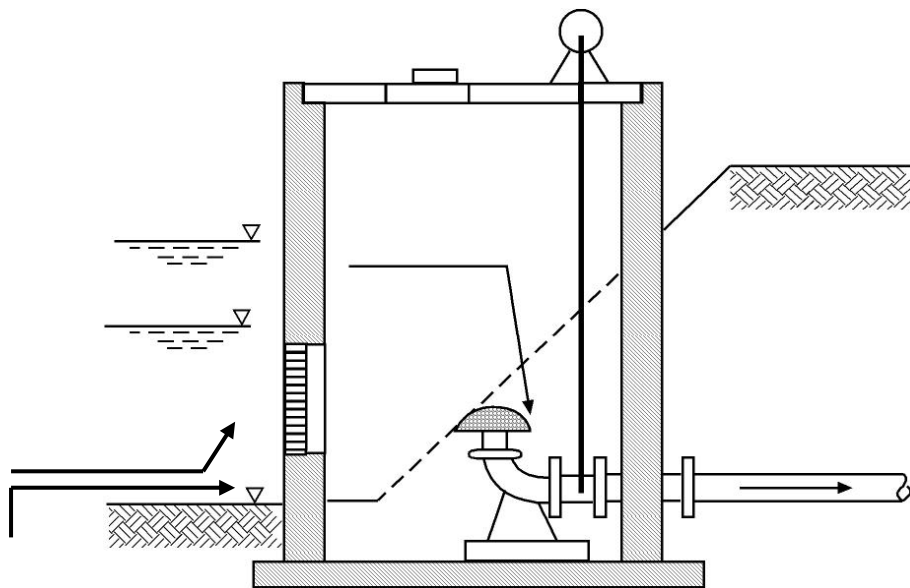
,

(-) .



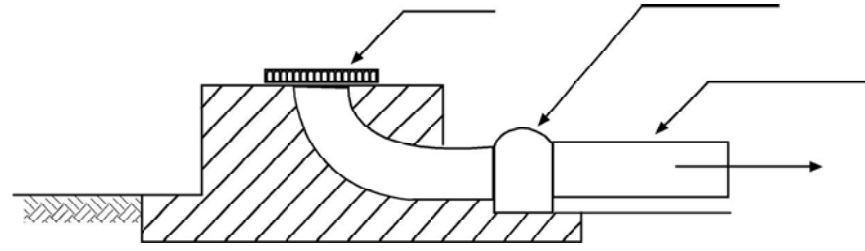
(-)

مأخذ الشاطئ (Shore Intake)

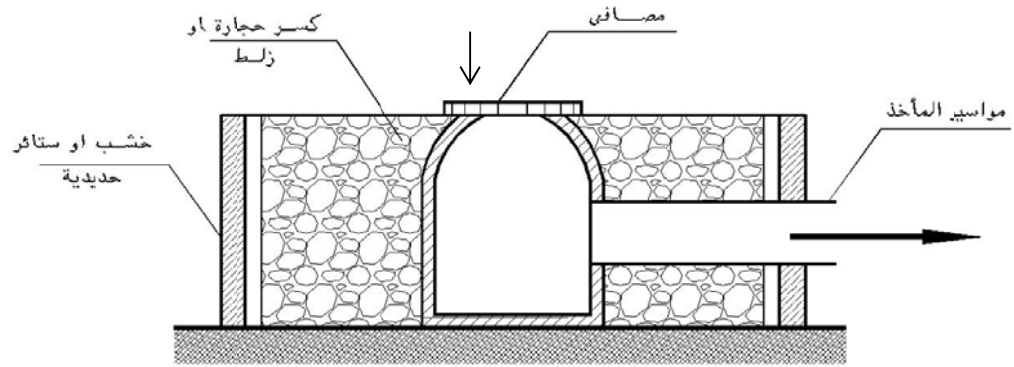


(-)

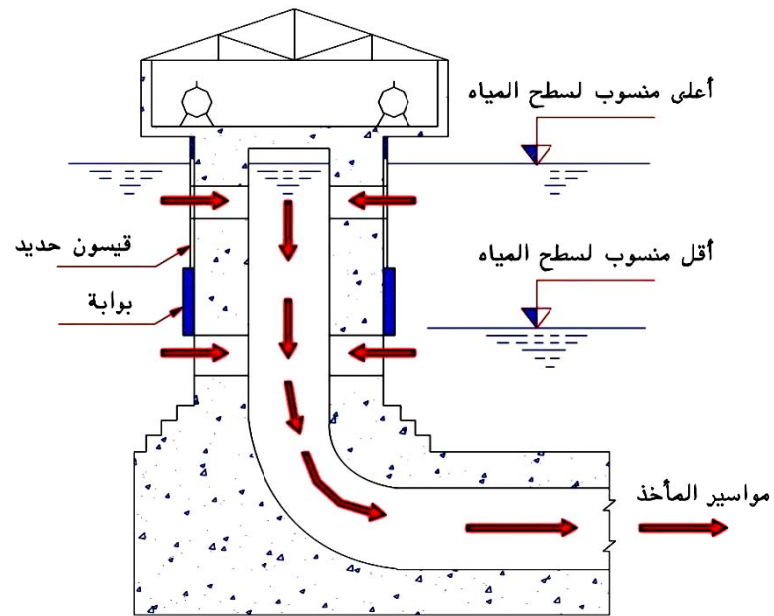
نموذج آخر لمأخذ الشاطئ (مغمور)



(-)



(-)



(-)

:

.

-

-

.

()

()

.

.

Bar Screens () -

:

,)

() ()

.(

.

.

(Mesh Screens) -

×

.

.

()

.(Mechanic – Rotating)

(Intake Conduit)

.

/ —

.

الفصل الرابع

الترويب والتديف

() :

:

•

•

•

•

•

•

•

•

•

•

.

)

() (

.

()

,

.

.

.

.

Non-Settleable

.Colloidal

(-)

.

(-)

(Non-Settleable)

.

.

.

" "

()

.

.

.

()

.

.

()

()

()

.

()

()

" "

=)

(,

, ,

()
() .

.

(-)

.

(-)

	X	
	X	
	X	
	X	
X	X	
X	X	
X	X	
X	X	
X		
X		
X		
X		
X		

:

.

:

() .

() .

.

.

()

.

.

()

:

.

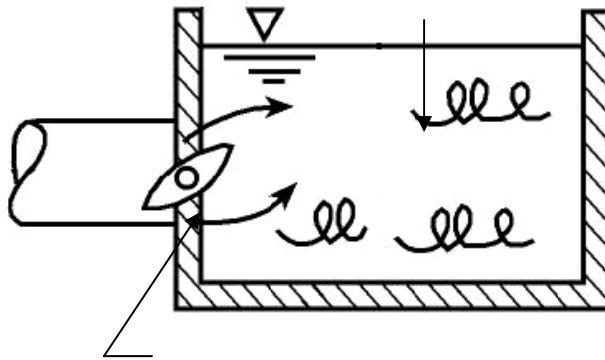
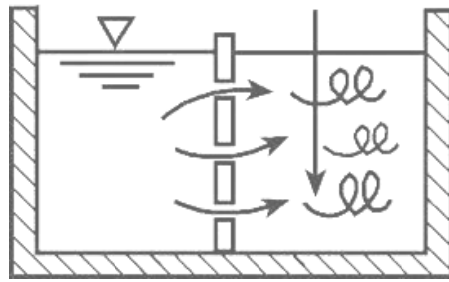
.()

.

.

(-)

.()



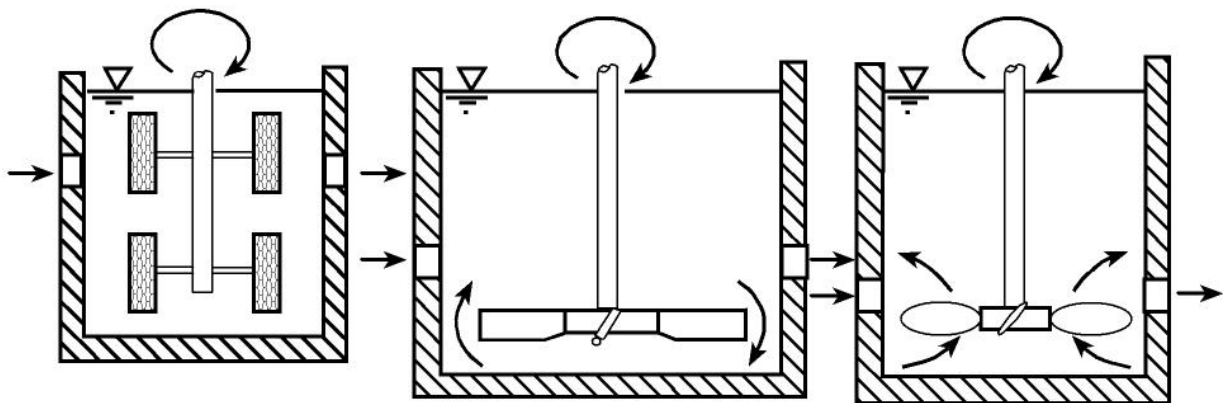
(-)

()

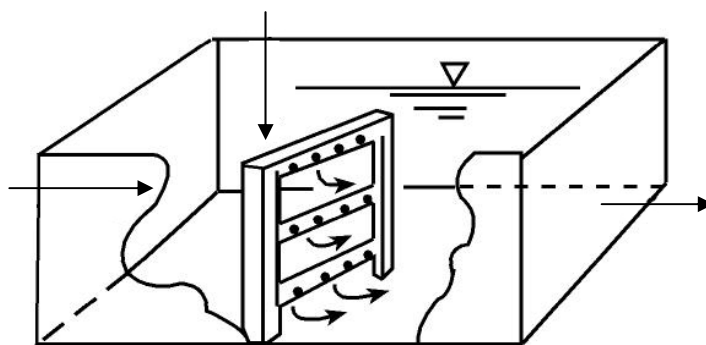
(-)

(-)

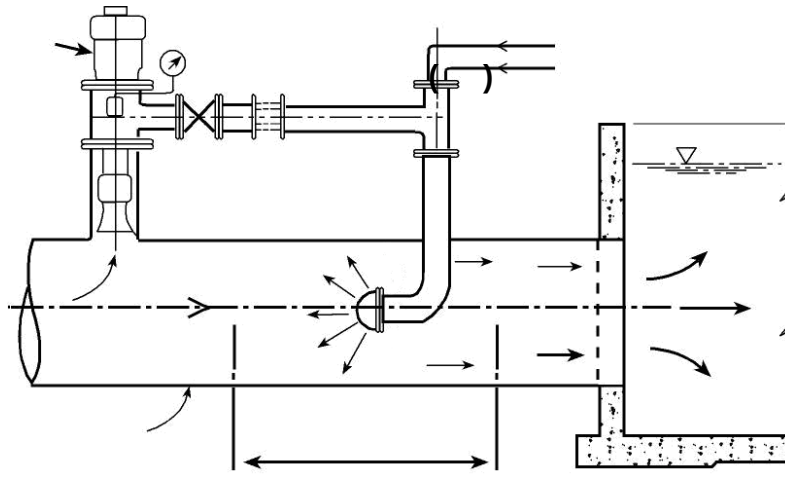
(-)



(-)



(-)



(-)

Source: Water Treatment Plant Design, AWWA, ASCE, Fourth Edition 2005

(Jet

orifice)

,

.

() .

:

() .

•

•

•

•

.

.

.

()

.

).

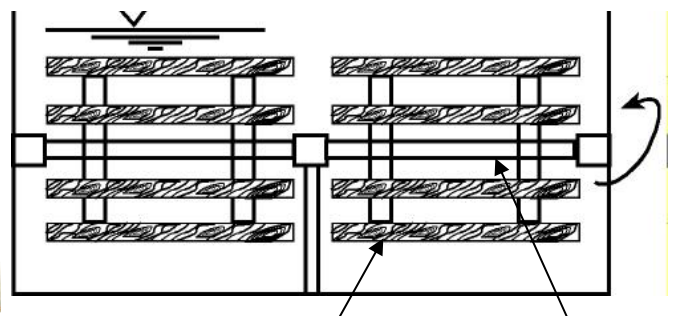
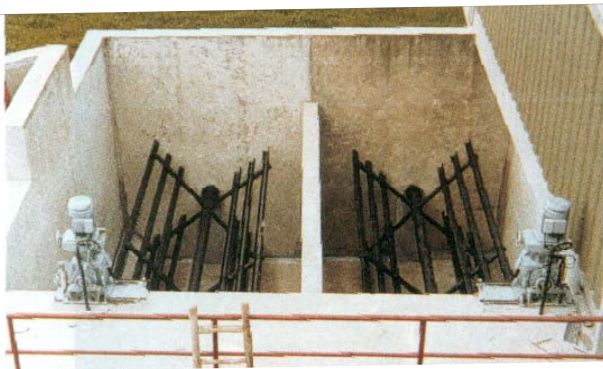
.(

()

(-)

(Baffles)

" (Orifice)

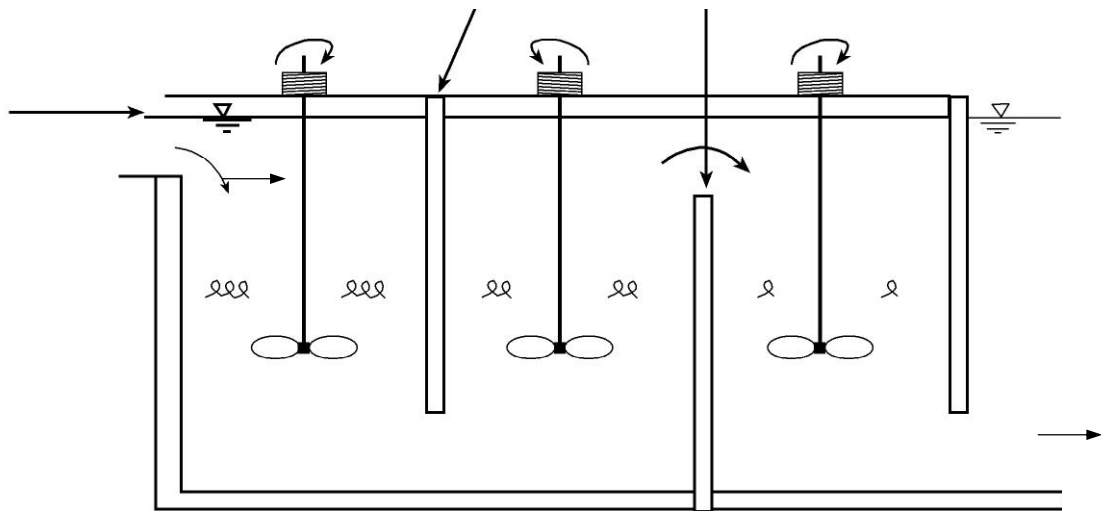


(-)

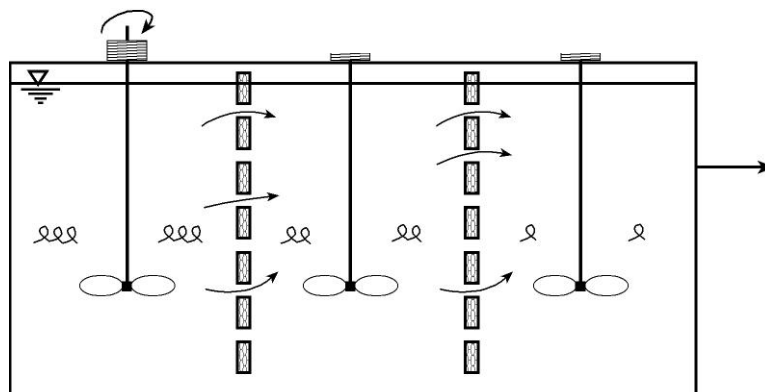
)

(

(-)



()



()

(-)

(Non-Settleable)

.

.

(Trihalomethanes)

.

:

.

.

:

.

.

.

.

.

:

.

:

.....
.....
..... ()
.....
.....
.....

.....

.....

.....

()

)

.(

)

.(

)

(

(Short circuit)

.

.

:

:

.

)

.(

.

.

:

(Short circuit)

.

:

.

.

.

.

()

.

.

.

.

.

.

.

.

:

.

.

()

()

.

:

()

.

.

.

.

.

.

(-)

()



(-)

						/
	,		,		,	()

.....)
..... (

/							
	٢	٢	٢	٢	٢	٢	

.....
..... /

.....

:

- .
- .
- .
- .
- .
- .
- .
- .

()

,

%

)

%

(

.

(/)

.(/)

الفصل الخامس

الترسيب

() :

:

•

•

•

•

•

•

(,)

.

.

:

.

.

:

-

:

.

.

()

(-)

.

.

.

.

()

.

)

.

(-)

(-)

.

-

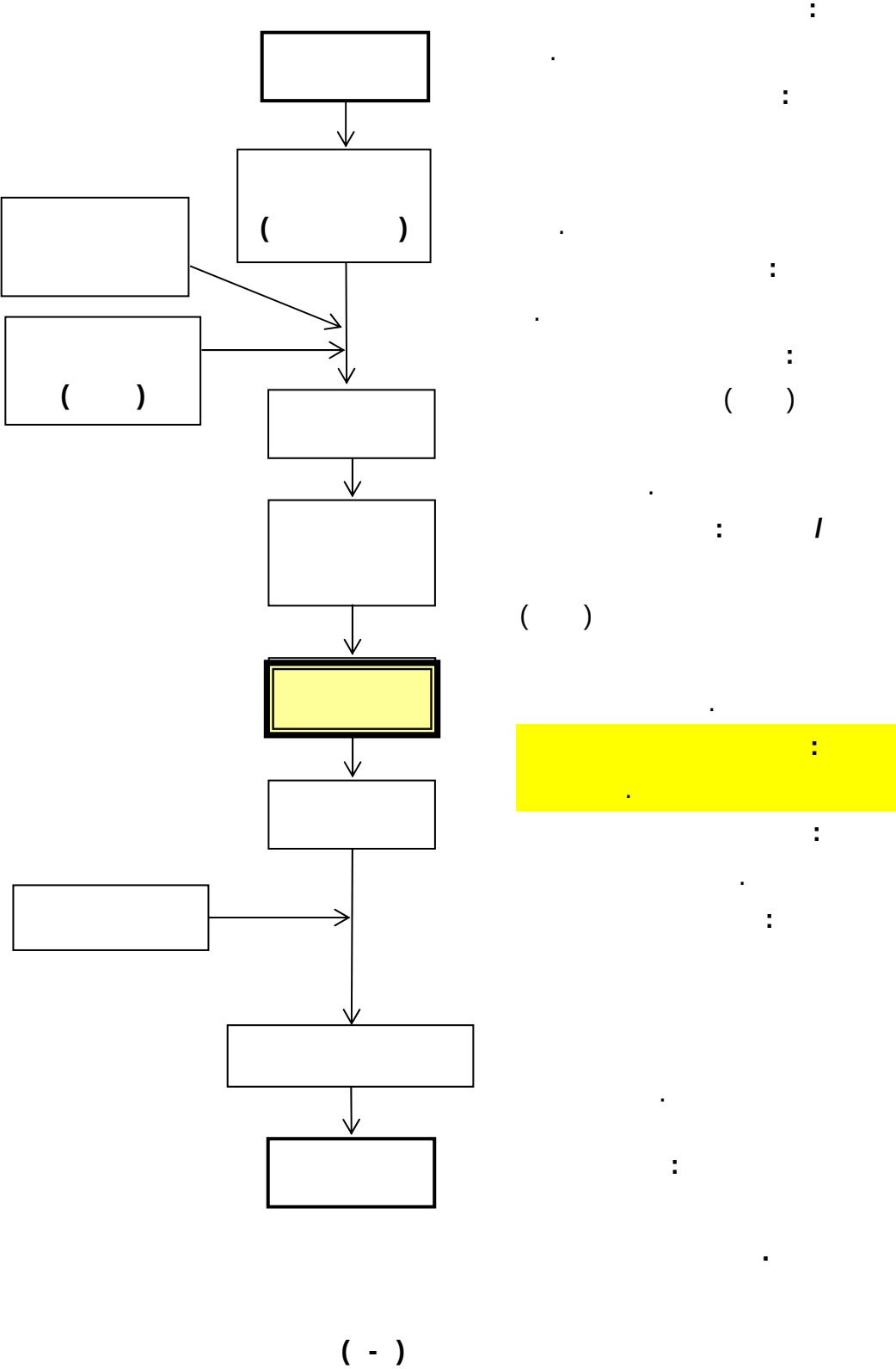
()

()

.

.

.



-

.

-

:

:

.

.

.

.

.

.

.

(Baffles)

.

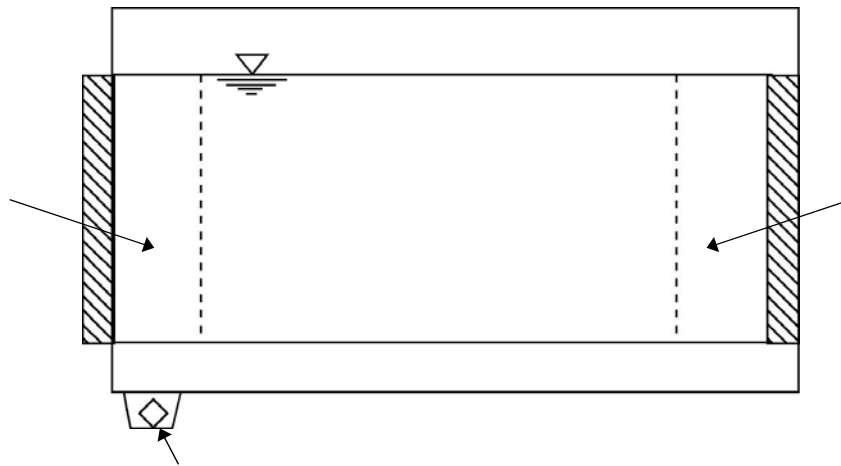
-

()

.

(-) :

:



(-)

.

)

(

()

()

()

)

// - ()

// V-notch

(V-notch)

(-)

.



(-)

:

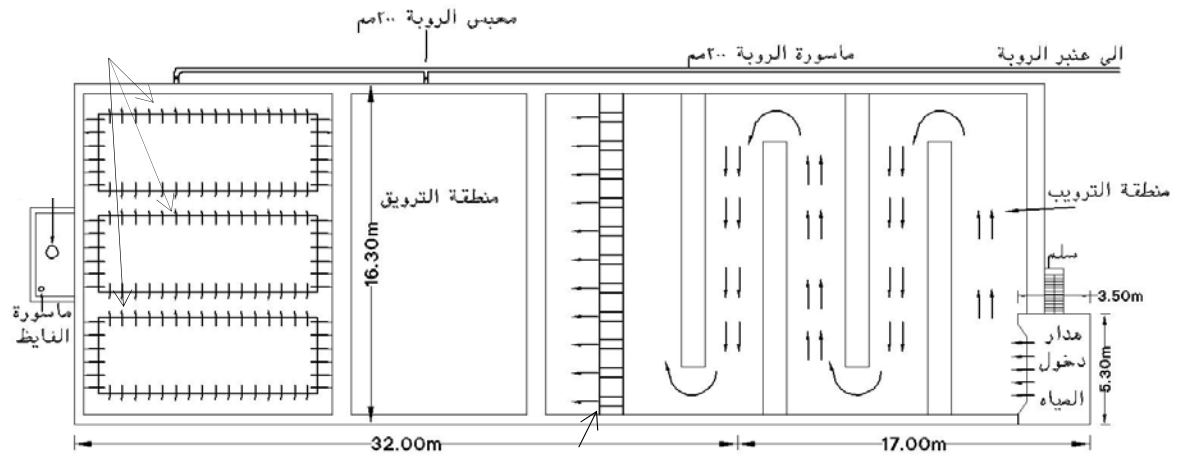
-

:

- .
- .
- .
- .
- .

(-)

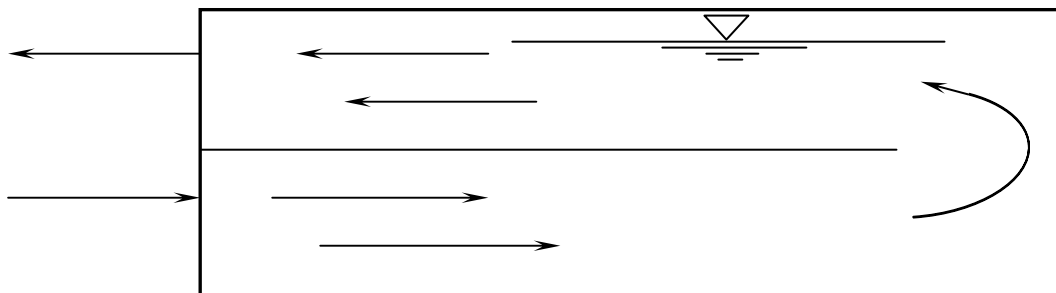
.



(-)

() -

(-)



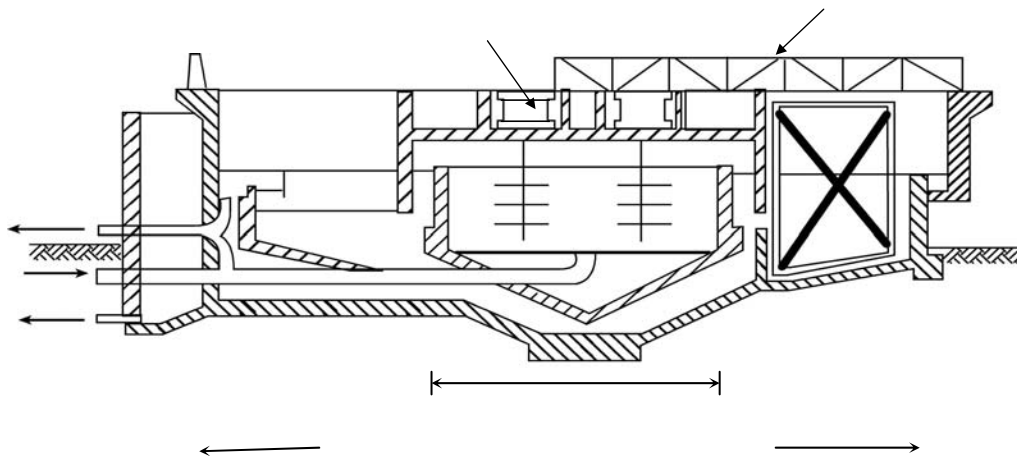
(-)

()

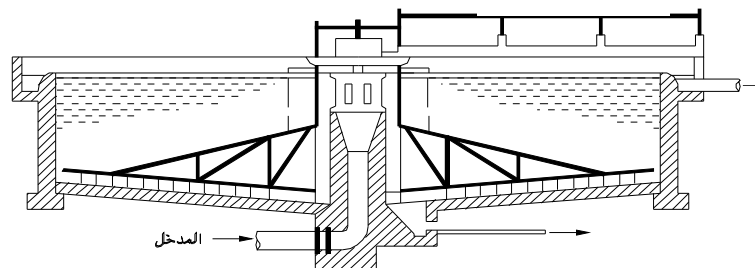
- :

(-)

(-)



(-)

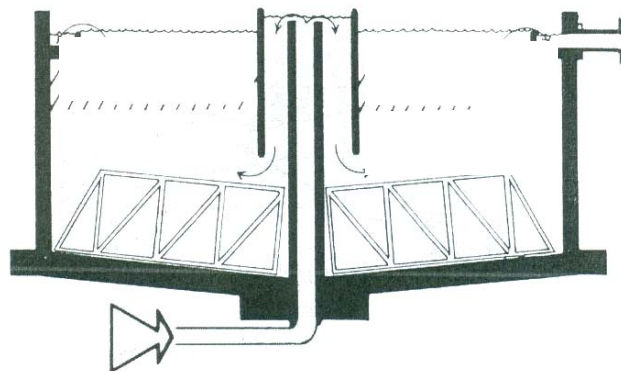
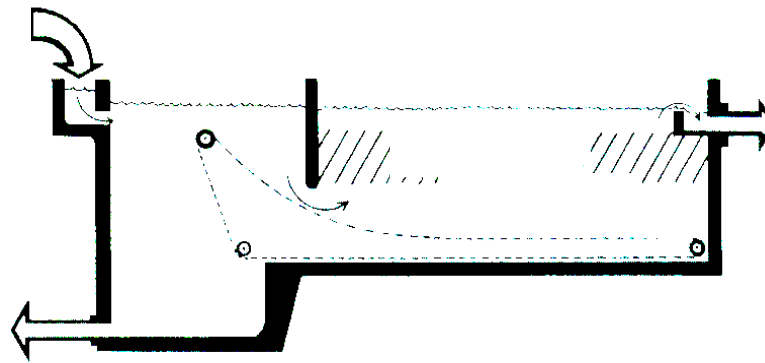


(-)

- :

()

(-)

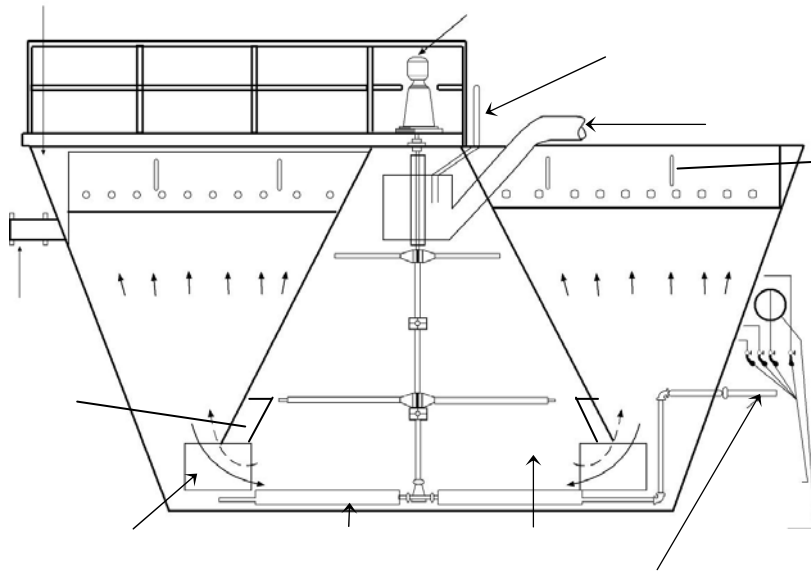
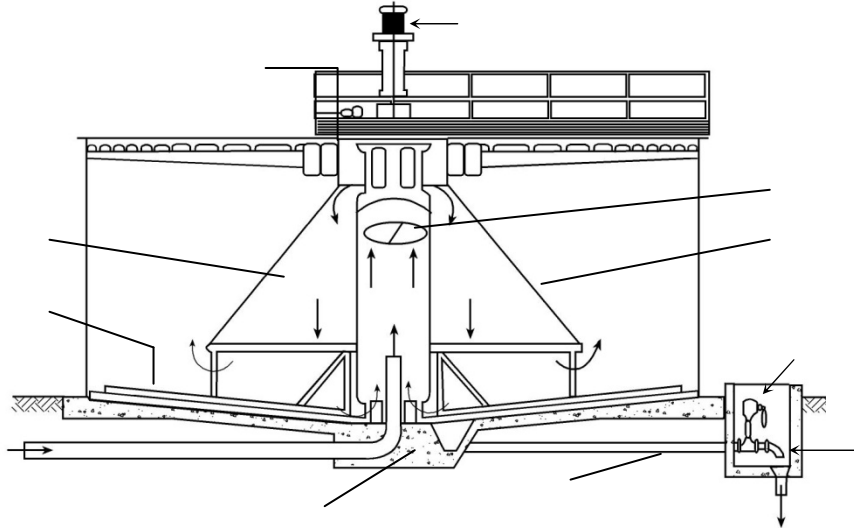


(-)

(Sludge ()
Blanket)

(-)

(Sludge Blanket) ()



(-)

(Sludge Blanket)

.

.

(Short Circuits)
).

(

()

.

:

% .

%

%. %

%

.

:

:

)

.

.(

.

.

.

.

:

,

) .

.(

)

(

.

(

)

.

.

(-)

.

(-)

-			
.	*	*	*
.	*	*	*
:			*
-			
-			
-			
.			
-			
.	*	*	*
:	()	*	*
*	*	*	() *
*	()		
*			
.			
-			
-	*	*	*
-	*	*	*
	()		

(-) " "

-			
-		*	*
:	)		
*	(	*	*
*			
()			
*			
.			
-			
-	*	*	*
			*
-	*	*	
-	()		*
	*	*	
	()		*
	*	*	

(/) :

—

■ ■ ■

—

.(

□

□

—

■

—

.(

.()

2

()

■

الفصل السادس

الترشيح

()

:

•

•

•

•

•

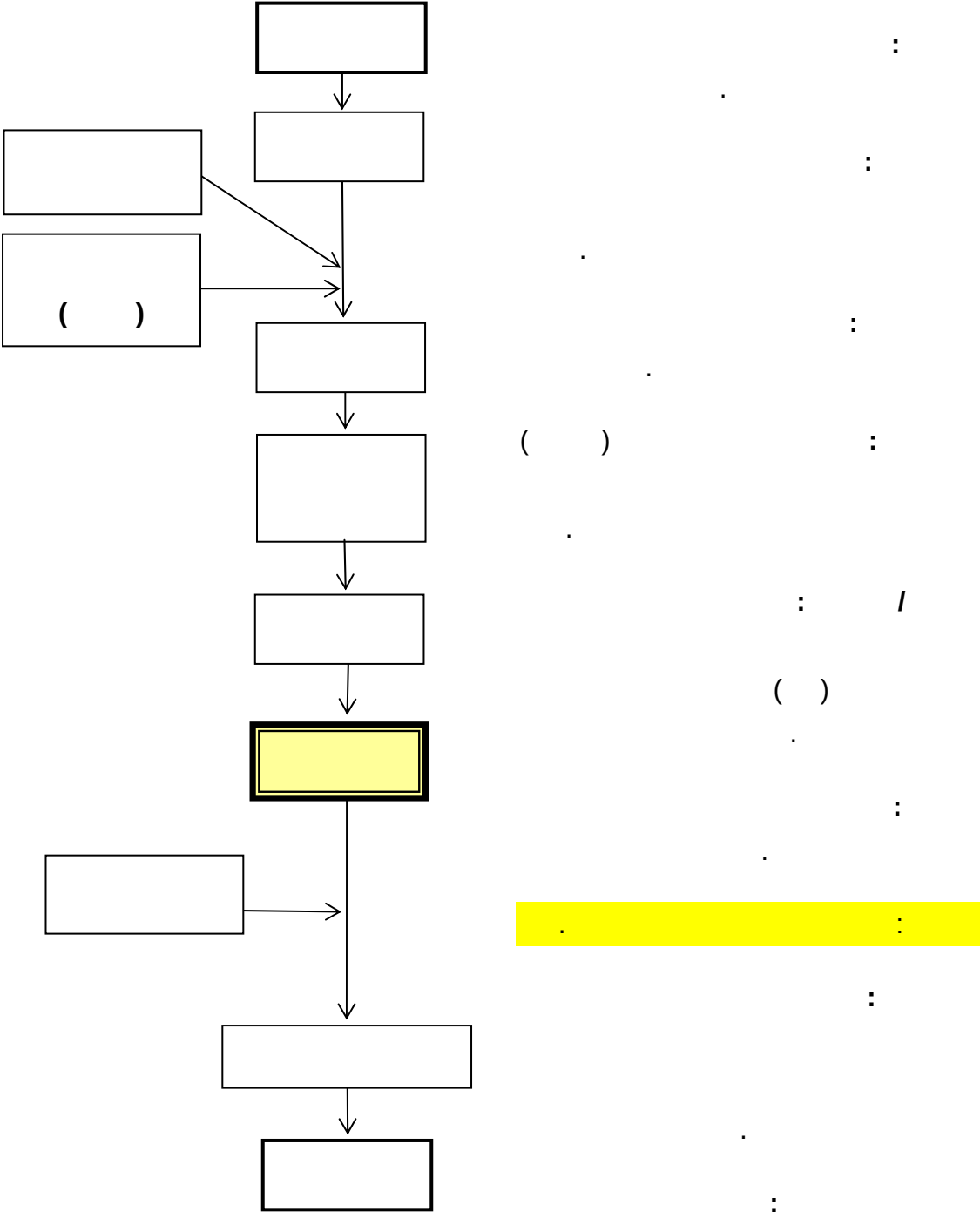
•

•

•

•

•



(-)

(Filtration)

.

.

.(film)

•
:

"Adsorption"

•

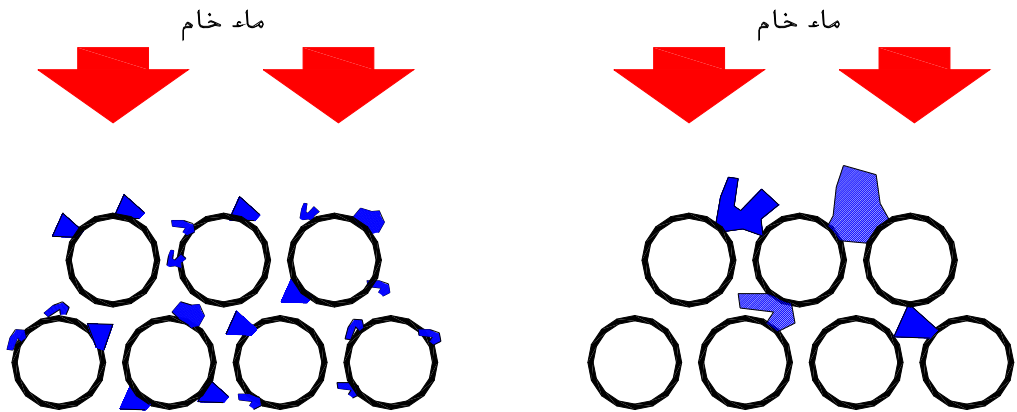
.

.

•

.

(-)



(-)

•

.

•

.

:

:

*

.

:

*

()

.

:

*

.

(Slow Sand Filter)

-

. / /

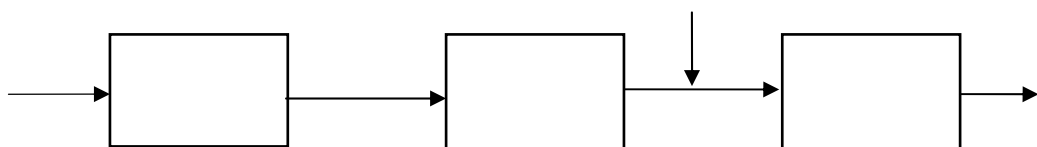
(-)

(-)

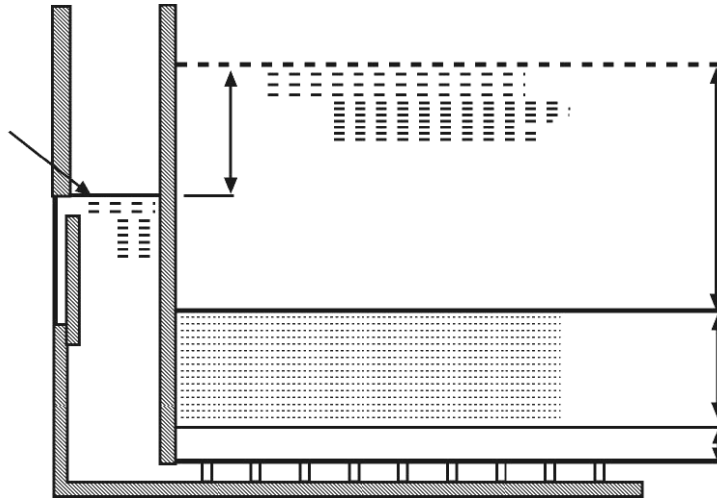
.

-

.



(-)



(-)

)

- / /

(

(Rapid Sand Filters)

/ /

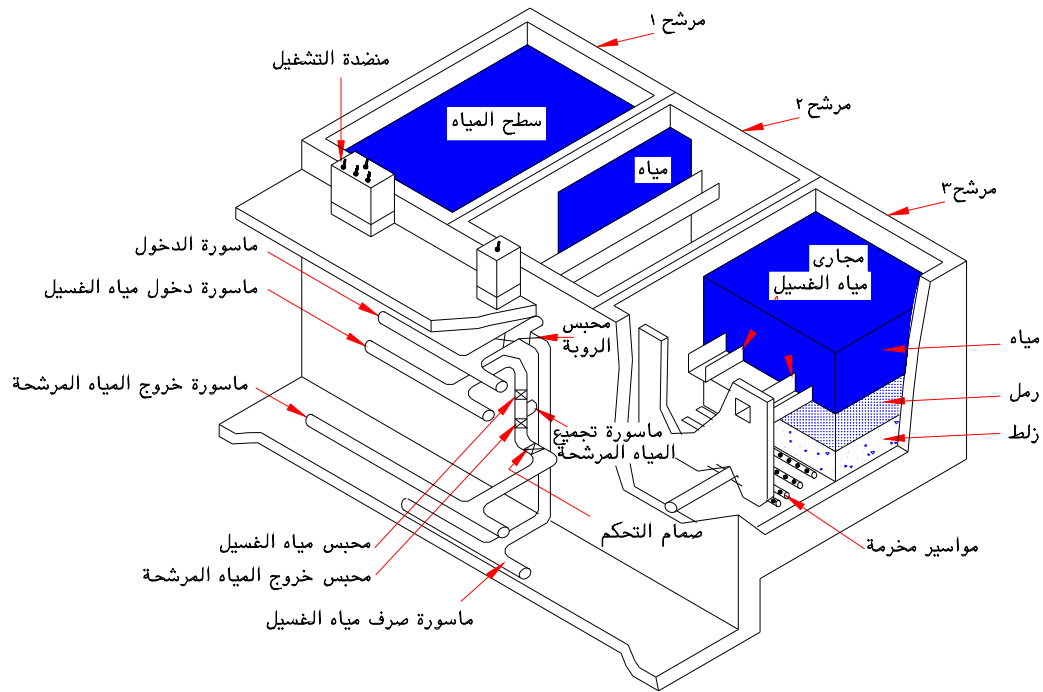
-

:(-)

.()

()

.(M-Block)



(-)

()

,

)

,

، - ،

.(

• ، ،

%

)

%

(

%

%

()

.()

، •

•

:

•

•

(M-Block)

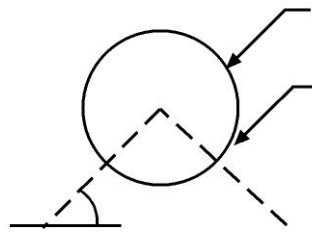
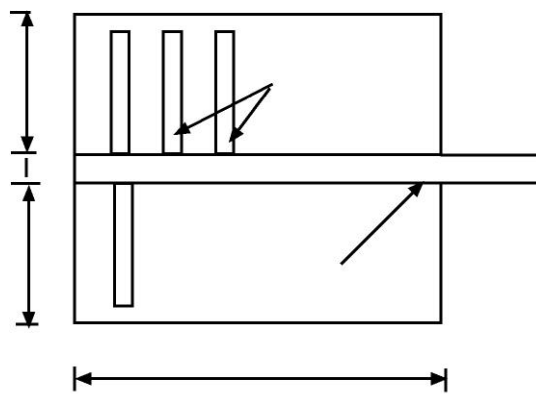
•

- _____
:

.

(-)

- .



(-)

)

-

-

(

.(-)

.

.

-

. - .

%

.

	(	)	
/ /	-		-
/ /	-		-
/	, - ,		-
/ /	- ()		-

N

M

.

:

+ -

-

.

:

•

•

•

)

.(

-

% -

.

:

,

.

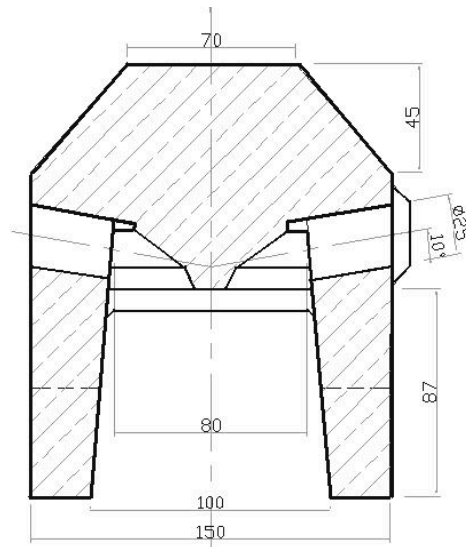
(-)



(-)

M (-)

.



(-)

(M-Block)

:

(Regulating Value)

(Loss of head)

(Turbidity Meter)

(Flow meter)

-
-
-
-

(Operating Table)

:

(Inlet Valve)	•
(Outlet Valve)	•
(Waste Valve)	•
(Wash Water Valve)	•
(Air Blower)	•
(Rewash)	•

.

()

.(Waste)

,

-

.

.

(-)

()

-

-)

-

(

:

:

() ()

.

:

() ()

() ()

()

.

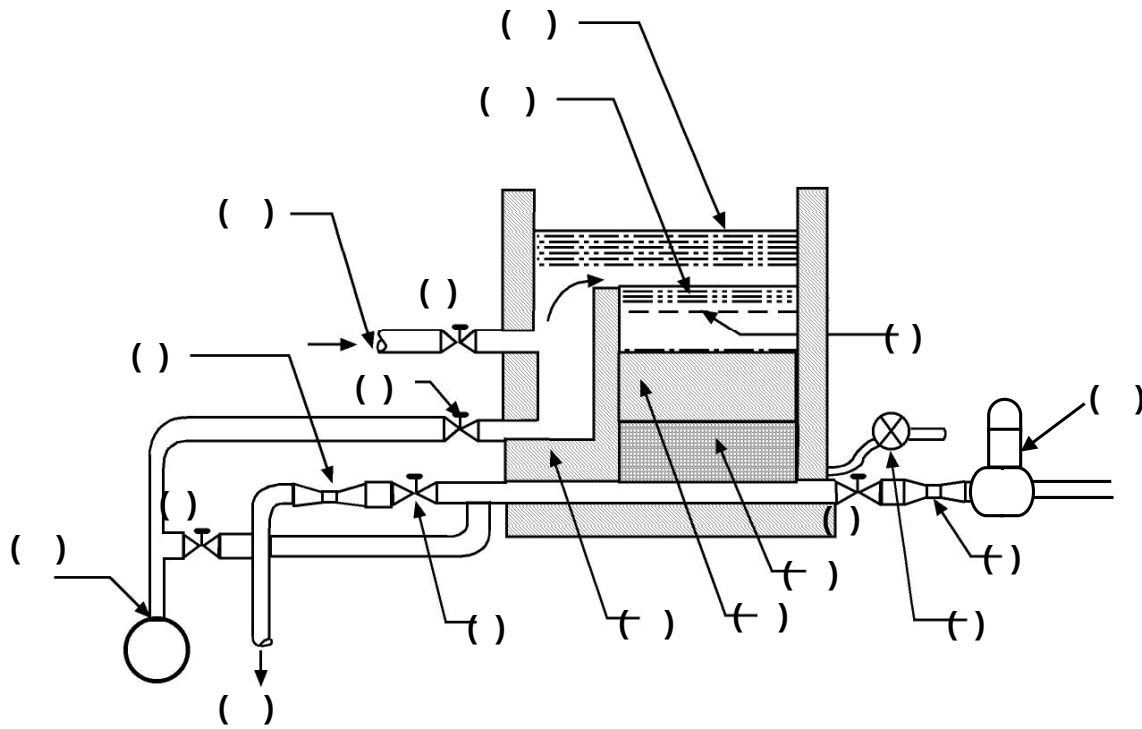
:

() ()

()

(-)

. (-)

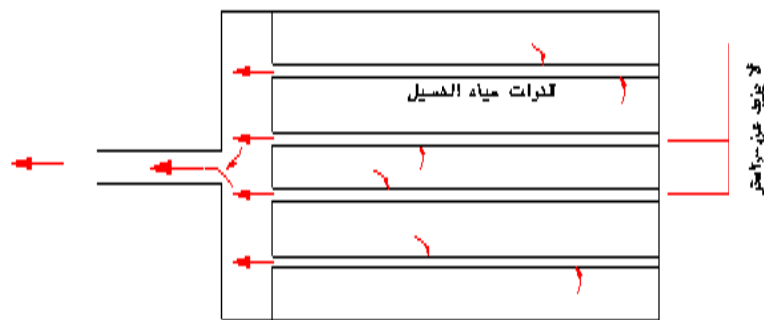
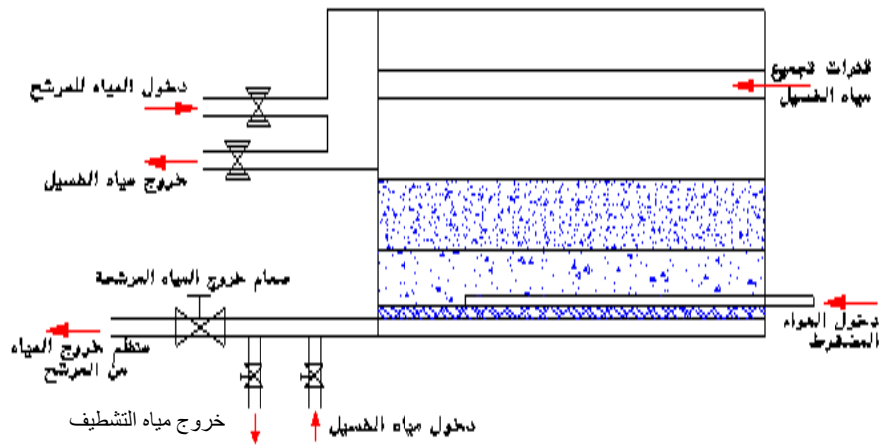


.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
.	-	.	-
()	-	.	-
.	-	.	-

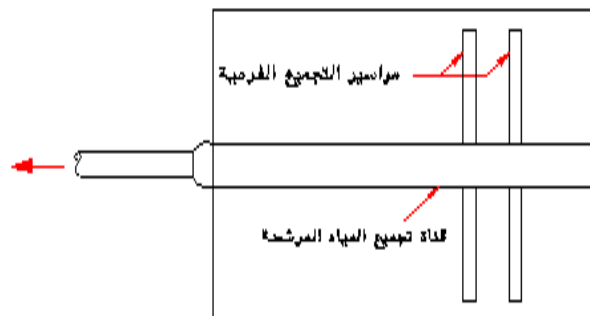
Rewash

(-)

(-)



مستقط أفقي لقنوات مياه التسميل



(-)

(Pressure Filters)

()

(Compact Units)

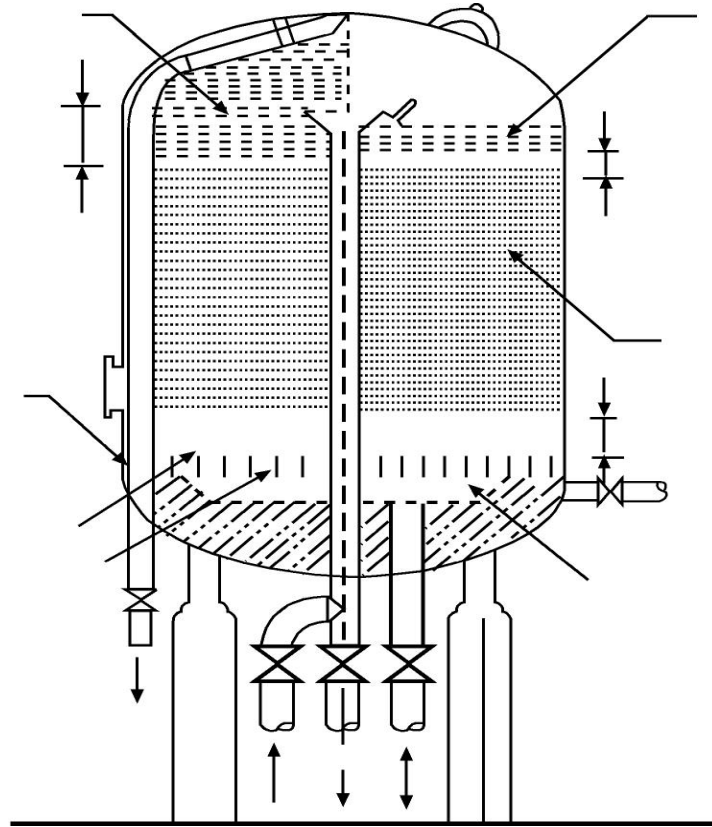
/
.
.
/ /
/ /
.

.()

/ / -
-
% -

(-)

(-)



(-)

(-)

	-	-	(/ /)
	-		
	- .	.	()
- -	x	x	
. - .	. - .	-	()
	يستخدم الماء والهواء		
	-	-	(%)

الفصل السابع

التطهير

() :

:

.

.

.

.

.

.

.

.

.

.

(Microorganisms)

(Pathogens)

(Disinfection)

(Pathogens)

(Sterilization)

:

*

*

*

*

-

.

()

.

(Pathogens)

.(Ultraviolet)

)

(

(Reverse Osmosis)

.

.

)

(Ozone O₃)

(

.

.

(Pathogens)

.

.

.

.

()

.

.

.

،
/ ، ° / ،)
(°

.

.

° ، -)
) ((

.

/

.

-

-

.

()

.

.

:

,

%

.

.

.

:

(-)

.

;

- :

()

%

NaOCl

.

- :

()

$\text{CaCl}_2\text{Ca}(\text{OH})_2$)

$(\text{Ca}(\text{OCl})_2\text{Ca}(\text{OH})_2$

%

.

:

.

:

-

()

% -

Ca(OCl)₂.4H₂O

.

.

.

:

.

.

.

.

.

.

:

-() -

-() -

-() -

.

: "Pre-Disinfection"

.

.

.

.

.

.

.

.

.

.

.

.

.

.

(Post-Disinfection)

.

.

/ .

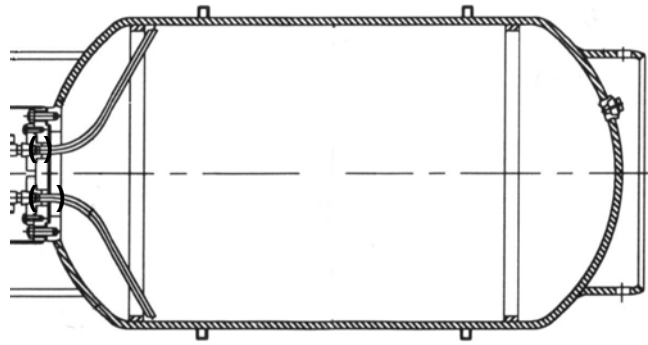
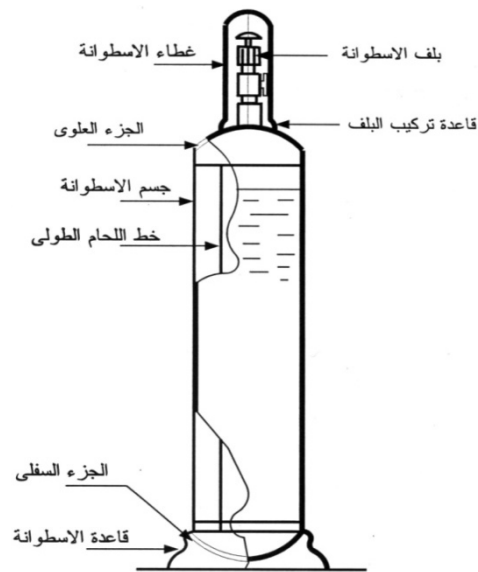
o

.(°)

(-)

()

()



(-)

11

11

■

8

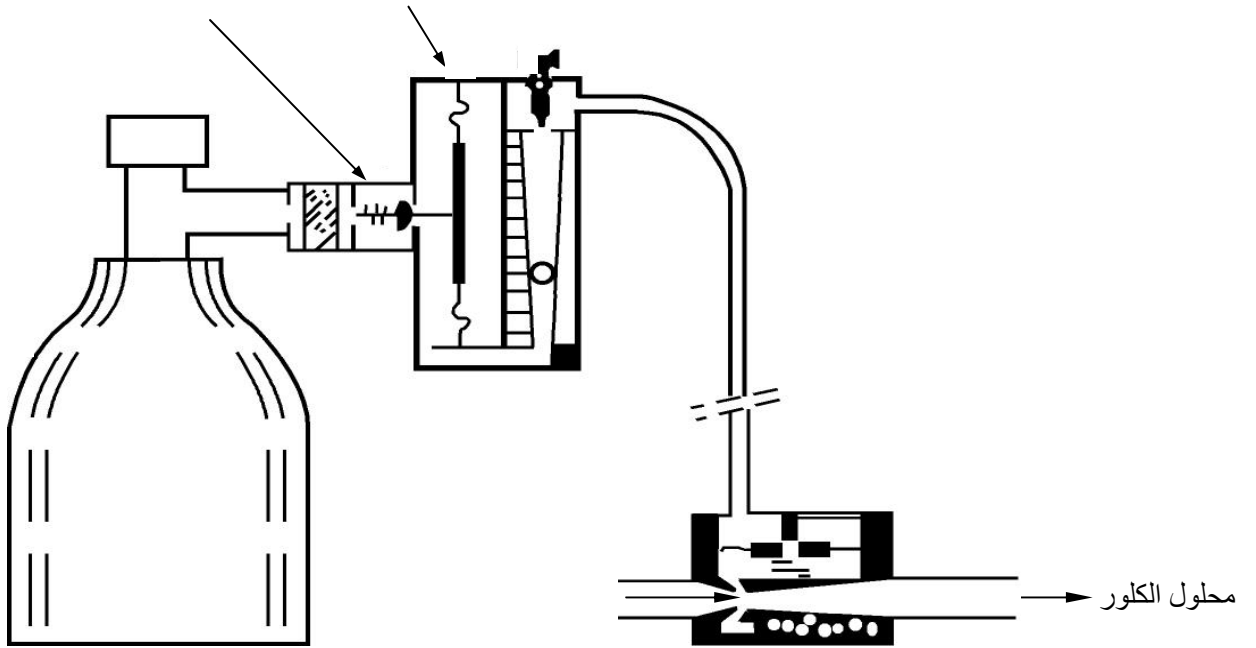
■

■

—

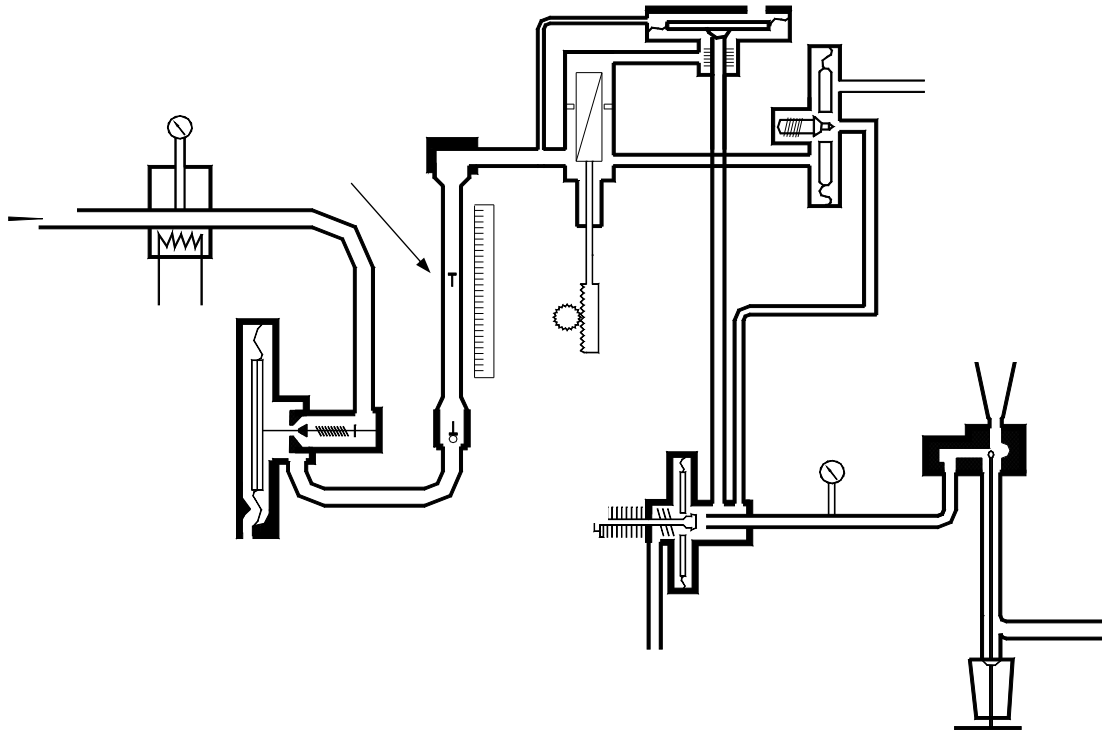
(-)

(-)



(-)

جهاز الكلور المدمج



(-)

:

.

/ , - ,

.

-

.

:

•

%.
()

•

.

• ()

• ()

• ()

3



() :

:

•

•

•

•

•

•

•

•

•

•

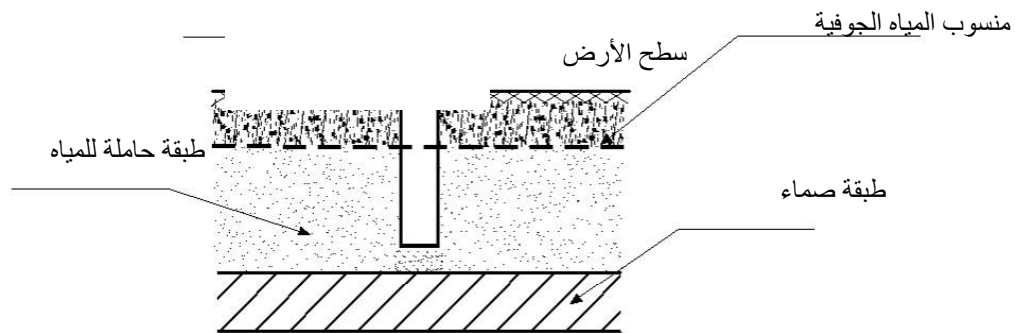
()

—

:

()

.(-)



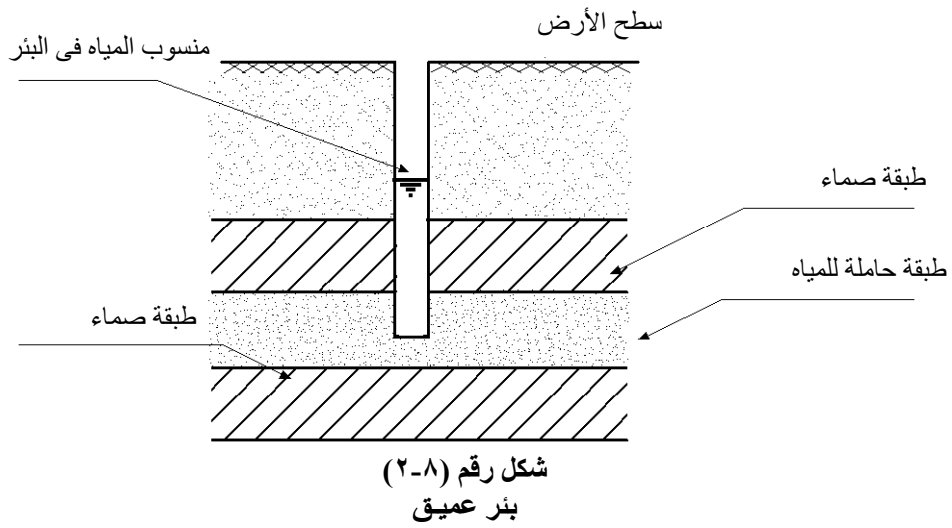
شكل رقم (٨-١)
بئر سطحي

(-) .

()

)

(



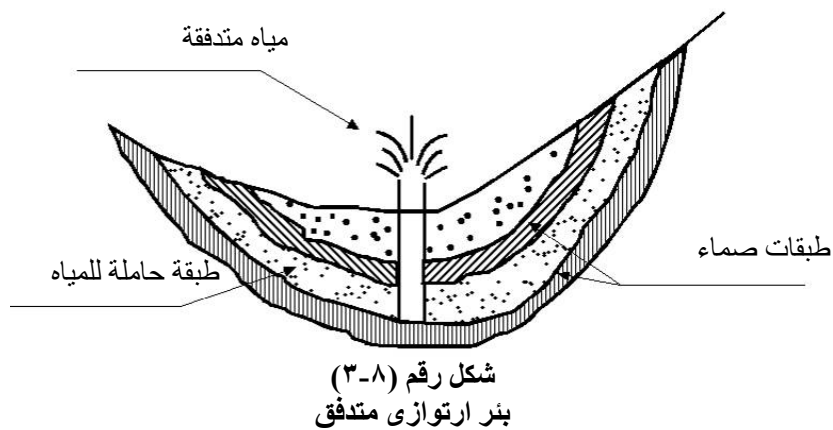
:

:

-

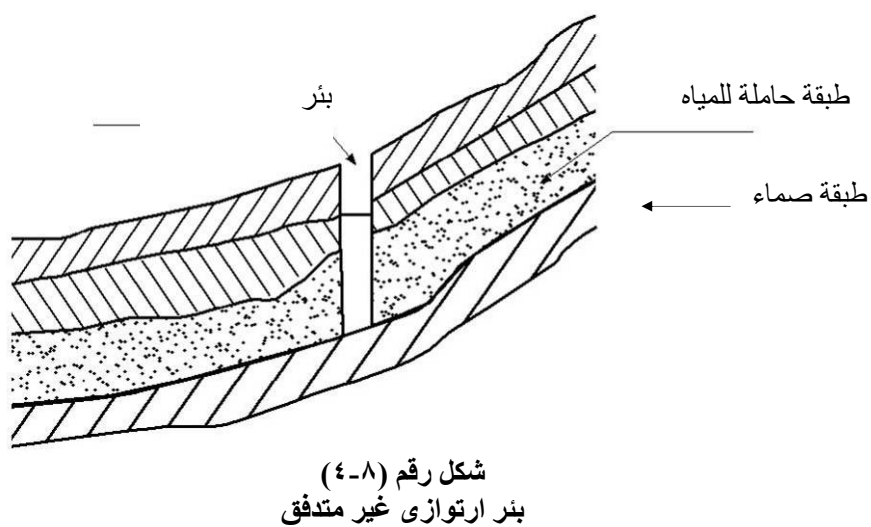
-

(-) .



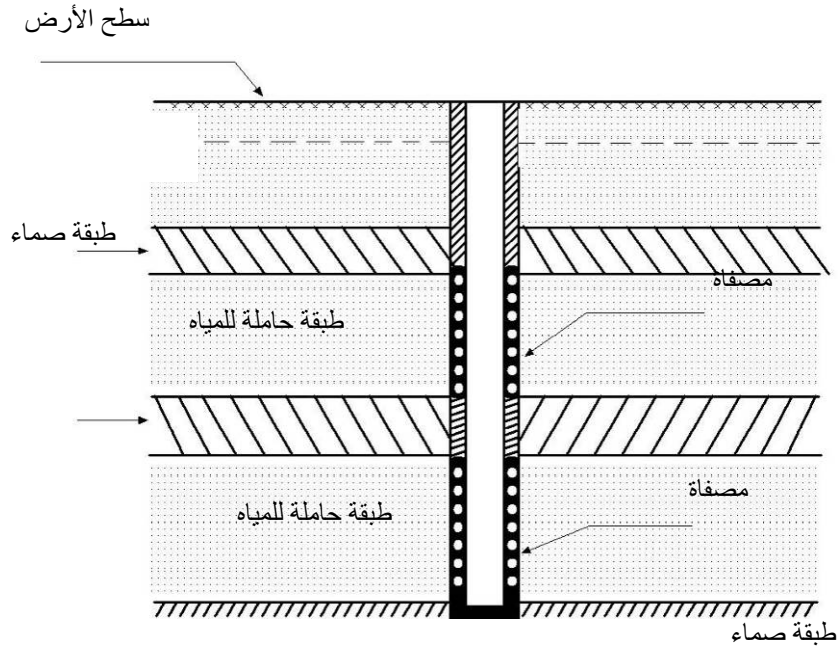
٢ - :

. (-) .



٣ - :

. (-) .



شكل رقم (٥-٨)
بنر متعدد الطبقات

·
:

·
:

·

·

uPVC

(Stainless Steel)

·

:

·

·

·

·

·
·
·
(
(

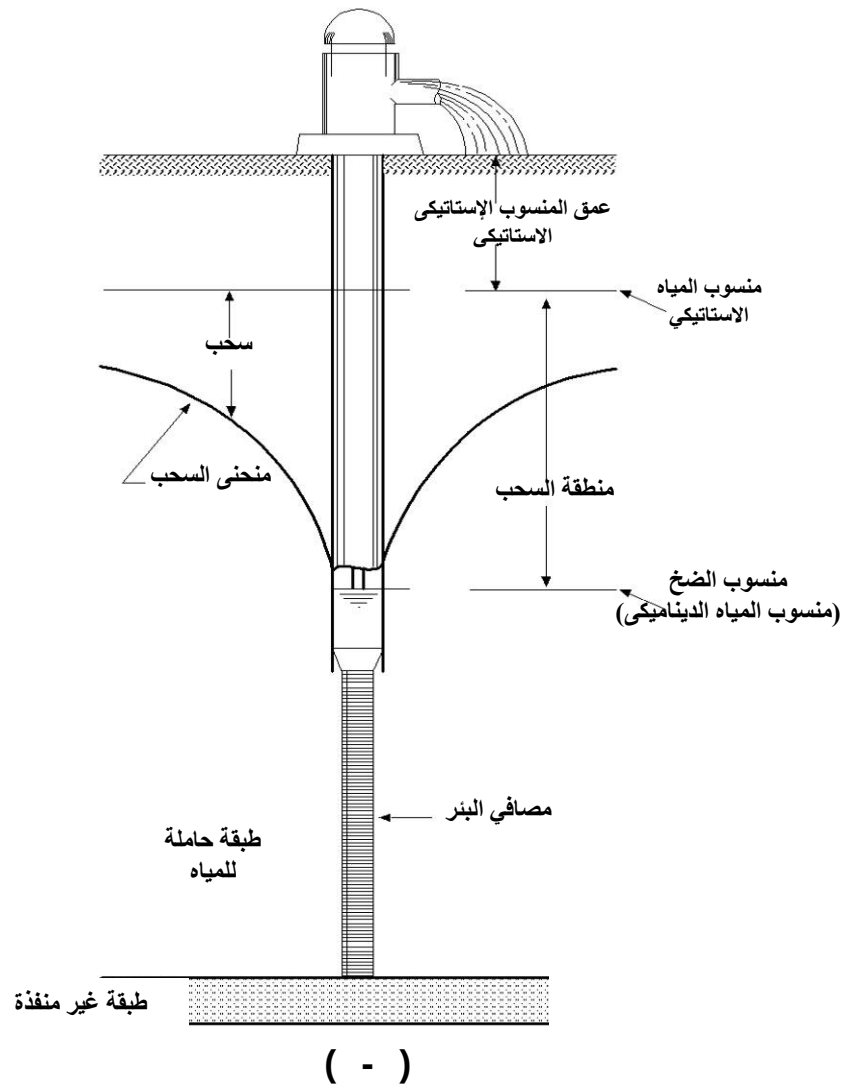
·

)
(

·

(-)

·



Vertical () -

.Turbine Pumps

Submersible () -

.Pumps

(-)



ب. عنبر الطلمبات الأفقية (الطاردة المركزية)



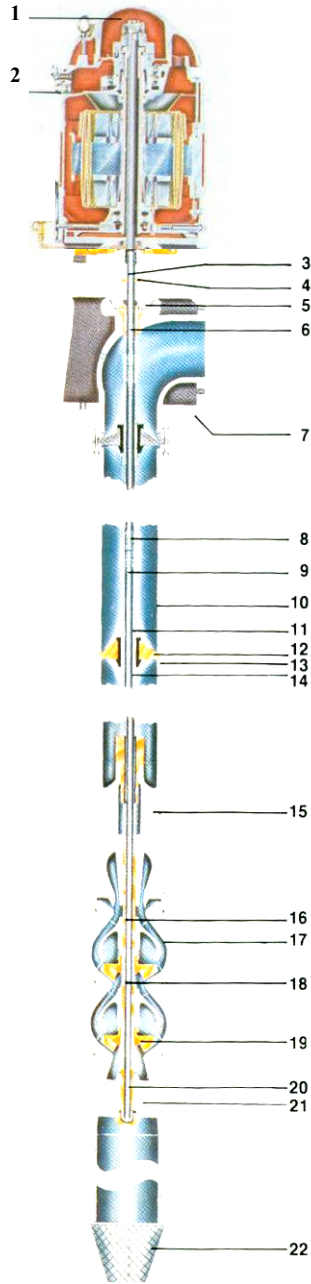
أ. طلمبة أعماق تربينية بأحد الآبار

شكل رقم (٧-٨)
طلمبة الأعماق التربينية والطلمبات الأفقية بعمليات الآبار

(Vertical Turbine Pump "Multistage")

(-)

:



- 1.
- 2.
- 3.
- 4.
- 5.
6. ()
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
14. ()
- 15.
- 16.
- 17.
- 18.
- 19.
20. ()
- 21.
- 22.

(-)

:
 Suction Strainer .
 Suction Case .
 Discharge Case .
 Bowls () .
 Pump Shaft .
 Line shaft .
) () .
 Discharge head (

. ...

.

:

Well casing vent .

.

Gravel Filter Tube

.

.

Sounding tube

.

.

Pump pedestal

.

.

Pump motor base seal

.

.

Sampling tap .

.

Air () .

release-vacuum breaker

(Foot-valve)

:

.

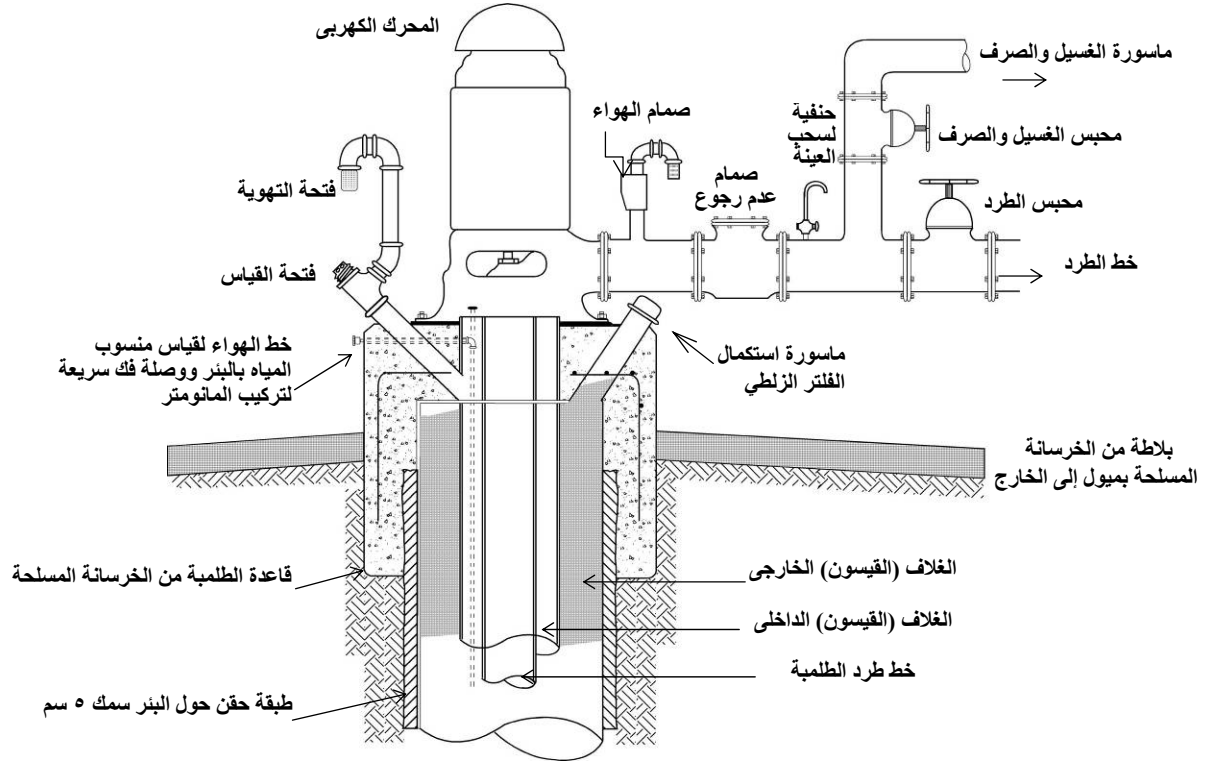
.

.

Wash and drain valve .

(-)

.

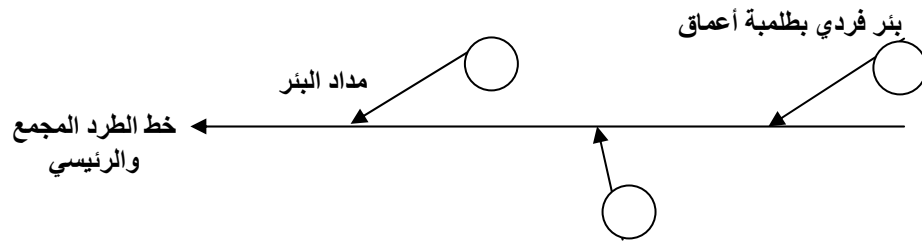


شكل رقم (٨-٩)
قطاع في تركيبات بئر المياه الجوفية

:

:

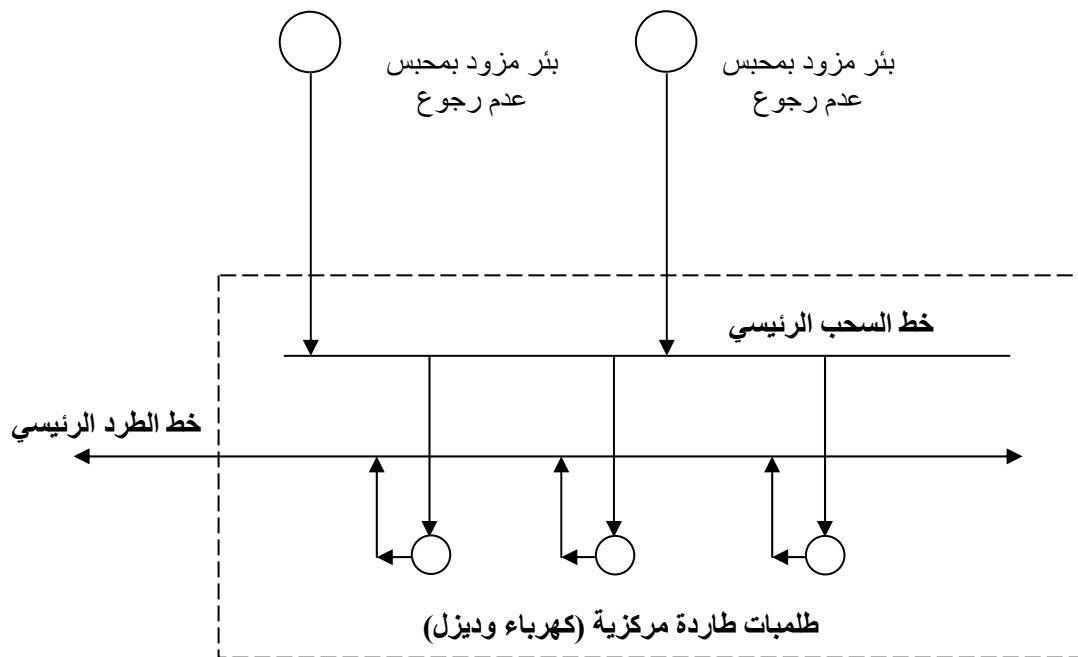
.(-)



شكل رقم (٨-١٠)
النظام الأول لتشغيل الآبار

:

.(-)



شكل رقم (٨-١١)
النظام الثاني لتشغيل الآبار

:

.

(Septic

(Cesspit) () tank)

(Force main) (Sewers)

. ...

.

.

.

.

.

.

)

(Draw down)

.

.

.

uPVC

(Stainless steel)

/

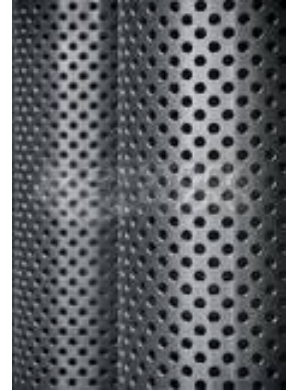
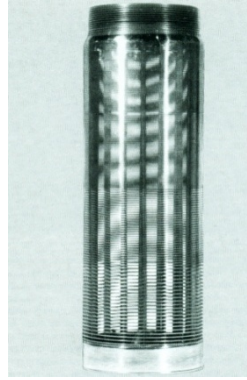
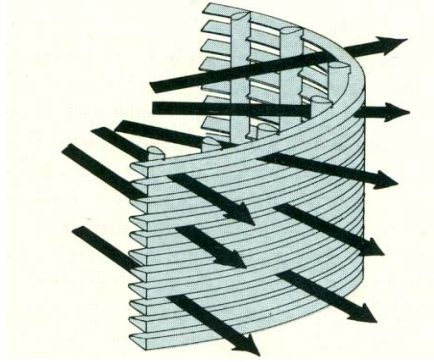
()

uPVC

(-)

(PVC)

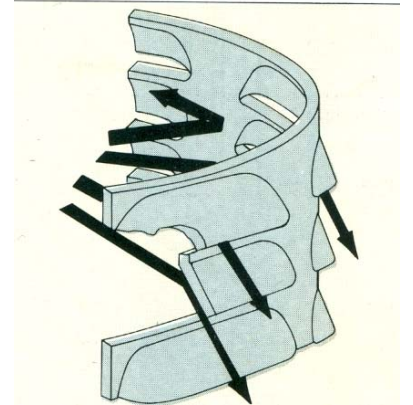
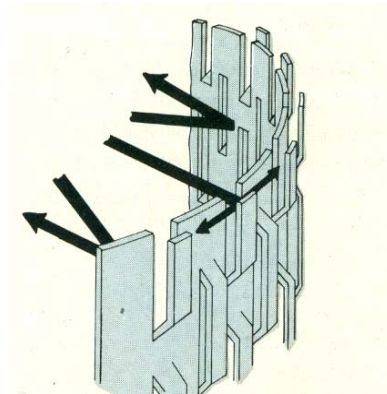
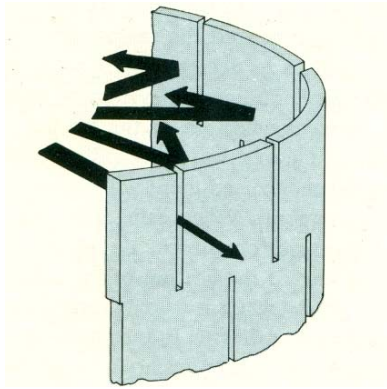
·
·
·



١. مصافي مثقبة

٢. مصافي ذات مشقيات طولية

٣. مصافي ذات مشقيات مستمرة



٤. مصافي ذات فتحات تهوية

٥. مصافي ذات مشقيات طولية

٦. مصافي ذات مشقيات قنطرية

(-)

()

() () (%)

()

.

.

.

.

.

.

:

:

-

.

-

.

.

:

:

:

—

$$(\quad)$$

—

■

□
□

□ □

■

■

■ ■

:

—

■

—

■

■

:

:

.

.

:

-

.

-

.

(Hardness of Water)

.

.(-)

(-)

/ -	()	
/ -		
/ -		
/		

.		
)		
(		
.		
:		
:(Cations)		
.	:	-
.	:	-
	:	-
-		
.	-	
	:	-
-		
.		
:(Anions)		
.	:	-
.	:	-
-	:	-
.		
.	:	-
)	:	-
)	- (/	.
.	(/	.

■ ■

—

—

—

—

—

—

*

*

.(

*

—

•

)

Chemical precipitation.

.(Ion Exchange

1

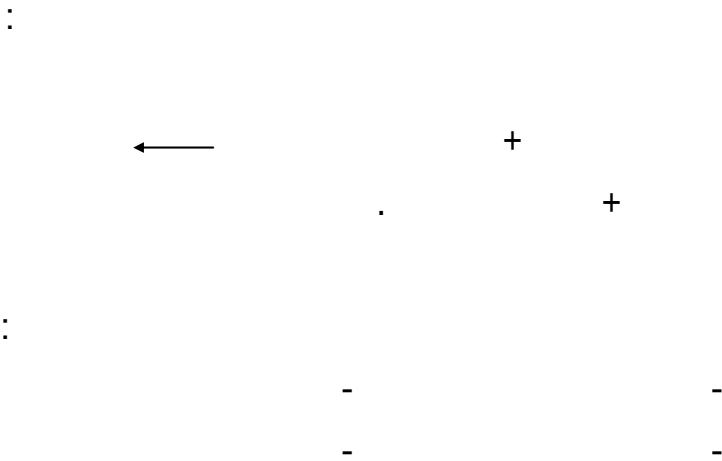
■

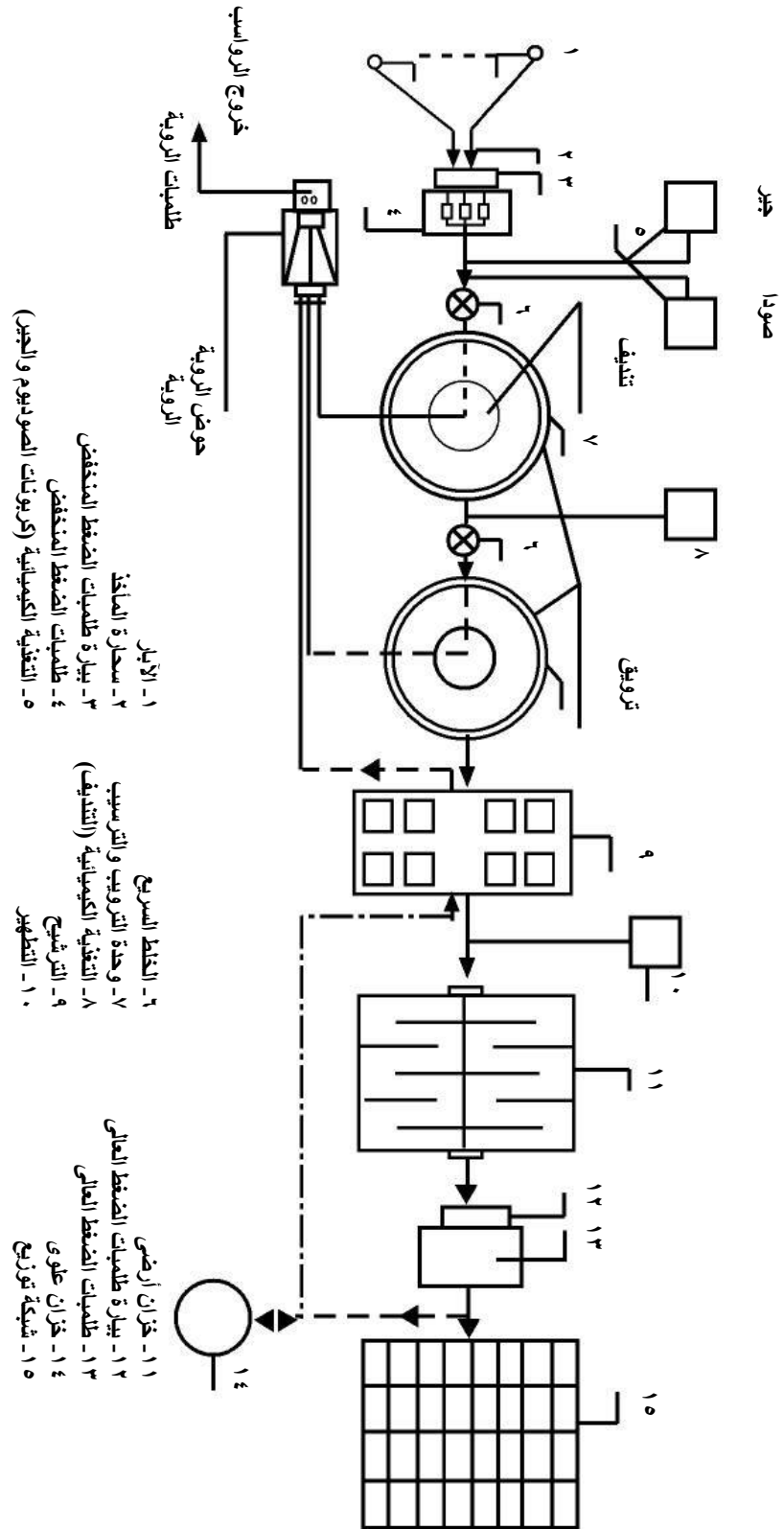
■

(Lime & Soda Ash)

■

Ion)]
:[(Exchange





(- -)

رسم تخطيطي لمسار المياه في وحدات إزالة العسر باستخدام كربونات الصوديوم والجير

- _____:

·
—

—

— (-) .

— (-) .

- _____:(Softening)

()

.()

- _____:

— () ()

() ()

()

.()

- _____:

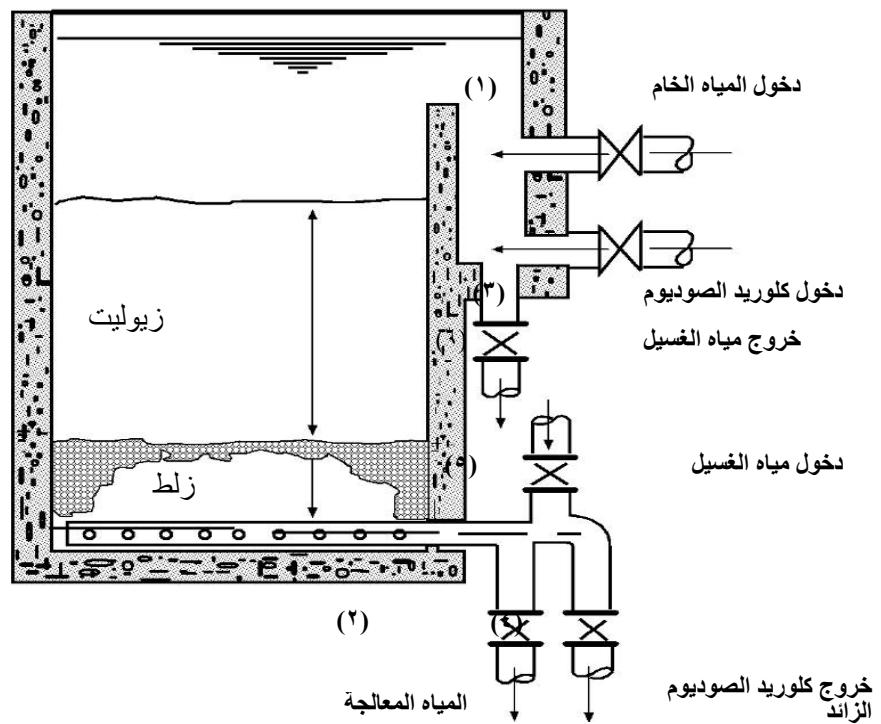
·

()

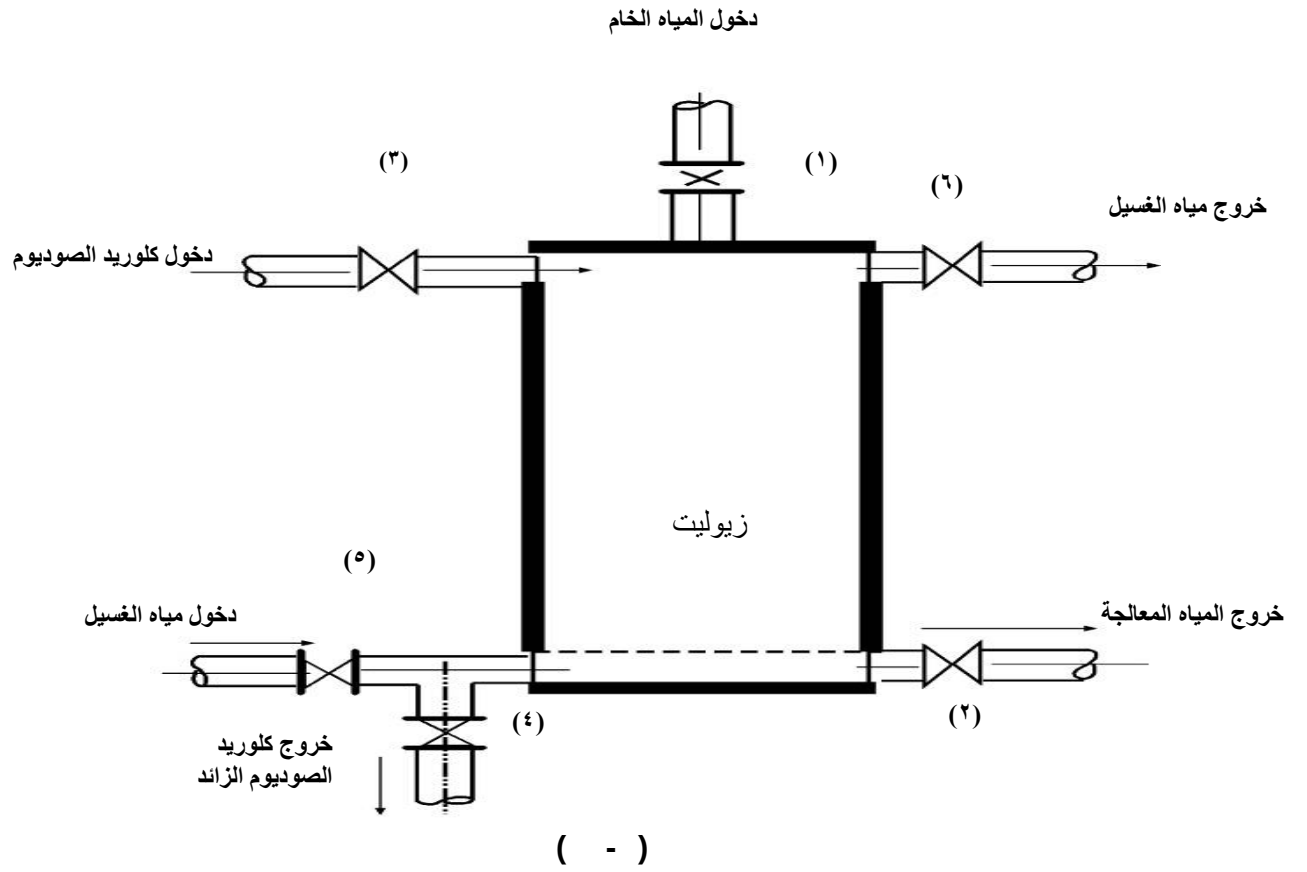
. ()

(-)

(-)



(-)



_____ :

-

-

-

-

-

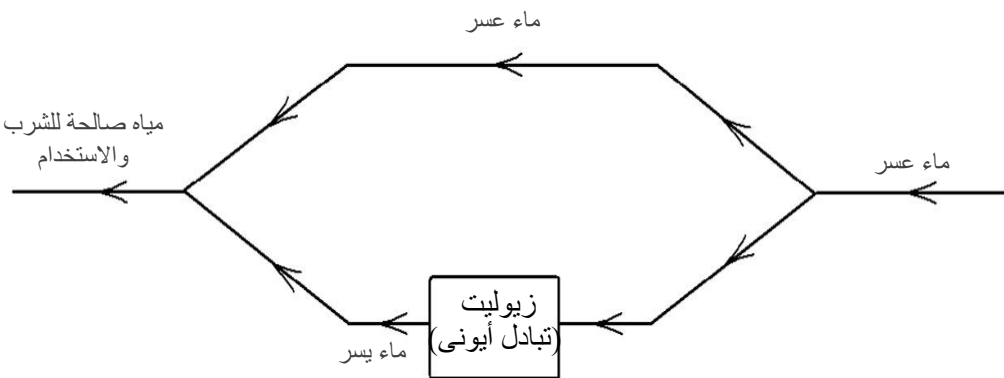
_____ :

-

.(-)

-

-



(-)

:

-

-

(Exchange Resin Cation)

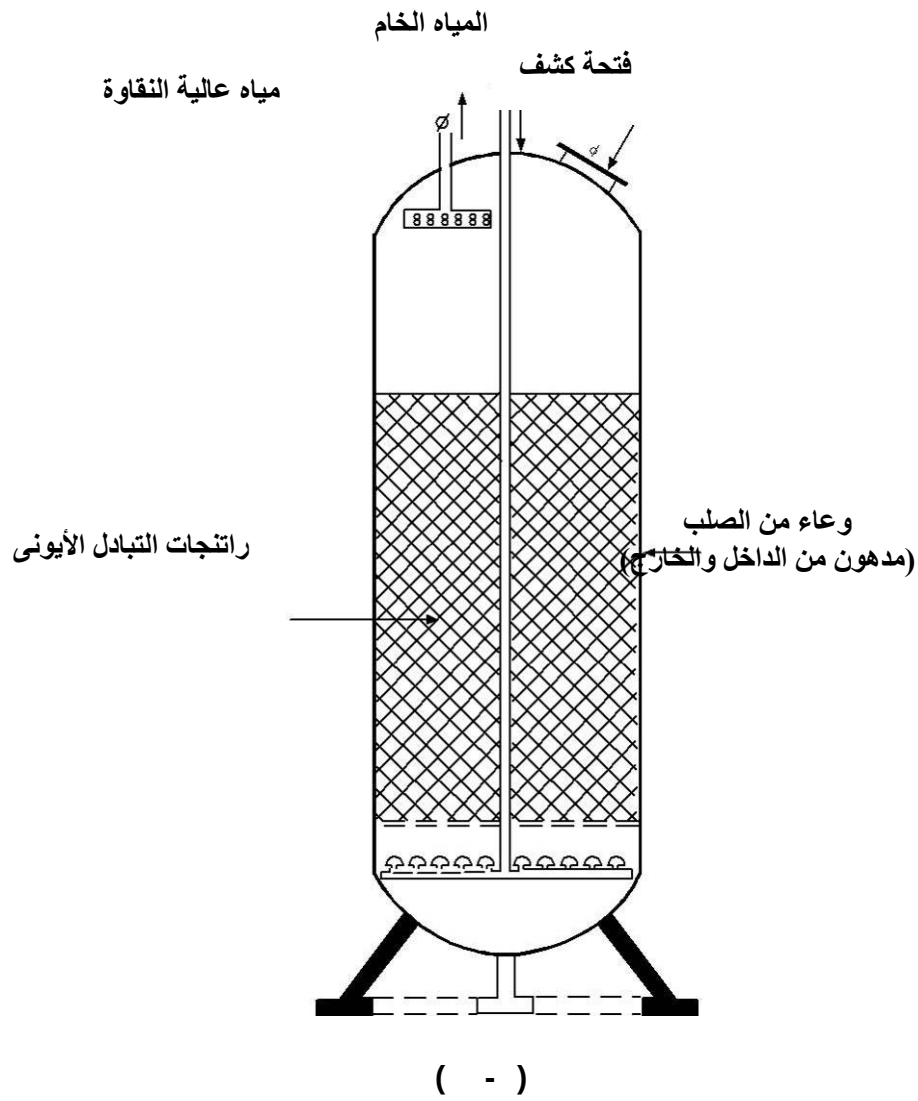
-

-

(-)

-

-



(Iron & Manganese)

- :
- .
-
-
-
-
- .
-

-

.

—

.

:

-

-

-

-

.

.

:

.

.

.

:

.

-

-

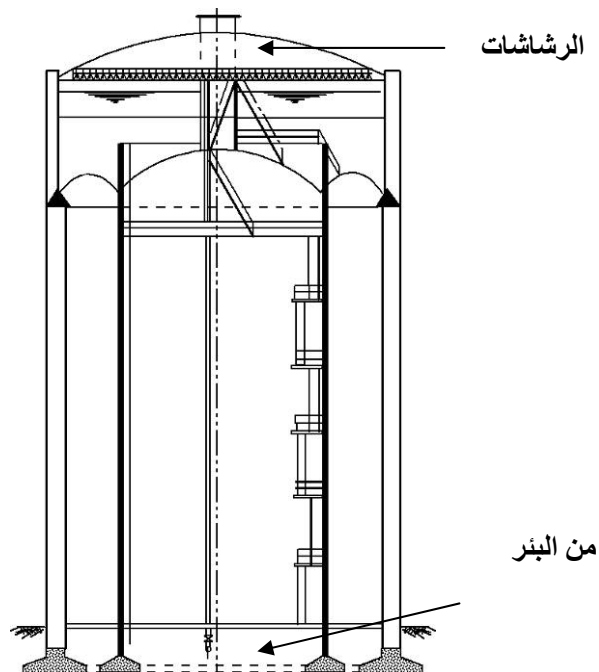
-

-

.

:(Spray Nozzles) :

()
((-))

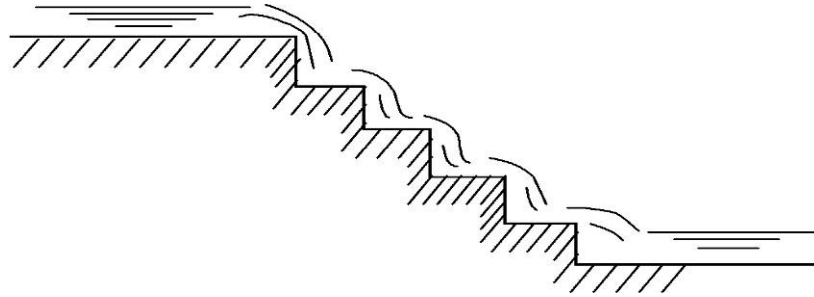


(-)

:(Cascade Falls) :

()

.((-))



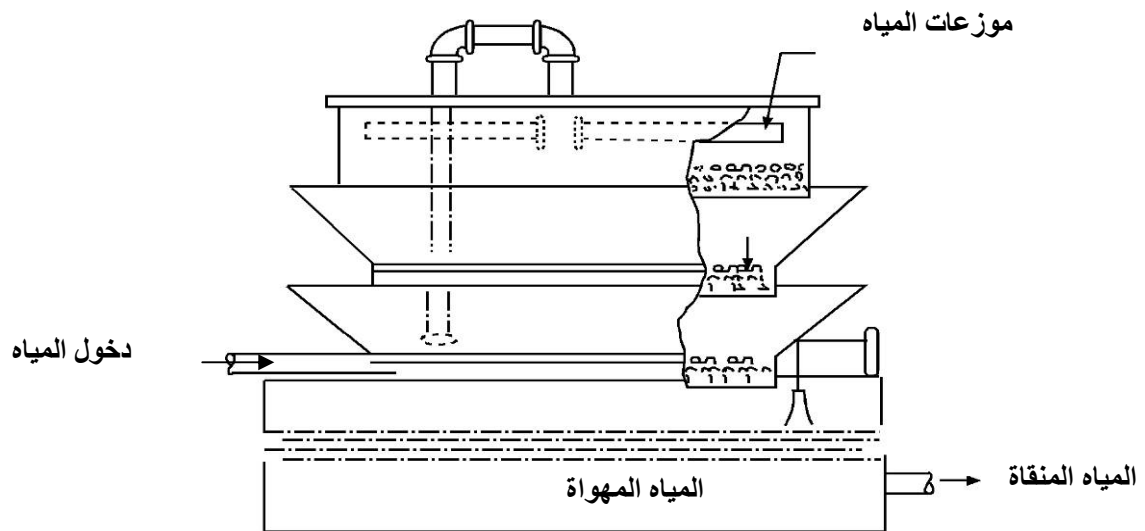
(-)

ثالثاً: استخدام الهوايات ذات الصواني المتعددة (Multiple Tray Aerator):

(Ceramic Balls)

· -
/ -

· (-)

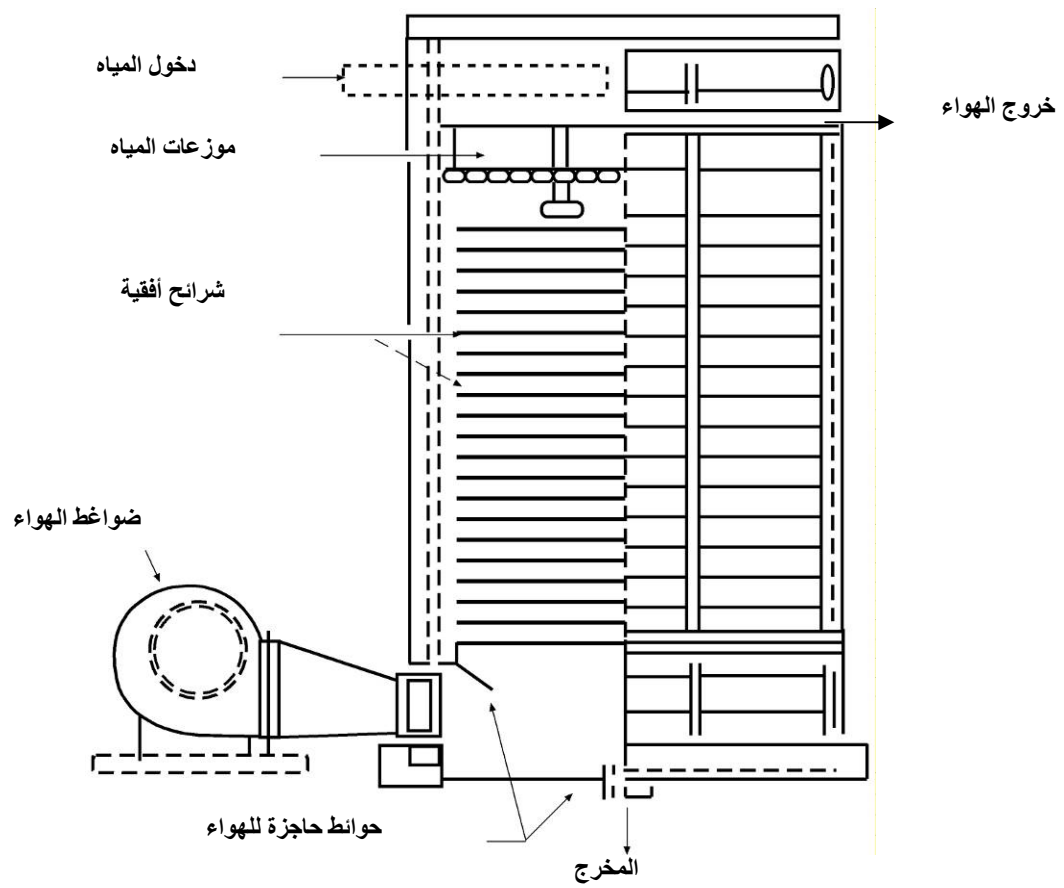


(-)

:(Compressed Air)

:

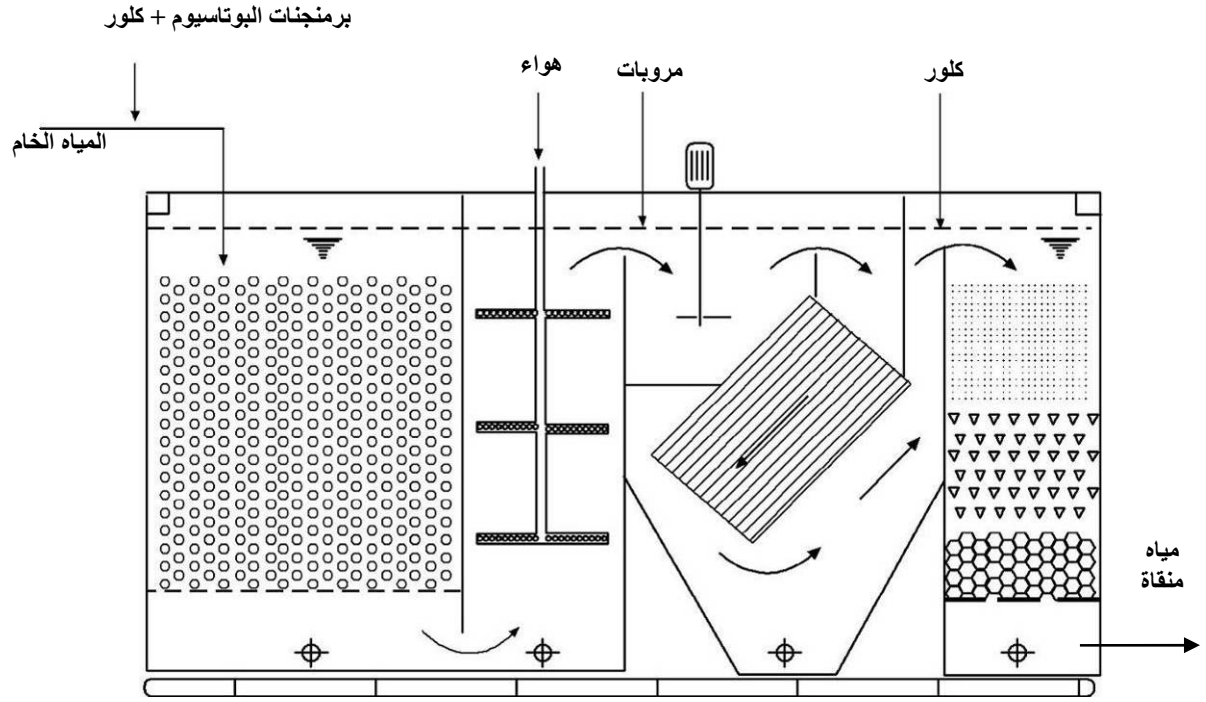
.(-)



(-)

-)

.(



شكل رقم (٨-٢٢)
وحدة إزالة الحديد والمنجنيز

(Tube Settler)

:BURMAN

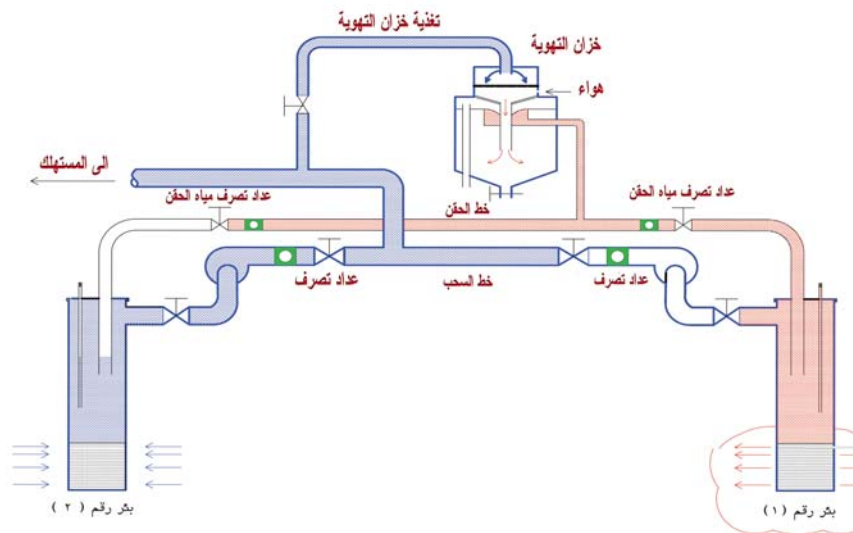
(NMCP)

(AWS)

.BURMAN

BURMAN

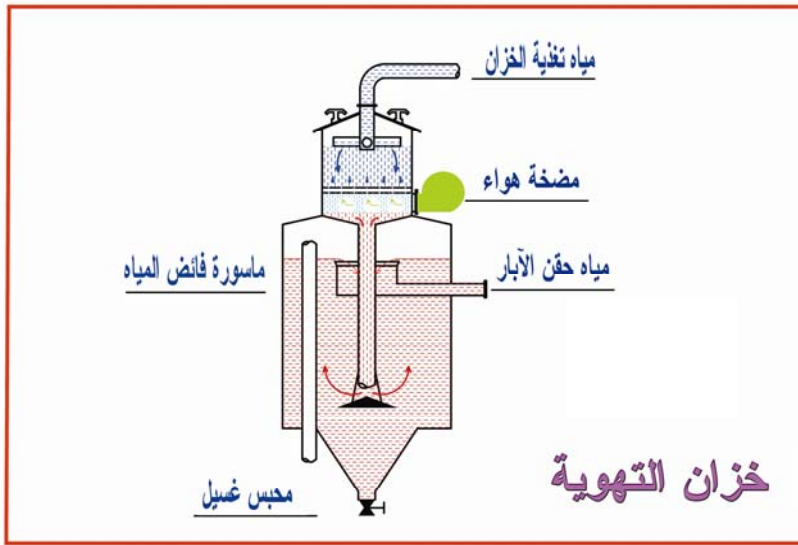
:(-)



شكل (٨-٢٣)
نظام الإزالة للحديد والمنجنيز باستخدام طريقة بيرمان

أ. :

(-)



شكل رقم (٨-٢٤)
خزان التهوية يستخدم أثناء عملية الحقن

ب. :

:

.

.

/ . , /

:	
•	
(	)
.	
•	
)	
.(	
.	
•	
.	
)	
(	
(	
.	
.	

.

)

.

(

.

(-)

.



(-)

—

%

.

Burman

Burman

:

●

)

,

.(

●

■

●

■

●

●

■

%

●

■

●

■ / ■

■

●

. /

/ . - .

.

(-)

.



(-)

/

/

/

/

/

/

/

(= × + ×)

.

الفصل التاسع

وحدات تنقية المياه النقالی

() :

:

•

•

•

•

•

•

•

•

•

(Compact Units)

" "

(/) /
:

-

-

-

(-)

.

.



(-)

:

-

.

-

.

-

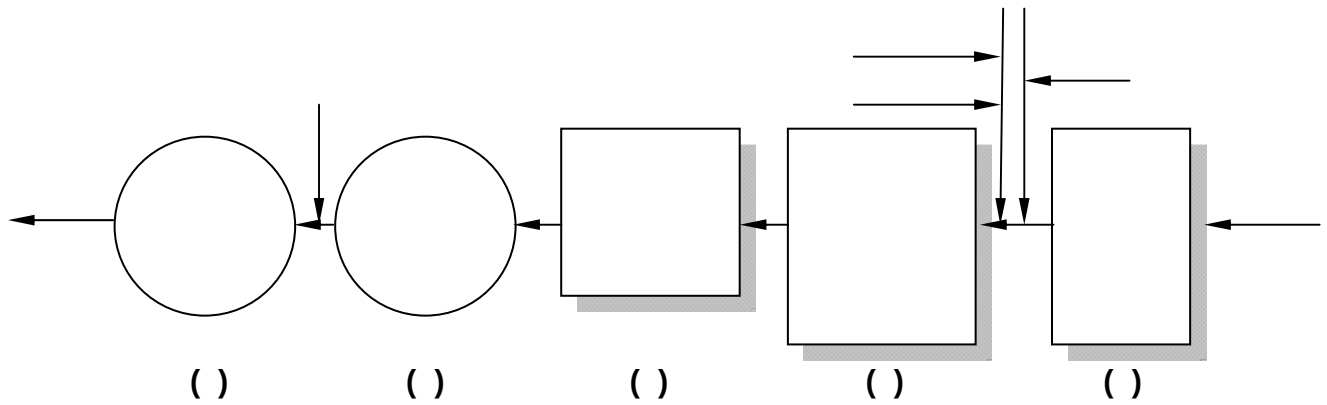
.

١٠٠

" "

(Pressure Filters).

(-)



(-)

مخطط لوحدة تنقية مياه نقالي

■

—

—

•

..

.

:

-

-

.

.

.

()

.

-	-
(/) .	-
:	-
.	-
- :	-
.	-
:	-
/ = %	-
.	-
:	-
:	-
%	-
%	-
- :	-
(/) .	-
, =	-
.	-
:	-
, :	-
, :	-
:	-
/ = %	-
, :	-
, :	-
:	-
:	-
(/) .	-
.	-

	:	/	-	.
	-			
	:			,
	:			
	:			
	-			
	-		" "	
	-			.
	-			
	-			.
	-			.
	-		()	.
	-		()	.

(Compact Unit)

	:	
	:	
	-	
	-	

—

—

■

■

—

■

—

■

1

—

■

—

■

—

■

■

1

■

•

—

■

—

■

—

—

■

—

—

8

—

■

١	-
٢	-
٣	-
٤	-
٥	-
٦	-
٧	-
٨	-
٩	-
١٠	-
١١	-
١٢	-
١٣	-
١٤	-
١٥	-
١٦	-
١٧	-
١٨	-
١٩	-
٢٠	-
٢١	-
٢٢	-
٢٣	-
٢٤	-
٢٥	-
٢٦	-
٢٧	-
٢٨	-
٢٩	-
٣٠	-
٣١	-
٣٢	-
٣٣	-
٣٤	-
٣٥	-
٣٦	-
٣٧	-
٣٨	-
٣٩	-
٤٠	-
٤١	-
٤٢	-
٤٣	-
٤٤	-
٤٥	-
٤٦	-
٤٧	-
٤٨	-
٤٩	-
٥٠	-
٥١	-
٥٢	-
٥٣	-
٥٤	-
٥٥	-
٥٦	-
٥٧	-
٥٨	-
٥٩	-
٦٠	-
٦١	-
٦٢	-
٦٣	-
٦٤	-
٦٥	-
٦٦	-
٦٧	-
٦٨	-
٦٩	-
٧٠	-
٧١	-
٧٢	-
٧٣	-
٧٤	-
٧٥	-
٧٦	-
٧٧	-
٧٨	-
٧٩	-
٨٠	-
٨١	-
٨٢	-
٨٣	-
٨٤	-
٨٥	-
٨٦	-
٨٧	-
٨٨	-
٨٩	-
٩٠	-
٩١	-
٩٢	-
٩٣	-
٩٤	-
٩٥	-
٩٦	-
٩٧	-
٩٨	-
٩٩	-
١٠٠	-

(Compact Unit)

□

•

■

■

■

■

■

■

■

•

■

•

:

•

1

■ ■

■

■

■

■

■

■

■

)

.(

■

■

■

■

■

■

■

()

□

■

■

■

■

■

■

■

■

(Over Load Relay)

,)

• (, —

■

■

(Push Button)

■

■

■

●

8

●

•

•

$$\cdot (\quad)$$

●

■

■

•

●

)

.(

$$\vdash (\quad)$$

●

■

□

□

●

2

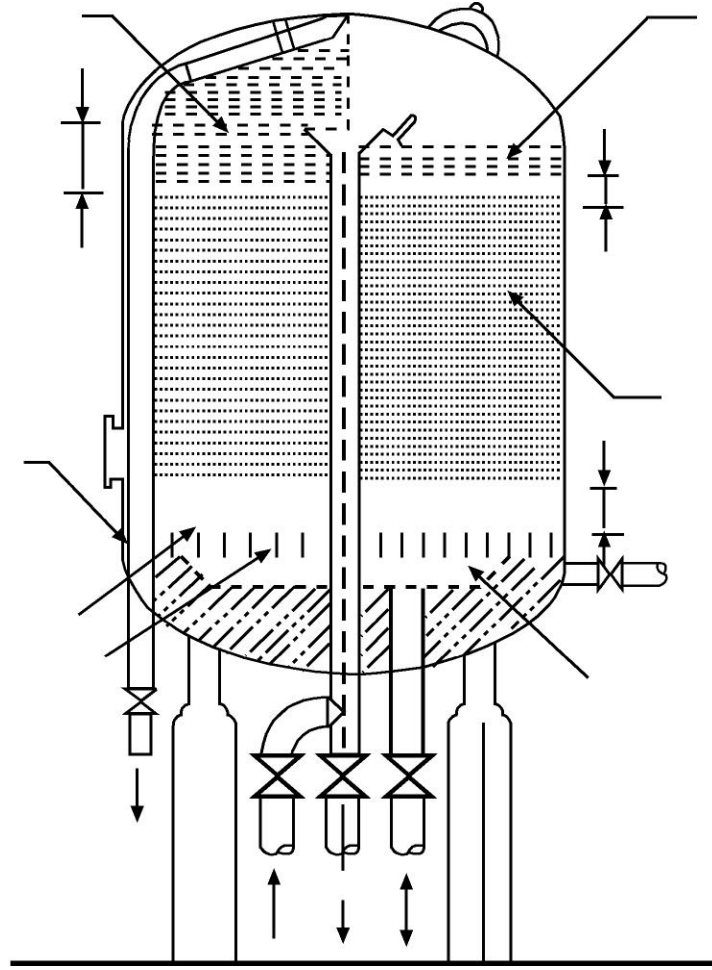
•

●

• ()

.			-
			-
		:	•
			•
			•
			•
		%	
		()	-
			-
			-
			-
			-
			-

.	-
.	-
.	.
.	-
.	-
.	-
.	-
.	-
.	-
.	-
.	.
.	-
.	-
.	.
.	-
.	-
.	.
.	.
.	.
.	.
.	.



(-)

:

-
-
-
-
-

:

-
-
-
-
-
-

:

:

-
-
-
-
-

:

•

•

•

•

•

•

:

:

•

•

•

•

:

•

•

•

•

() .

:

:

•

•

/

:

•

.

•

.

•

.

:

:

/

()

(

.(/) /

:

) / .(-)

: .(

-

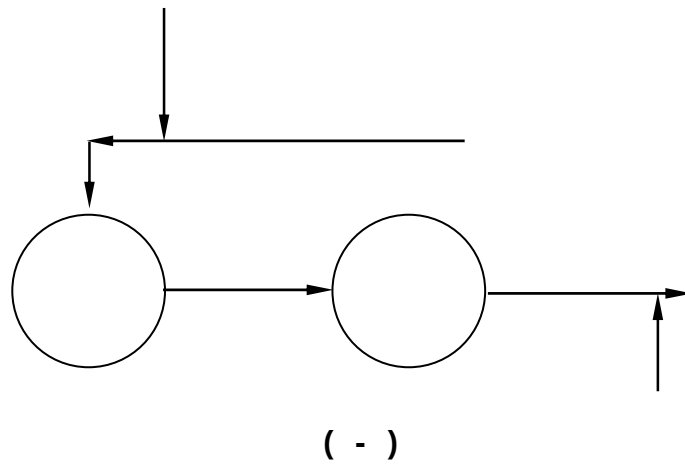
.

%

-

.

- ١٠٠٠ : (-)
- () - ()
- Rough / Contact Filter -
- () -
-



- ١٠٠٠ :
-)
- In-) (
- .(line Mix
- (Rough/Contact Filter)

-
-

%

■

■ ■

■

•

(-)

)

■

(

.(

)

—

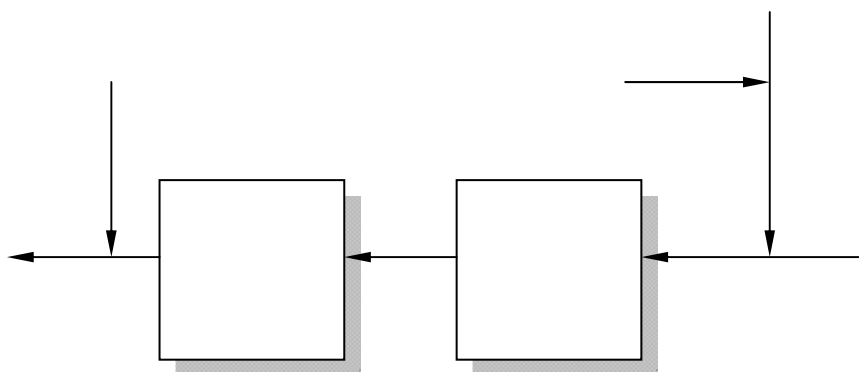
.(

)

+

)

.(



(-)

:

-

.

()

.

-

:()

.

:

-

:

-

.

.

()

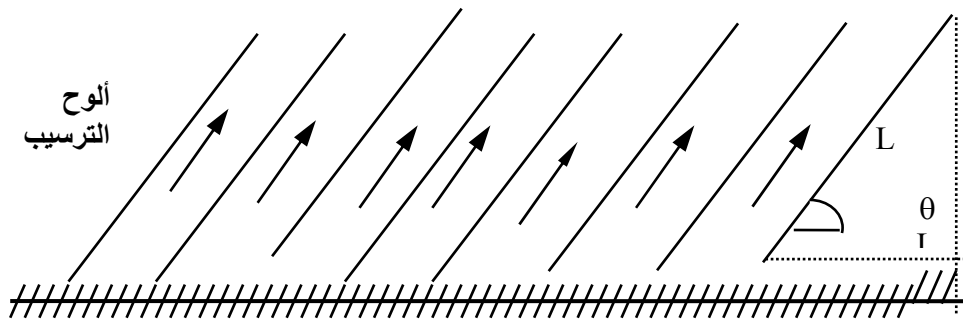
.

.

.

(-)

.



(-)

:

$$N =$$

$$L =$$

= B =

$N * L * \cos \theta * B =$ ∴

.

∴ _____

:

-

.

-

.

-

.

الفصل العاشر

تشغيل محطات تنقية مياه الشرب

:()

:

•

•

•

•

•

•

•

•

•

■

■

■

-

-

-

■

■

■

■

()

■

■

:

()

()

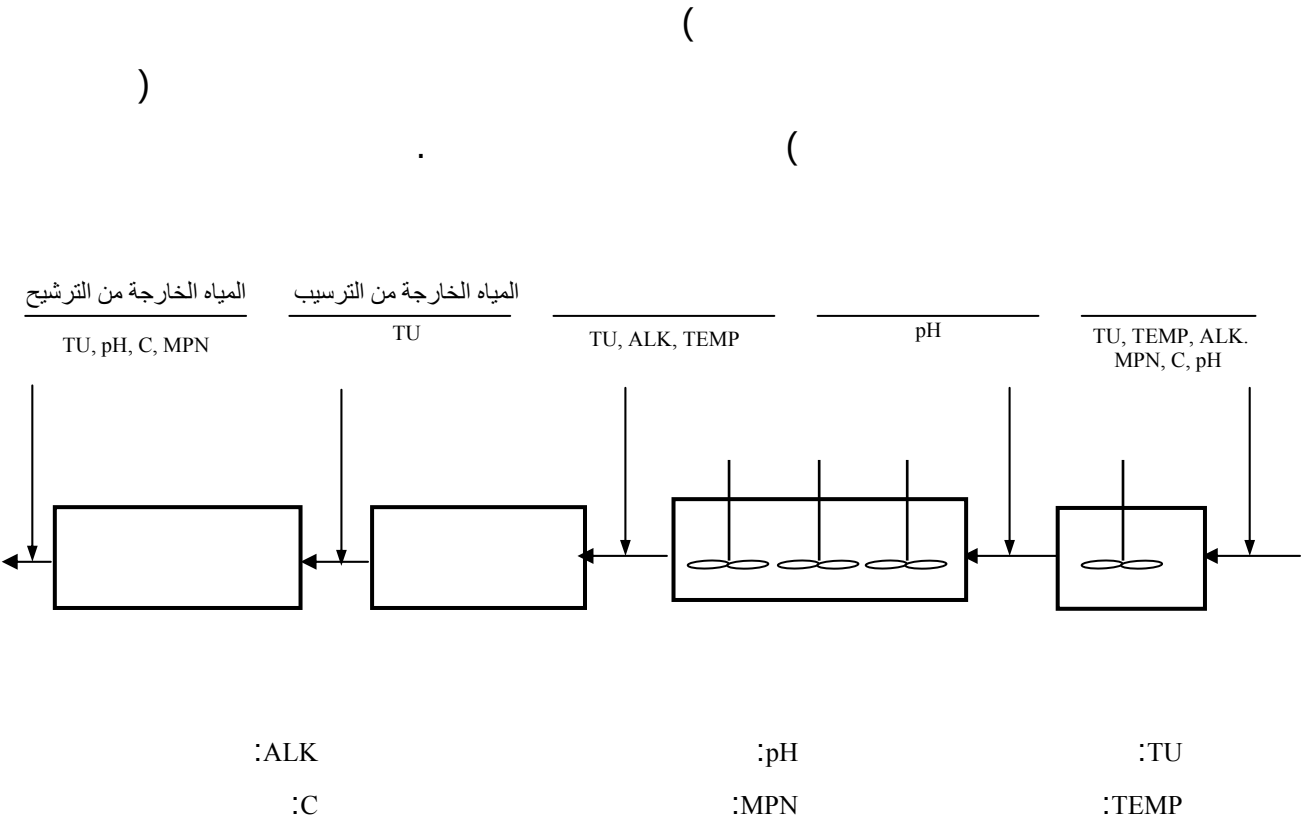
(Grab Samples)

(pH)

(Composite Samples)

(-)

)



(-)

.

.

)

(

.(

)

.

.

.

.()

(-) - ()

.

.

:

-

.

(Checklist)

.

.

.

.

:()

-

.

.

()

.

-

.

.

-

-

.

-

.

.

-

.

:

.

.

:

•

.

(..... - -)

.

:

•

.

.		.	
:		:	
:		-	
		*	
.		.	
		*	
.		-	
.		-	
.		.	
		.	
		-	
.			
.		-	
		-	
.			
		-	
		.	

.

-

.

-

.

-

.

.

.

.

)

(pH)

(Jar test

.

.

.

.

.

.

.

:

-

)

.

.(

-
-

■

■

8

□

■

■

■

•

8

■

□

■

—

■

—

■

8

—

(Jar test)

(pH)

.

-

.

.

.

:

-

:

-

)

.(

-

.

-

.

-

.

/

.

.

■

(-)

■

■

■

)

.(

2

■

)

(

■

(-)

	Head Loss		
()			
		()	

-

:

.

.

.

() .

() .

() .

.

-

:

()

.

(/ /)

.

/

(/ ,)

= % = :)

.(% = %

.

()

()

.(

.()

(Remote readings)

()

.

:

- [(Analog Gauges) -

- (Digital Indicators)

[(Cathode Ray Tube Displays)

- () -

- () -

- () -

- [- -

[(Relay logic systems)

- :

()

.

.

()

.()

:

-(On/Off) -

-) Time-Impulse Control -

-(

-() -

.(Hybrid Systems)

."Relay Logic"

(Contacts)

(Timers)

()

.

:

-

-

-

-

-

-

()

.(-)

.

.

.

.

(Demand-Feedback)

.

)

(

.

()

)

.

(

.

.

.

()

.

:

.

-

.

-

.

-

.

()

.()

.

()

.(/) /

:

.

()

-

-

. /

:

:

:

/

/

,

, / + /

.

()

.

⋮ _____ ⋮

. , = — =

. / = × , =

. / , = , × =

/ ()

/

. /

.

.

.

()

.

.

()

()

.()

()

.

:

-

-

-

-

-

-

.

()

.

()

()

.

.

()

.

() ()

.

.

.

.

:

() -

-

-

-

-

()

-

.

.

.

.(Material Safety Data Sheet "MSDS")

/ / .

(MSDS)

:

-

-

() -

-

-

/ -

-

.

(-)

.

.

(-)

(Comments)	(Commercial Concentration)	(Chemical Formula)	(Chemical Name)
	47-50% (Al ₂ (SO ₄) ₃)	Al ₂ (SO ₄) . 14 H ₂ O	()
	59-61% FeCl ₃	FeCl ₃ . 6 H ₂ O	
	90-94% Fe ₂ (SO ₄) ₃	Fe ₂ (SO ₄) ₃ . 9 H ₂ O	
	55% (FeSO ₄)	FeSO ₄ . 7 H ₂ O	
		—	
		—	
		—	
	12-15% (Cl ₂)	NaOCl	
	65-70% (Cl ₂)	Ca(OCl) ₂ . 4 H ₂ O	(HTH)
/	99.8% (Cl ₂)	Cl ₂	
/	99-100% (NH ₃)	NH ₃	
	29.4% (NH ₃)	NH ₄ OH	
	6.3% (NH ₃)	(NH ₄) ₂ SO ₄	
	26.3% (Cl ₂)	ClO ₂	
	—	O ₃	
		C	
	100%	KMnO ₄	
	99% (CuSO ₄)	CuSO ₄ . 5 H ₂ O	
			()
	75-99% (CaO)	Ca(OH) ₂	()
	98.9% (NaOH)	NaOH	()
	75-99% (CaO)	CaO	()
	99.4% (Na ₂ CO ₃)	Na ₂ CO ₃	

1

1

1

•

$$\left(\begin{array}{cc} - & - \end{array} \right)$$
$$\left(\begin{array}{cc} & \\ - & - \end{array} \right)$$

1

▪ ()

1

•

□

()

,	,	,		,	,	,	(/)

/

(/)

:

()
_____ = (/)
()

, + , + , + + , + + ,
_____ =

/ , = _____ =

()

()

()

.

. /

.

()

()

=

=

/

=

:

()

× (/)

_____ = ()
(/)

= _____ = _____ × _____ =

.

()

.

.

.

.

.

.

.

.

.

.

.

()

.

:

:

-

-

-

-

-

.

(As Built Drawings)

.

.

)

)

(

)

(

.(

)

(

.

.

.

:

:

-

-

-

)

.(

()

.

(-)

الفصل العاشر - ٢٦٢

()

//

[illegible]

.

.

.

:

-

-

-

-

-

.

() .

:

.

.

:

()

.

.

(Jar Test)

.

.

.

.

.

.

.

.

.

.

:

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

- () : ()

:

•

.

•

.

:

-

()

.

:

-

:

•

.

•

.

:

-

.

□

□

—

—

)

.(

—

■

—

—

■

—

—

—

■

■

■

)

■

()

(

■

$$\cdot \left(\begin{array}{c} \\ \\ \end{array} \right)$$

■

■

•

•

•

•

•

•

•

(pH)

.(BOD)

•

•

%

•

(Drying Beds)	(Lagoons)	(Thickeners)
:		
(Lagoons)	-	:(
		.
		.
		.
:(	(Thickening)	-
		-
		.
:(		-
(Belt Filter Presses)		
		.
		:

:

-

-

.

-

.

-

.

-

.

-

.

-

.

-

.

-

.

.

(-)

:	-
	-
	-
	-
	-
	-
.	-
	-
	-
	-
	-
	-
	-
:	-
	-
.	-
.	-
.	-
()	-
	-

(-)

-	:
-	
-	
-	
-	.
-	.
-	
-	.
-	:
-	:
-	.
-	
-	
-	()
-	.
-	:
-	.

(-)

:	:
-	-
-	-
-	-
-	-
-	-
-	-
.	:
:	-
-	-
-	-
.	-
-	-
.	.
.	.

(-)

:	:
(pH)	
-	-
-	-
-	-
-	-
-	-
:	-
(pH)	.
-	.
-	.
-	:
:	-
-	.
-	-
-	.
-	-
()	
.	

الفصل الحادي عشر

الصيانة

() :

:

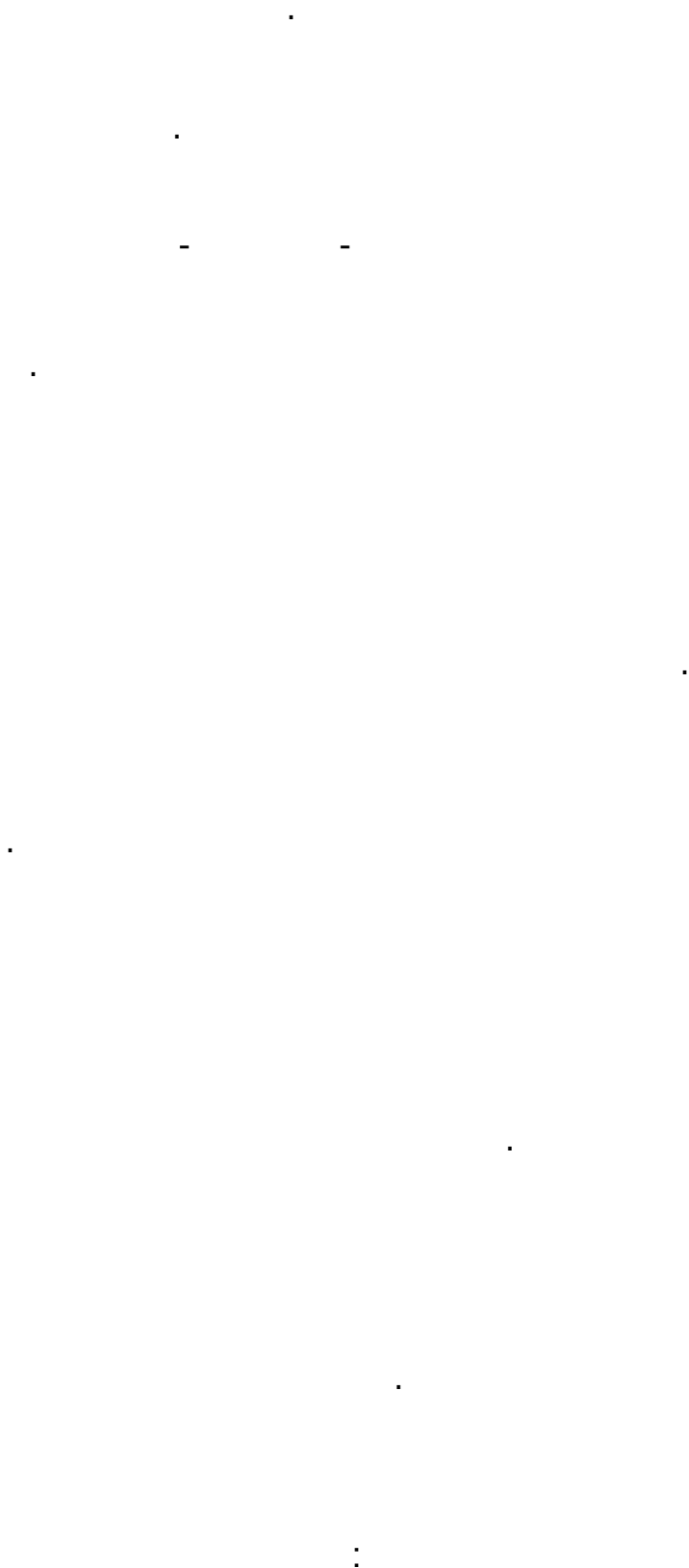
•

•

•

•

•



-
.
-
.
, /
/ . /
/ .

.

.

"

"

()

()

.

:

(-)

.()

_____ ()

:

- Feel •
- Inspection •
- Tightening •
- Cleaning •
- Adjusting •
- Replacing •
- Lubricating •

_____ ()

:

•

(- /)

...

-

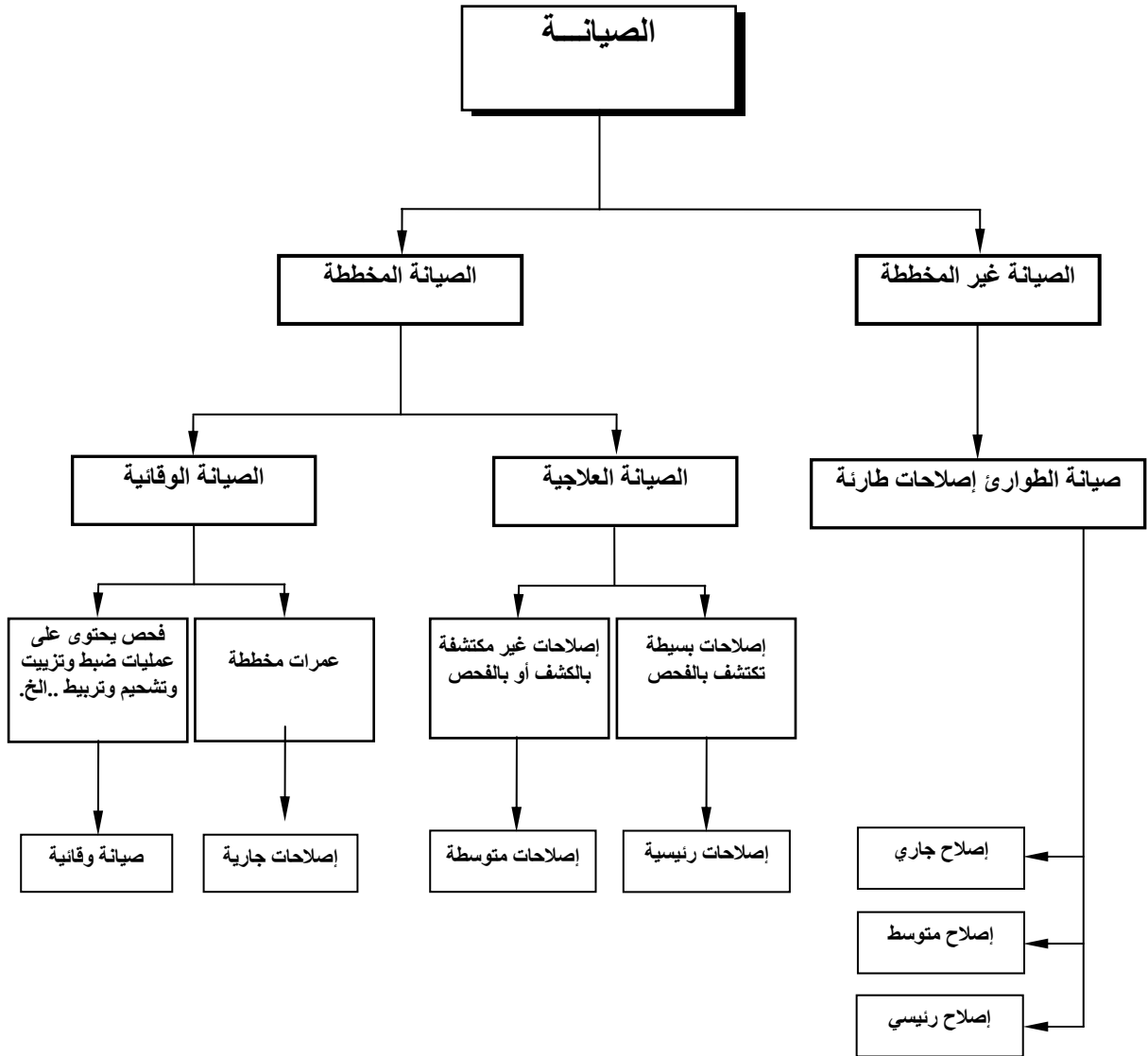
-

.

•

(... / /)

.



شكل رقم (١١-١)

■

■

■

$$- \quad - \quad)$$

() (-

■

— — —

— — —

— — —

—

■ <http://www.oxfordjournals.org/doi/10.1093/oxfordjournals/ajph.a002525>

■

■

■

—

—

■

مستويات تنفيذ

الصيانة

والإصلاحات

المزعم تطبقها

-
-
-

:

()

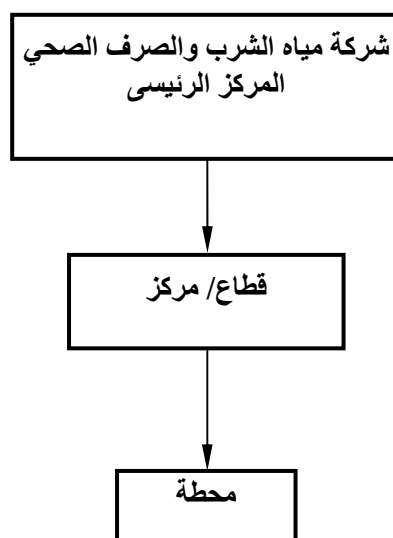
(-)

مستوى القطاع/ المركز

/

/

/



(-)

(Mechanical Equipment)

(Scrapers)

(Valves)

(Pumps)

(Moving Equipment)

Preventive Maintenance)

(Programs

.

Good Record)

(Keeping System

.

:

(Equipment Service Cards) ()

.

(Service Record Cards) ()

.

.

(Equipment Service Cards) ()

() :

/				
			Packing Gland Boxes	
			Bearings	
			(Alignment)	

(Service record cards) ()

() :

	) (	

.

.(- -)

(- -)

.

:

(Rotodynamic pumps)

-

(Positive displacement pump)

-

(Compact)

.

:

.

:(Centrifugal pump)

-

(-)

(2)

(1)

.()

/

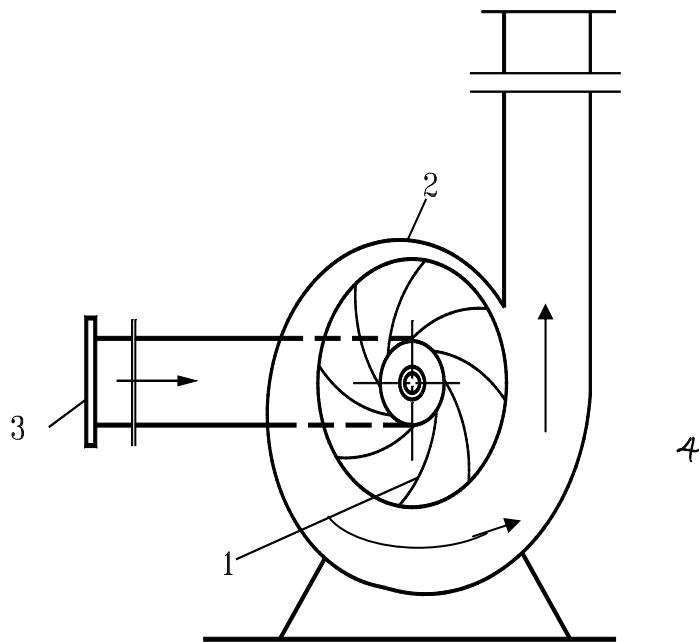
/

(4) (3)

(4)

.()

.



(-)

:(Axial flow pump)

-

(-)

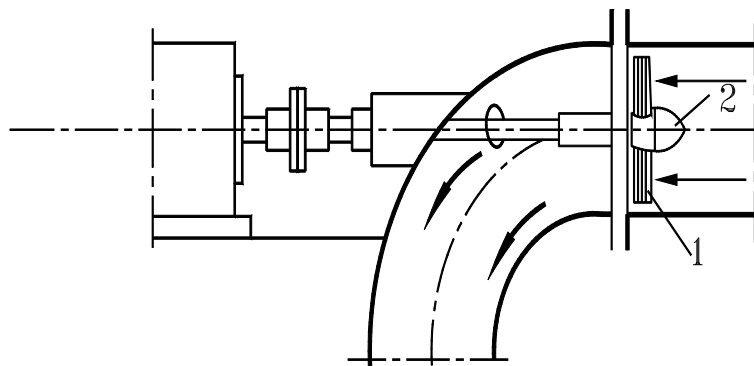
(2)

(1)

()

()

.

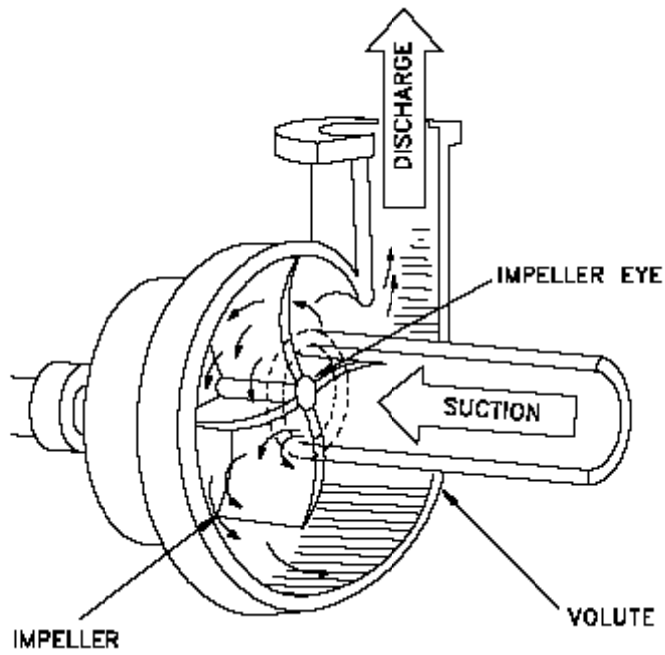


(-)

(Mixed Flow Pumps)

-

(/)



(-)

(Positive displacement pumps)

(Rigid)

(Piston)

.(Gears)

(Sliding Gate)

.

:

:

-

(-)

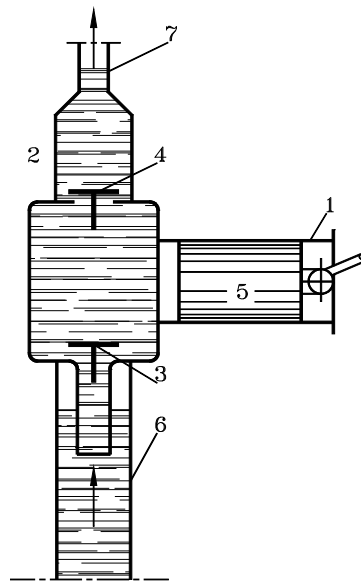
(Reciprocating-positive displacement pump)

(2)

(1)

- (3) (4) (5)
(6) (7)

(Pulsating)



(-)

:

(-)

(Rotary-positive displacement pump)

(1)

(2)

(P).

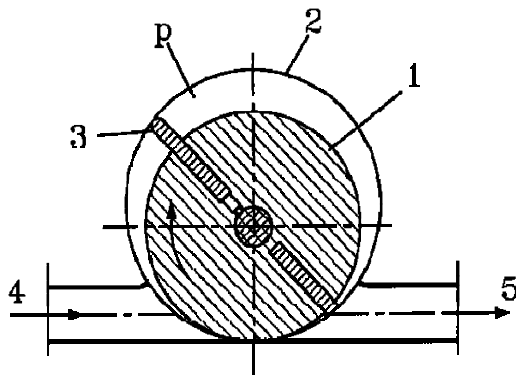
(3)

)

(

(4)

(5).



(-)

:

-

-

(-)

(-)

:

(/) (/) -
(/) (/) -

.

(Axial flow pump)

(Reciprocating pump)

.

(-)

.

:

.

*

-

-

.

-

-

*

.

-

*

.

:

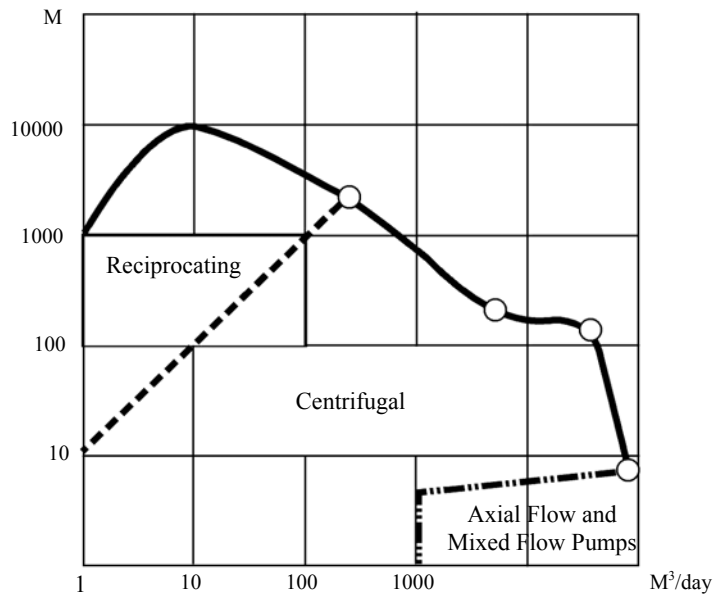
*

-

-

.

-



(-)

:

-

-

-

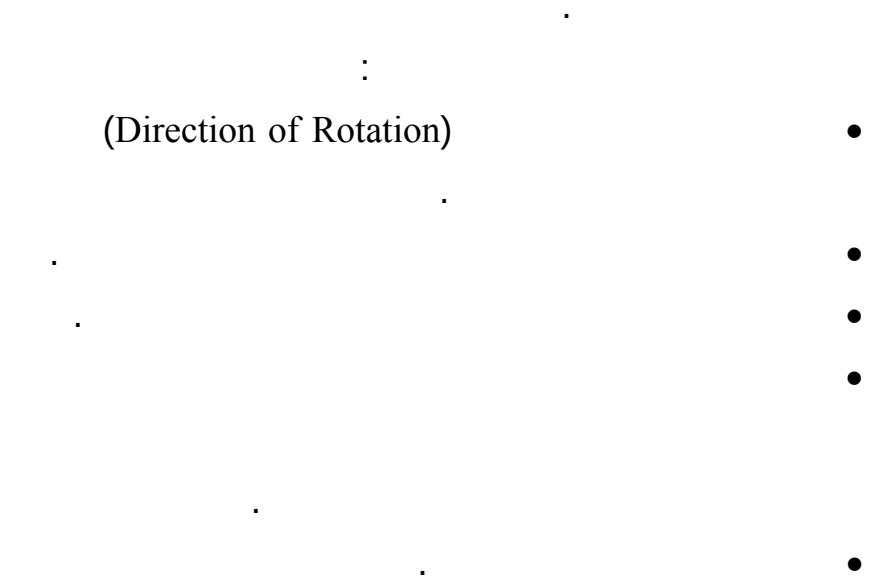
-

-

:

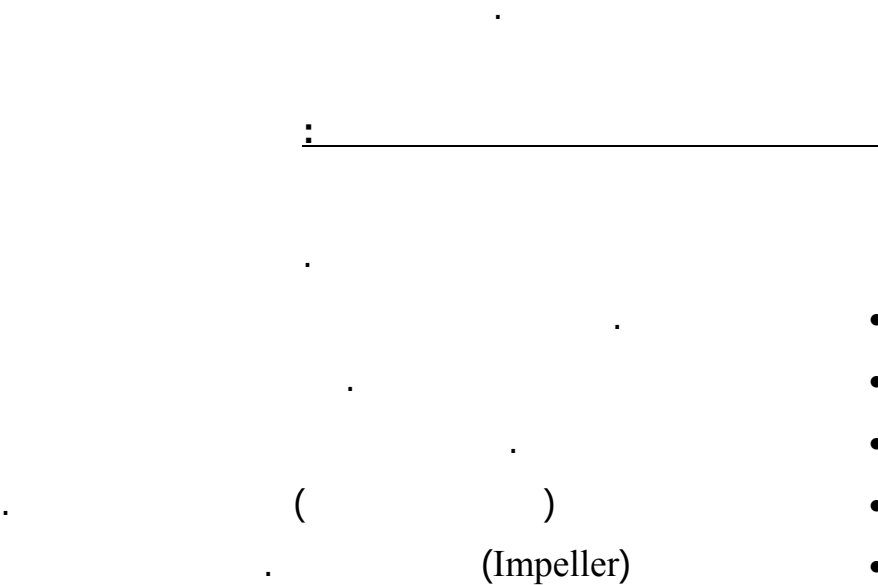
:

	.
(	)
	.
	.
	.
	(Shaft)
	(Flexible Coupling)
	(Belts)
Electric Current)	.
	(Characteristics
	.(Wiring)
Thermal) (	.
	(Unit
	.
	(Rotational Arrows)
Separate Water)	.
Vacuum Primer)	(Seal Units
	(Systems
	.
	(Discharge Valve)
.	.
)	.
(	
(	)



(Performance Curves)

(Design flows and Pressure)



●

8

■

■

■

■

▪ ()

8

•

•

• ()

• ()

▪ ()

▪ ()

.()

• ()

• ()

▪ ()

▪ ()

▪ ()

)

.(

■

:

•

.()

.()

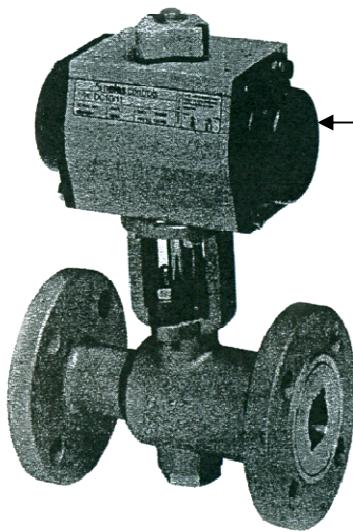
.()

•

•

:

- _____ :



(-)

المشغل الهوائي



(-)

- _____
/

.

Pneumatic Actuator : -

.

- _____

:

-

.

() -

.

.

-

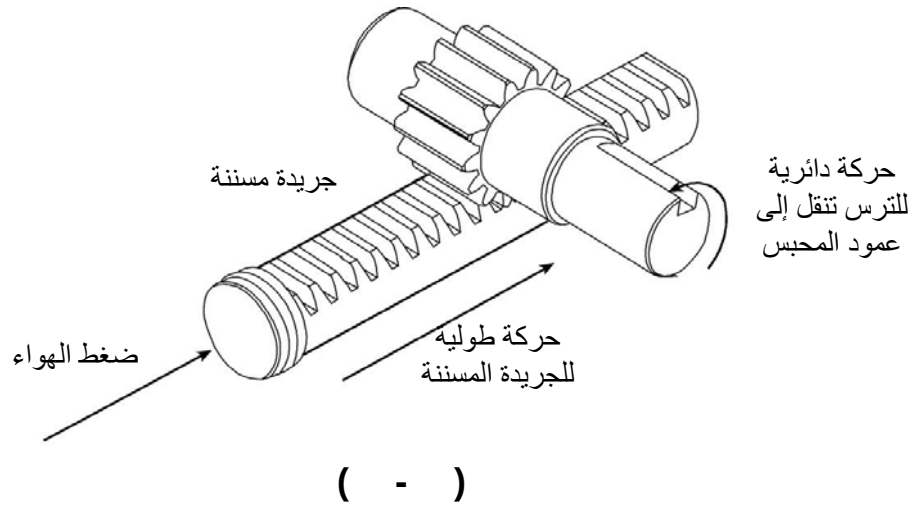
-

.

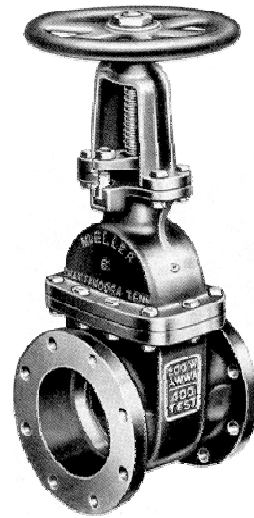
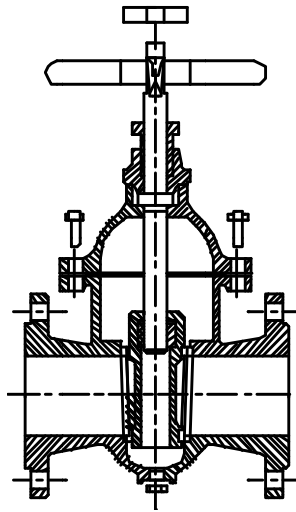
)

(

.



- (-)
- :
- () .
 - () .
 - () .
 - () .
 - () .
 - () .
 - () .
 - () .



(-)

(-)

:

()

()

()

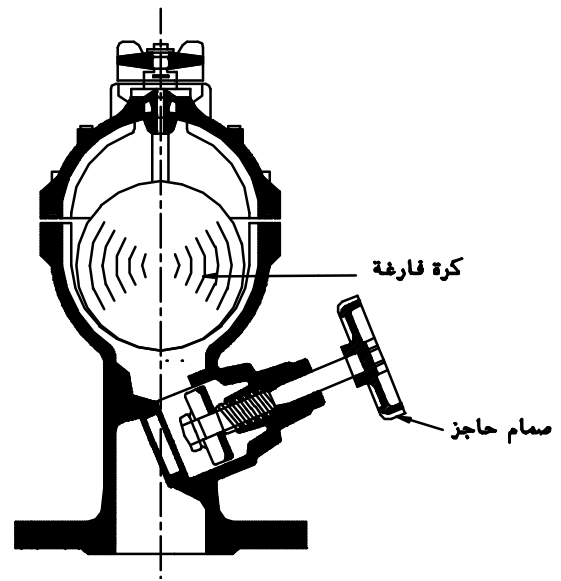
()

•

•

•

•



(-)

(-)

:

.()

.()



(-)

(-)

:

()

()

()

()

()

()

•

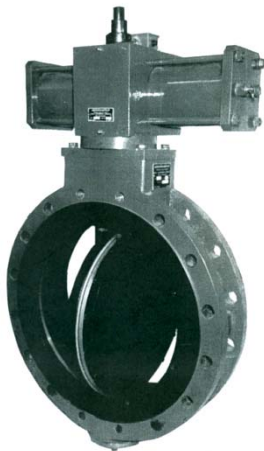
•

•

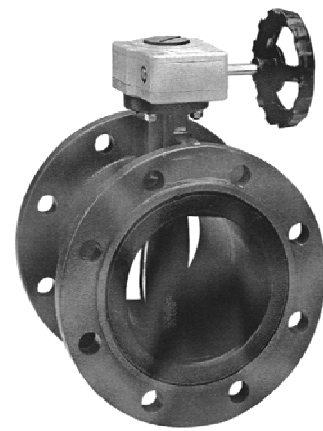
•

•

•



()



()

(-)

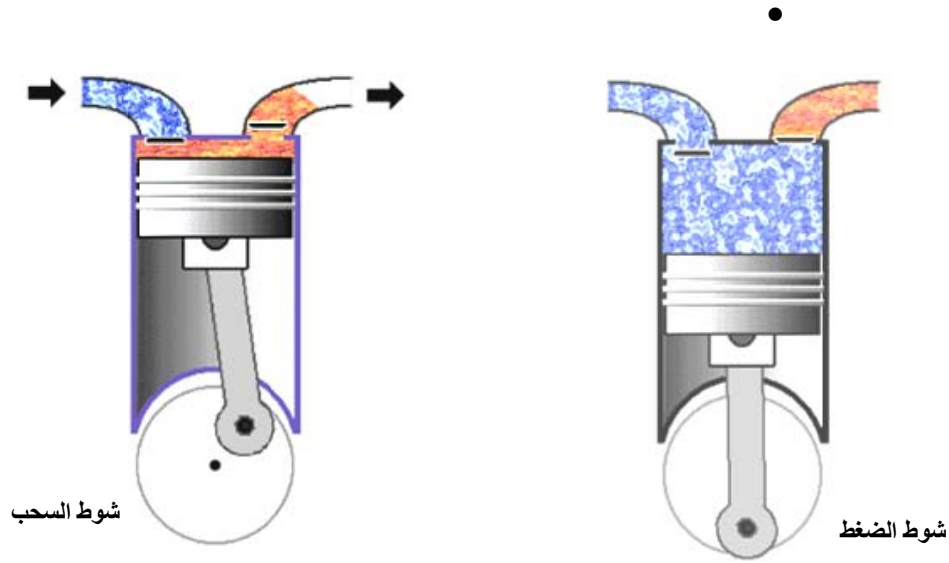
:

:

•

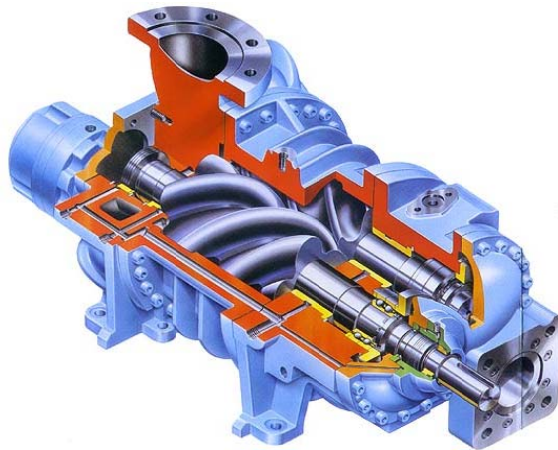
(-)

.



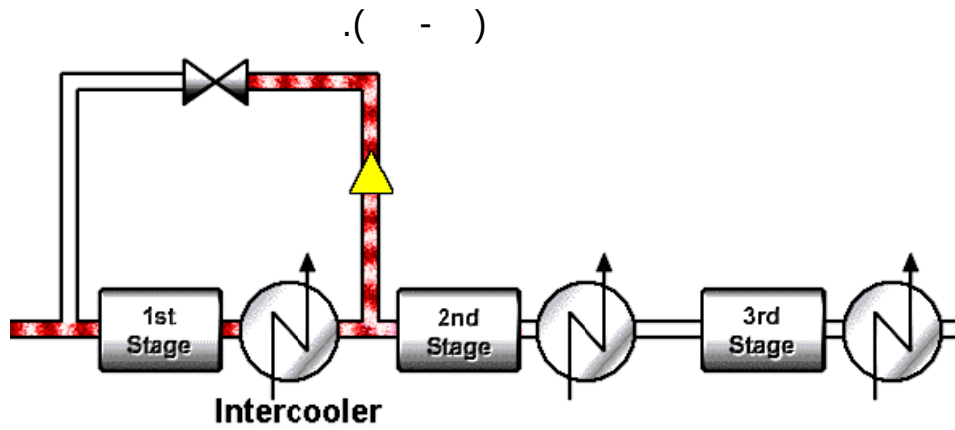
شكل رقم (١١-١٥)
ضاغط ترددي ذو المرحلة الواحدة

(Gear (Screws) ()
(-) Pump)



شكل رقم (١١-١٦)
ضاغط حلزوني

• :



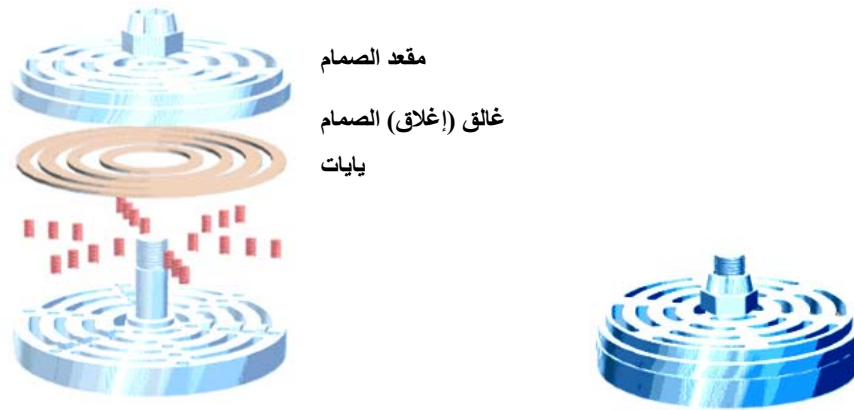
شكل رقم (١١-١٧)
ضاغط متعدد المراحل مع مبرد بعد المرحلة الاولى

- •

(Air End)

.

() () (-)



شكل رقم (١١-١٨)
مكونات محبس التفريغ

(Air Receiver).

)

(

•

•

•

•

•

:

•

•

•

•

•

•

•

•

:

(Electro Magnetic Flow

-

Meter)

(-)

Ultrasonic Flow Meter

-

(-)



شكل رقم (١١-١٩)
جهاز قياس التدفق (Electromagnetic)



شكل رقم (١١-٢٠)
جهاز قياس التدفق (Ultrasonic)

▪

(-)

(Pressure Logger)

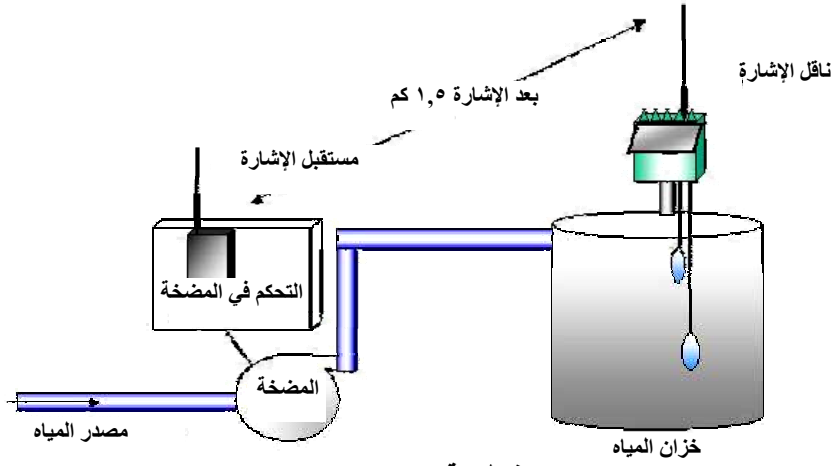
(USB)



شكل رقم (١١-٢١)
بعض أنواع عدادات قياس الضغط

(-)

()

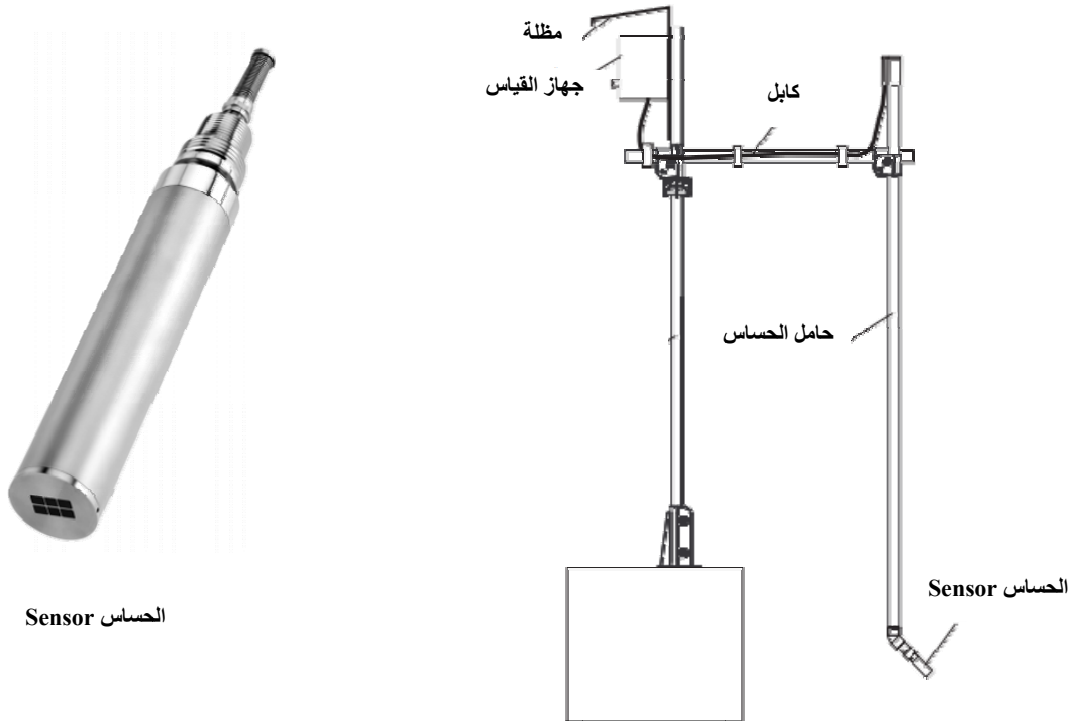


شكل رقم (١١-٢٢)
منظومة للتحكم في تشغيل مضخة باستخدام العوامات

(pH)

(-)

pH



شكل رقم (١١-٢٣)
حساس وشكل توضيحي لتركيب إحدى أنواع أجهزة قياس pH

()

.....

()

$$\begin{aligned}
 & \cdot \\
 & \cdot \\
 & : \\
 & = \quad) \quad - \\
 & \cdot (\\
 & - \\
 & \cdot (\quad) \\
 & = \quad) \quad - \\
 & \cdot (\\
 &) \\
 & \cdot (\\
 & (\quad / \quad)
 \end{aligned}$$

:

()

.

:

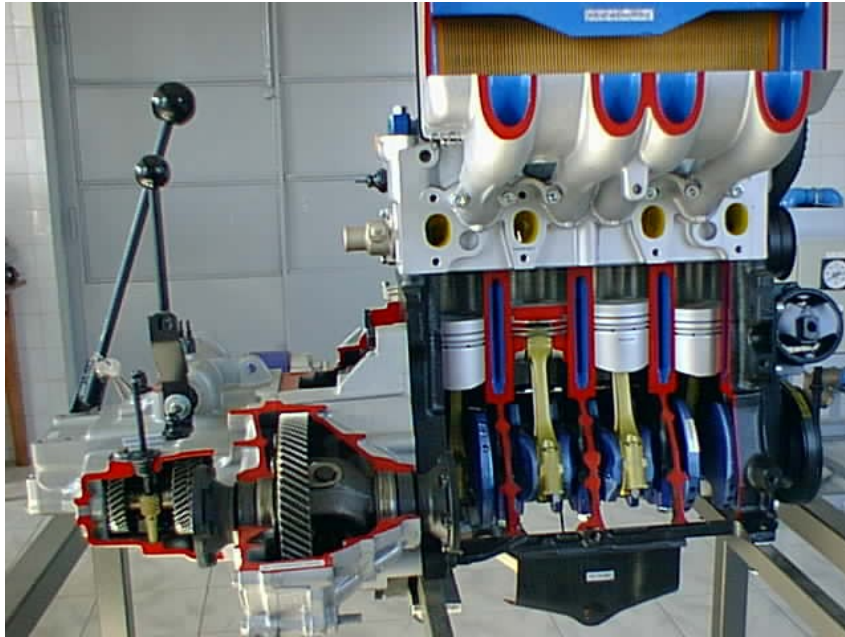
()

:

.

.

(-)



(-)

:

:

:

.

.

.

.

.

.

()

()

.

.

()

:

)

.(

:()

:

()

:

:

*

/

*

(A) "S"

*

.

"R"

*

*

.

.

.

"O"

.

.

."O"

:

.

.

.

.

.

.

(-)

:

.

.

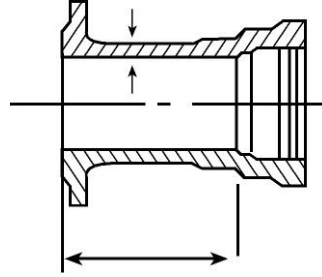
.

(-) " "

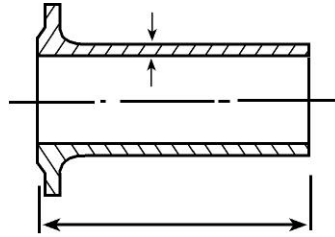
	(-)) (	
	▪ (Pres-Switch) ▪	
	% ▪	

- .
- :
-
-
-
-
-
-
-
-
- .(GRP)
-]
- [()
- ...

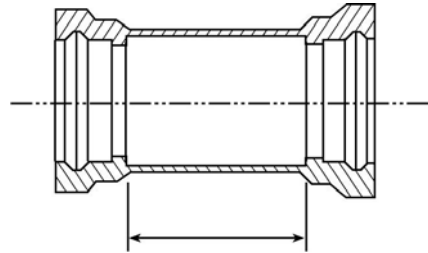
(-)



قطعة خاصة ذات رأس
وشقة بردة



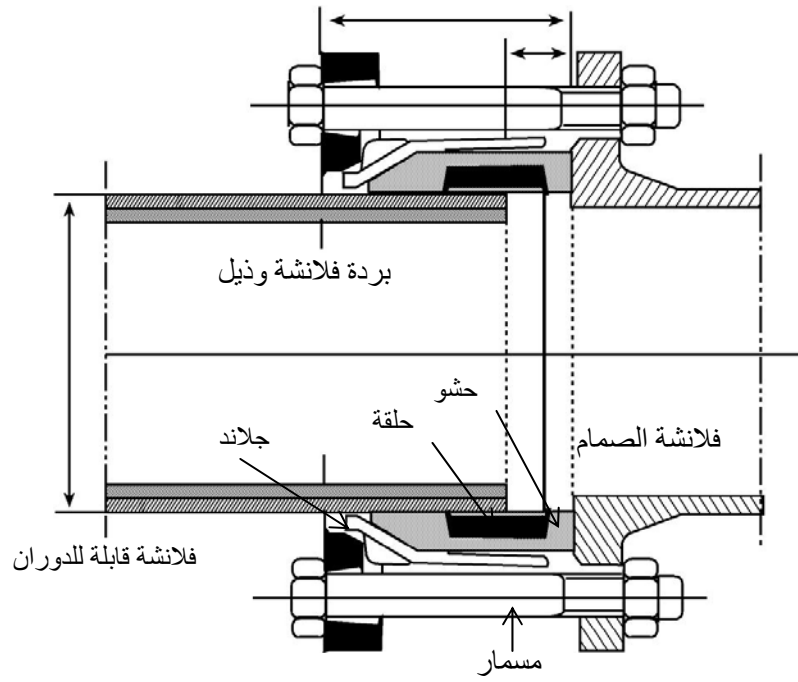
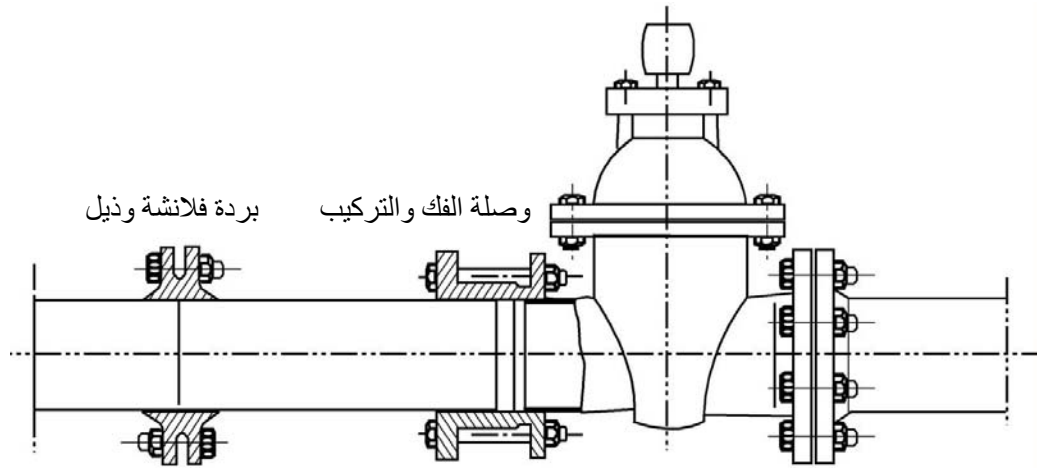
قطعة خاصة ذات ذيل
وشقة بردة



جلبة

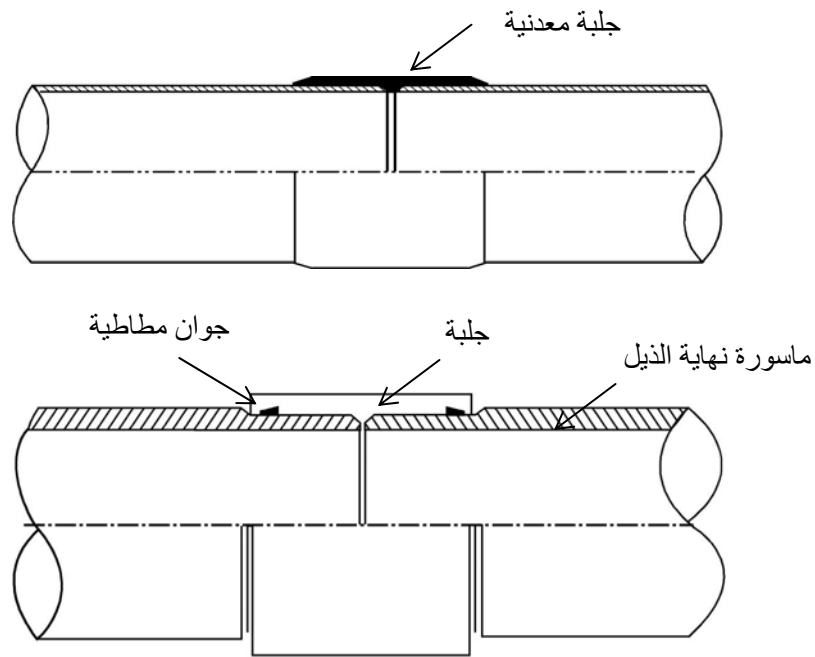
(-)

(-)



(-)

(-)



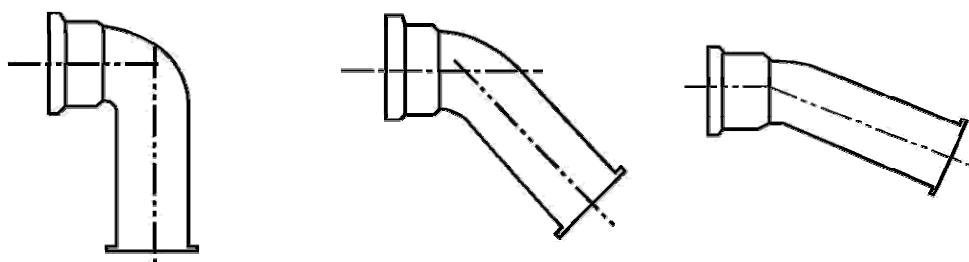
(-)

(GRP Pipe)

$$\frac{1}{4}$$

(-) .

$$\frac{1}{8}$$



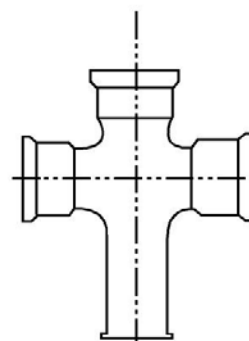
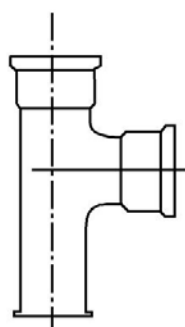
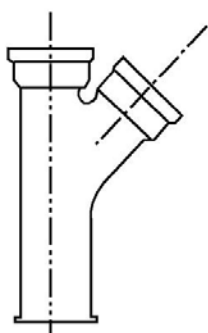
(-)

(+ T)

.(y)

.

(-)



(-)

(Y)

$(\frac{7}{12} Y)$

:

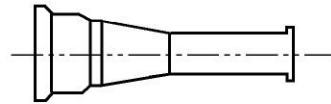
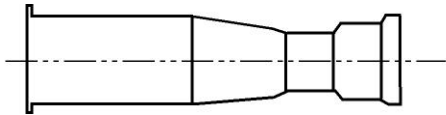
(

.

—

.

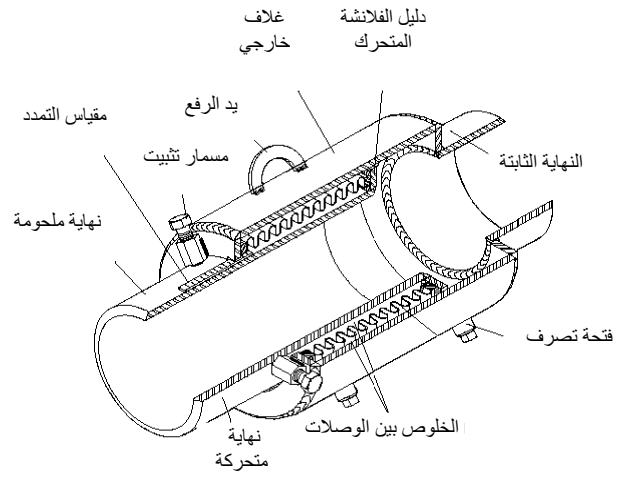
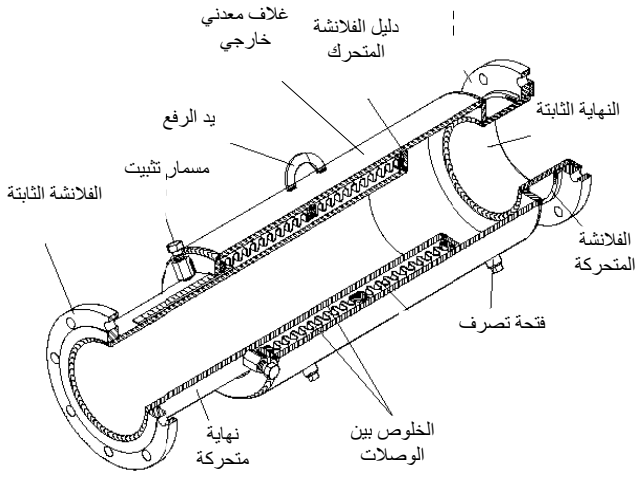
(-) .



(-)

.

(-) .



(-)

الفصل الثاني عشر

السلامة والأمان في الموقع

:()

:

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

.

.

:

)

.

.(

.()

.

.()

.

)

.

.(

.()

.

.

.()

.

.

.

.

8

■

●

8

•

■

•

■

•

■

■

●

■

•

■

•

■

•

■

1

■

1

1

1

•

1

■

■

•

*

1

*

*

•

•

•

*

■

*

*

■

*

■

*

■

*

■

*

■

*

*

■

*

■

*

■

•

—

.	.	-	
		-	
.		.)	
		" "	
		:	
.	.	-	
		-	
		-	
.			
.		-	
		:	
.			
.		-	
		-	
.		-	
		-	
.			

()

(% , %)

-

% ,

()

-

()

.

:

:

() .

.

.

.

() .

.

.

.

.

.

.

.

.

.

.

.

.

.

:

.

.

.

.

•

:

.

.

.

.

.

.

.

.

.

.

,

.

.

.

()

.

-

.

.

.

:

.

-

-

-

.

-

.

(-)

(-)

- -	•
- -	•
-	•
	•
	•
	•
-	•

■

1

■

1

•

■

—

1

1

—

1

—

•

()

—

■

—

1

■

—

)

.(

—

■

()

—

■

—

■

—

8

—

■

—

■

—

—

■

—

■

—

■

■

■

	-
.	-
.	-
-	-
	-
.	-
()	-
-	
.	
:	-
.	
:	
:	
)	-
.	-
.	-
.	
.	

.

-

-

.

.

-

.

-

.

-

.

-

.

-

.

-

.

-

.

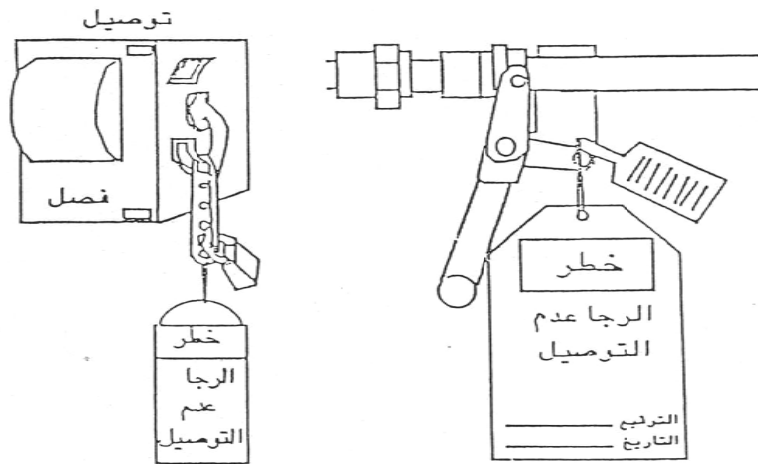
-

-

-

-

()



(-)

/

- :

- :

(-) .

.

- :
:

.

.

.

- :

- :

- .

- .

- -

-

.

-

- ()

-

.

.

-

-

.

-

.

-

.

	-
.	
-	-
	.
	-
.	
	-
...	
.	
	-
.	
	:
)	.
)	(
	(
	.
)	.
)	(
	(
	.
:	

-

.

-

.

-

.

-

(-) .

.

-

.

-

-

.

-

(-) .

(Short Circuits)

-

.

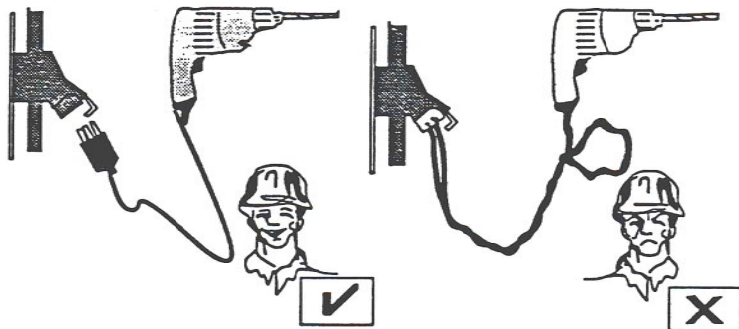
-

)

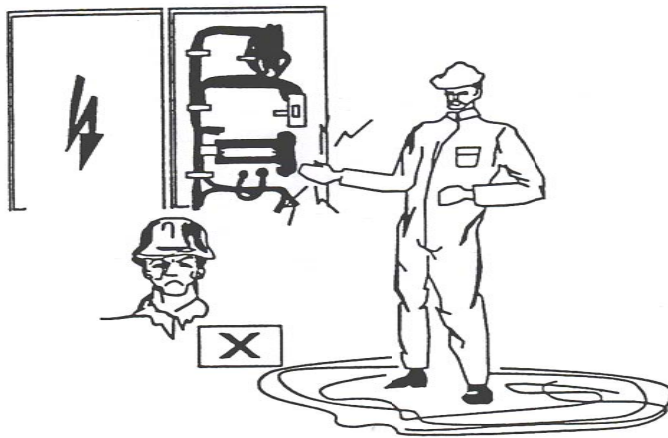
(-)

()

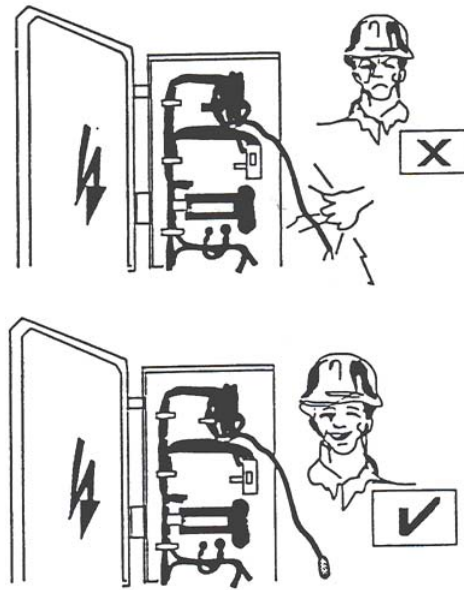
.



(-)



(-)



(-)

:

()

()

• ()

(Terminal boxes)

)

.(

)

(

:

-

-

-

-

-

:

.

.

.

:

.

.

.

.

:

.

.

.

.

.

.

.

(Test lamp)

■

■

■

■

■

8

.

—

"

11

—

!!

11

■

•

■

■

■

■

*

■

*

■

*

■

*

*

■

*

*

*

*

:

()

-

-

-

-

-

-

-

-

-

.

-

.

-

.

-

.

.

(-)

.

.

.



(-)

(-)

.

(-)

. - . - . - . -	. - . - . - . -	
. - . - . - . - . - . - . - . - . - . - . -	- . - . - . - . - . - . - . - . - . - . -	
. - . - . - . -	. - . - . - . -	

(-)

[illegible]

■

■

■

■

■

()

5

•

•

■

—

()

—

—

$$\cdot \left(\quad \right)$$

—

1

■ ()

—

()

—

—

$$\cdot \left(\quad \quad \quad \right)$$

—

-

)

("CPR" Cardiopulmonary Resuscitation

) .

."("

.

- ()

.

.

.

.

.

.

.

—

:

•

•

•

•

.

-

.

:

-

.

$$\cdot \left(\quad \right)$$

•

—

$$\cdot \left(\quad \right)$$

■

—

$$\cdot \left(\quad \right)$$

1

1

$$\cdot \left(\quad \quad \right)$$

—

■

■

■

1

الفصل الثالث عشر

الإجراءات الإدارية في مرافق المياه

()

:

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

·
:

.()

)
.(

·

)

(.....

.(-)

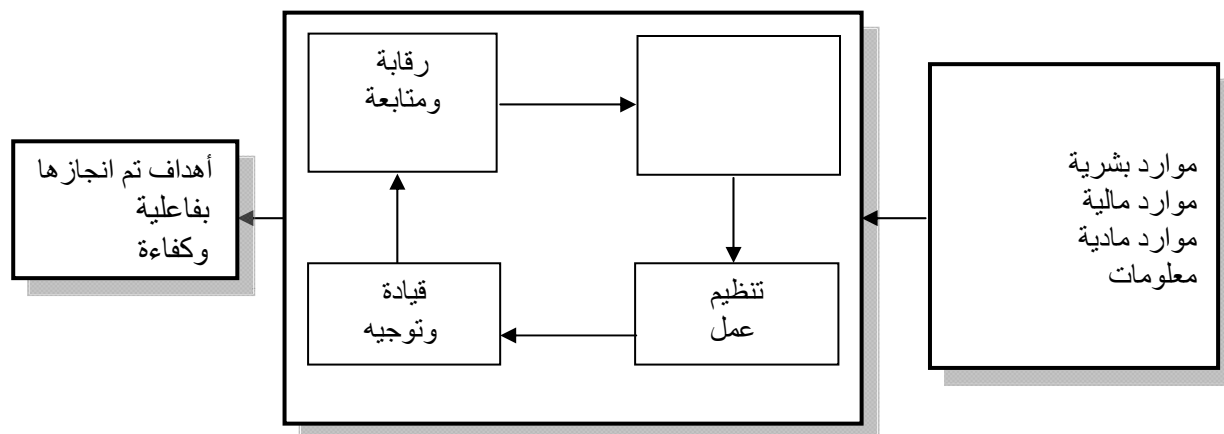
:

·

-

-

·



(-)

:

:

()

:()

.

.

:()

.

() ()

.

:

.

.

.

:

:

:

.....

:()

:

....

:()

...

:

-(Objectives) " "

-(Environment)

) -

-(

-

-()

(Products) (Functional)
 (Customers)
 (Geographic)

.

.

-

-

...

.

.

:

.

:

•

.

•

.

•

.()

•

.

:

•

•

•

•

•

:

١-

٢-

٣-

٤-

:

:

•

•

•

•

•

.

•

•

.

•

.

.

.

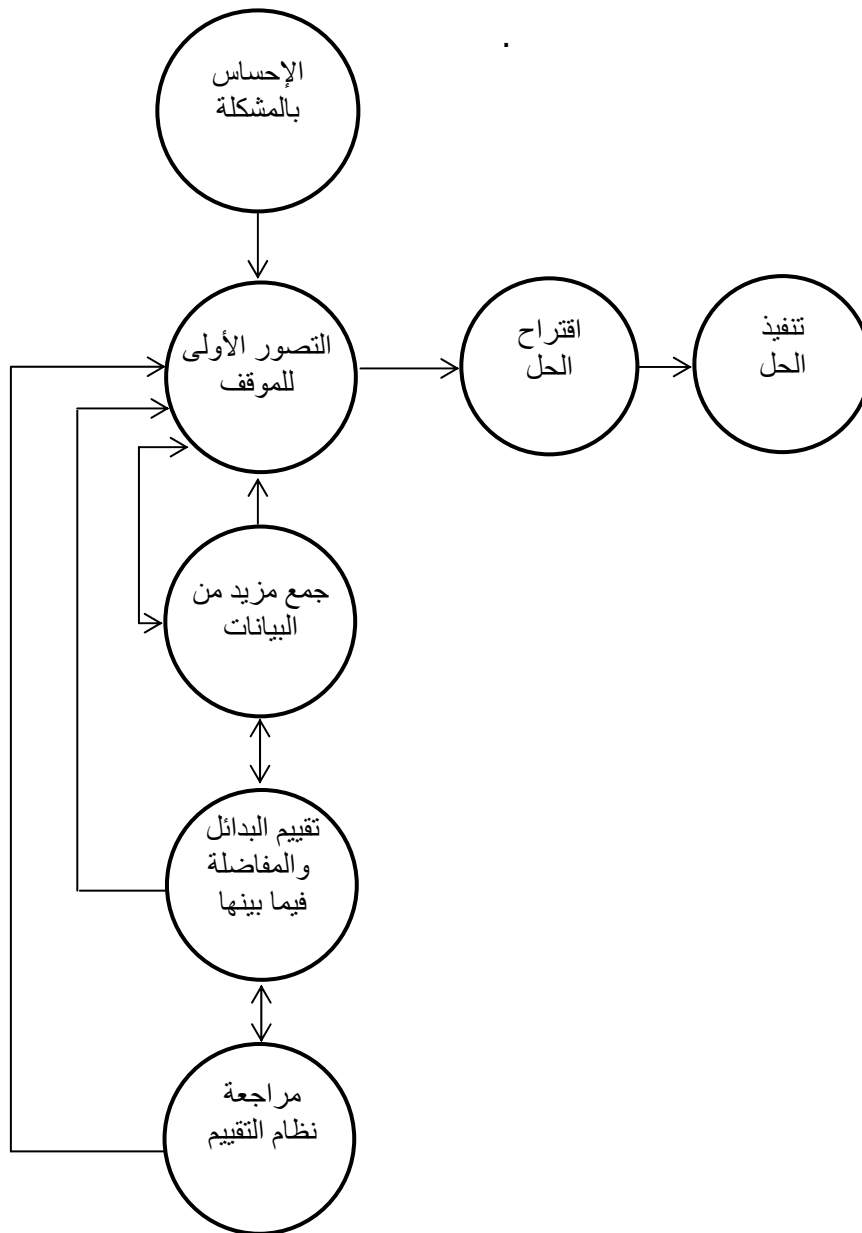
(-)

.

()

.

(Symptoms)



(-)

(%)

 () ()

.

:

*

.

*

.

*

.

.

(Independent Variables)

.

:

(-)

:

:

.

:

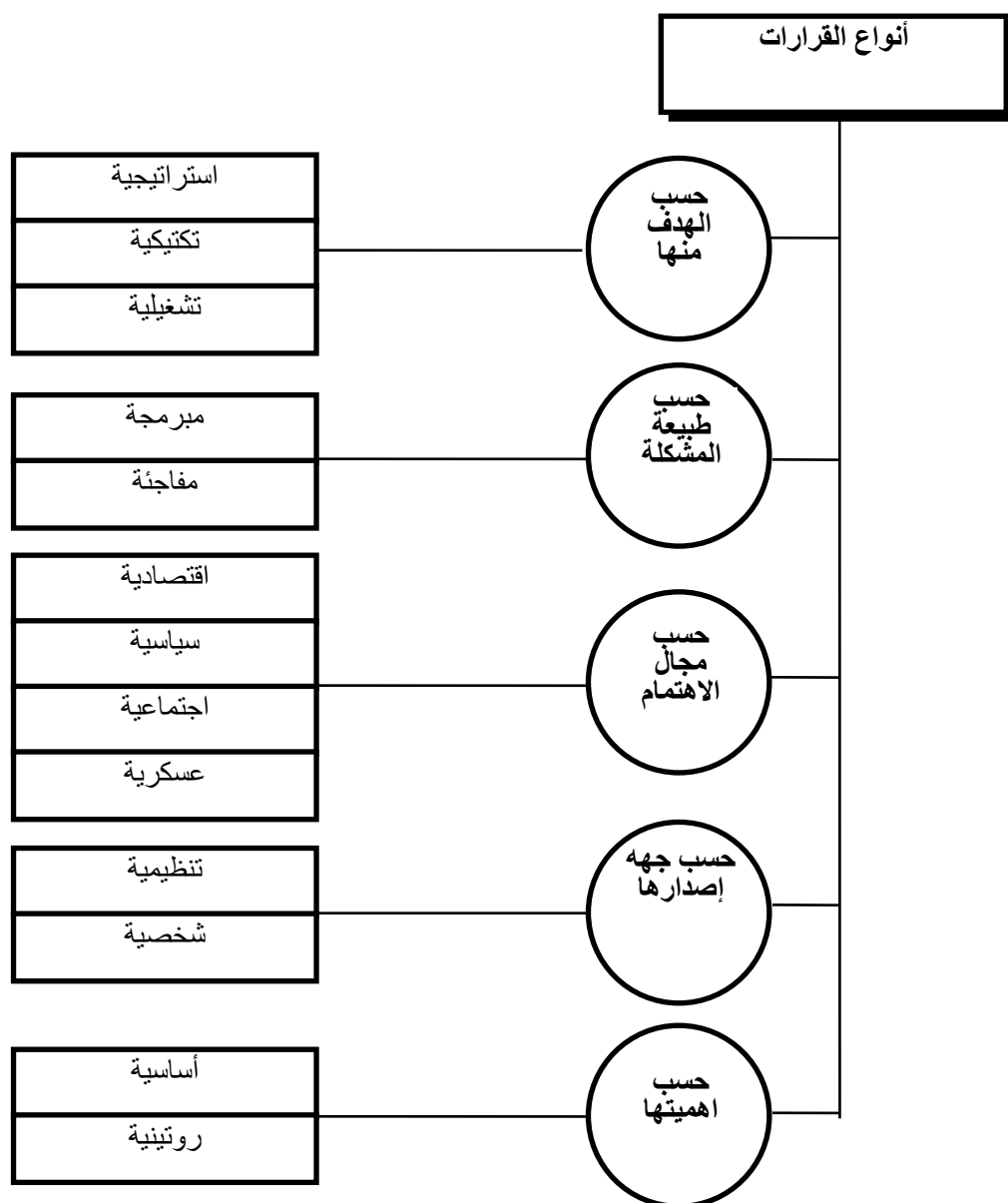
.

.

()

:

.



(-)

:

:

.

.

:

.

:

.

:

.

:

:

.

.

:

:

:

.

:

()

()

.

:

:

:

•

•

•

•

:

:

(Standard)

.

(Indicators)

.

:

:

:

.

:

.

:

..

:

.

:

.

.

.

.

.

.

.

.

.

.

:

.

-

-

.

-

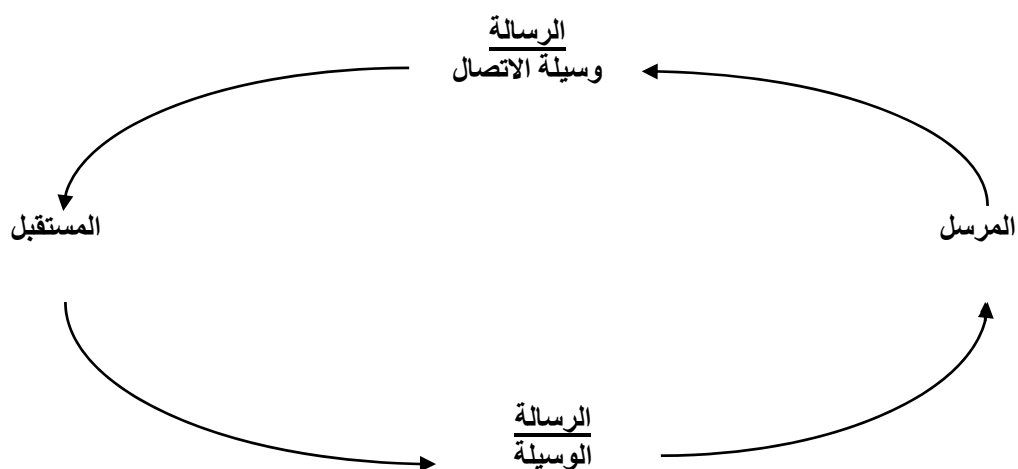
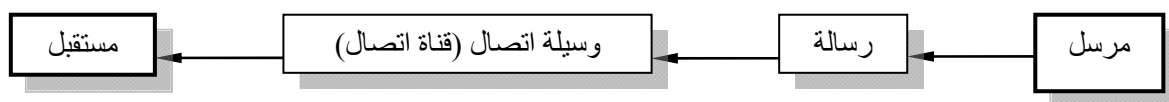
) -

- (.....).

-

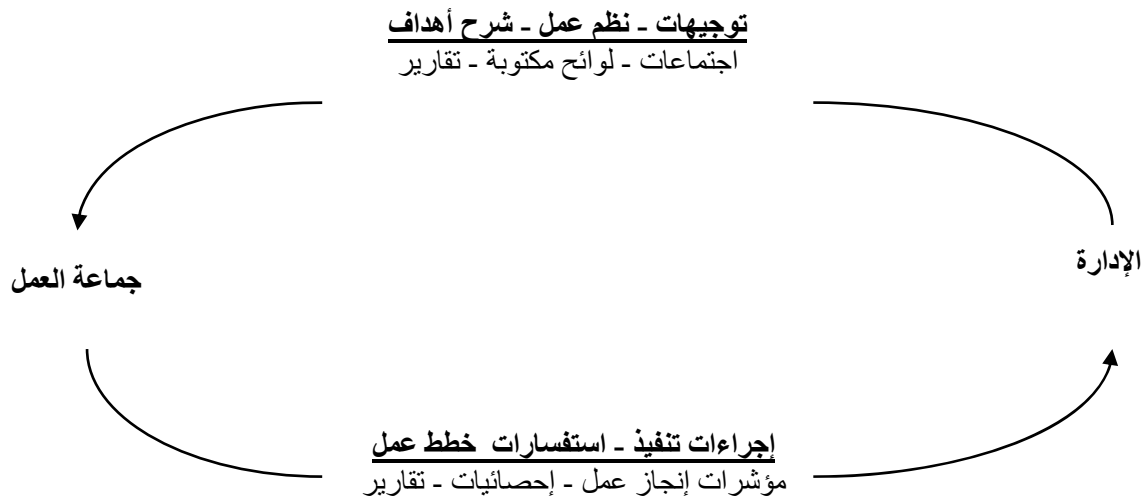
.

(-) .



(-)

(-) .



(-)

() ()

() (- -)

(-)

.

·
:

: _____

- -)
()

(

·

: _____

(Feed Back)

·()

: _____

·

:

)

-

(

-

·()

-

·

-

.

-

.

-

.

-

.

(-)

(-)

()		
- - -	-	

.		●
:		
	-	
.		
"	-	
"	-	
	:	
.	-	
.	-	
.	-	
.	-	
.	-	
:		●
:	-	
.		
.	-	
.	-	
.	-	

.

.

.

:

:

.

.

.

.

.

.

.

.

.

.

.

تحديد الاحتياجات التدريبية

.

.

...

.

.

:

- .
- .
- .
- .
- .
- .
- .
- .
- .
- .

(-)

(-)

طرق وأساليب
التدريب

-
-
-
-
-
-
-
-
-
-

.

:	:	:	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•
.	.	.	•

أ- عناصر خطة التشغيل

ب- العناصر الأساسية لخطة الصيانة

:

.

Record Keeping and Using Technical Reports

:

.()

.()

-

-

-

-

-

.

.

.(Hummer Drill)

(..... -)

.

:

.١

-

-

-

-

-

-

.٢

-

-

-

-

-

:

:

.

•

•	/	.
•	(	- -)
•		
•		.
•		.
•		.
•		.
•		.
•		.

() /
()

:

.(Assets)

-

-

.(Liabilities)

-(Owners Equity)

:

	+	=	
--	---	---	--

()

.

.

.

:

- () .

-

-

:

التكلفة: هي نفقات لم يتم الانتفاع بها بعد.
 المصروف: هي نفقات تم استنفادها أو تم الانتفاع بها.
 الخسارة: هي نفقات تم استنفادها دون الانتفاع بها.

.

إجمالي الإيرادات للمبيعات = عدد الوحدات المباعة × سعر بيع الوحدة
 = كمية المياه المباعة (م^٣) × سعر المتر

.

**الربح أو الخسارة
(الدخل)**

•

*

■

*

1

*

1

■ ■

	-	=
--	---	---

	-	=
--	---	---

)

(

■

8

(-)

- .

(-)

()

			()	
(%)	(%)	()	()	
			،	:
				:
،	،	،	،	
،	،	،	،	
،	،	،	،	
،	،	،	،	
،	،	،	،	
،	،	،	،	
،	،	،	،	
،	،	،	،	
،		،		: *
،		،		: **
		،		

*() .

**

الملاحق

()

()

:

.

()

.

()

.

()

.

.

.

.

.

(-)

.

(-)

	-
	-
:	
:	
:	
:	-
:	
:	
:	
:	
:	-

:

.

-

.

-

-

-

.

.

:

/ /

(-)

.

(-)

.

()

=====

-:_____

-

.

-

-

-

.

/ /

-

.

-

=====

-:

.

-:

.

-:

.

() ()

-:

.

=====

.

_____ / / :

.. /

=====

=====

: :

		1
		2
		3
1 (NTU)		4
6.5 – 8.5		5

: :

(/)		
1000	120°	1
500	as CaCO ₃	2
350	as CaCO ₃	3
150	as CaCO ₃	4
250	SO ₄	5
250	Cl	6
0.3	Fe	7
0.4	Mn	8
2.0	Cu	9

3.0	Zn	10
200	Na	11
0.2	Al	12

:

:

()

/)		
(		
0.01	Pb	1
0.001	Hg	2
0.01	As	3
0.05	CN	4
0.003	Cd	5
0.01	Se	6
0.05	Cr	7
0.5	NH ₃	8
45	as (NO ₃)	9
0.2	as (NO ₂)	10
0.8	F	11
0.02	Sb	12
0.7	Ba	13
0.5	B	14
0.02	Ni	15
0.07	Mo	16

() :

(/)		
0.02	Alachlor	1
0.01	Aldicarb	2
0.00003	Aldrin and dieldrin	3
0.002	Atrazine	4
0.03	Bentazone	5
0.007	Carbofuran	6
0.0002	Chlordane	7
0.03	Chlorotoluron	8
0.001	D.D.T . .	9
0.001	3- 2,1- 1,2 Dibromo 3- chloropropane (DBCP)	10
0.03	2,4- Dichlorophenoxyacetic acid 4,2 (2,4 D)	11
0.02	1,2 - Dichloropropane (1,2- 2,1 DCP)	12
0.02	1,3 - Dichloropropene (1,3- 3,1 DCP)	13
0.001	Hexachlorobenzene	14
0.009	Isoproturon	15
0.002	Lindane	16
0.002	Methylchlorophenoxyacetic acid (MCPA)	17
0.02	Methoxychlor	18
0.01	Metolachlor	19
0.006	Molinate	20
0.02	Pendimethalin	21

(/)		
0.009	Pentachlorophenol	22
0.02	Permethrin	23
0.02	Propanil	24
0.3	Pyriproxyfen	25
0.002	Simazine	26
0.02	Trifluralin	27
0.09	2,4 DB , 4,2	28
0.01	2,4 Dichloroprop - 4,2	29
0.009	Fenoprop	30
0.01	Mecoprop	31
0.009	2,4.5 T 5,4,2 -	32
3	Monochloramine	33
5	Chlorine	34
0.01	Bromate	35
0.7	Chlorite	36
0.2	2,4,6 Trichlorophenol 2,4,6 -	37
0.1	Trihalomethanes	38
0.05	Dichloroacetate	39
0.1	Trichloroacetate	40
0.01	Trichloroacetaldehyde	41
0.02	Dichloroacetonitrile	42
0.07	Dibromoacetonitrile	43
0.001	Trichloroacetonitrile	44
0.004	Carbon tetrachloride	45
0.02	Dichloromethane	46
0.03	1,2 Dichloroethane 2,1	47

(/)		
0.07	1.1.1 Trichloroethane 1,1,1	48
0.0003	Chloride Vinyl	49
0.03	1.1 Dichloroethene 1,1	50
0.05	1.2 Dichloroethene 2,1	51
0.04	Tetrachloroethene	52
0.7	Toluene	53
0.01	Benzene	54
0.0007	Benzo[a]pyrene) (	55
0.3	Monochlorobenzene	56
1	1,2 Dichlorobenzene 2,1	57
0.3	1,4 Dichlorobenzene 1,4	58
0.02	Trichlorobenzenes (Total)	59
0.08	Di (2-) (2- ethylehexyle)adipate	60
0.008	Di (2 -ethylehexyle) (2- phthalate	61
0.0005	Acrylamide	62
0.0004	Epichlorohydrin	63
0.0006	Hexachlorobutadiene	64
0.6	Edetic acid (EDTA)	65
0.2	Triacetic Nitril	66
0.0006	Endrin	67
0.7	Chlorate	68
0.1	Bromoform	69
0.3	Chloroform	70
0.01	Chloralhydrate	71

(/)		
0.006	Dimethoate	72
0.9	Formaldehyde	73
0.007	Cyanogen Chloride	74
0.002	Trtibusyltin Oxide	75
0.002	Phenol	76
0.005	Di- and Trichloramine	77
0.5	Xylenes	78
0.3	Ethylbenzene	79
0.02	Styrene	80
0.06	Bromodichloromethane	81
0.02	Trichloroethene	82

/	•	poured plate method	
/	•		
%	•	" " MF " MPN " .	TOTAL COLIFORM
	•		" "
	•		
/	•		•
BLUE			•
GRAEEN ALGAE	•		

⋮ ⋮

/ 0	(A)	
/ - 1	(B)	

.

.

.

//

/

.

- :

()

.

- : ()

.

- :

.

- :

.

//

/

()

()

■ ■ ■

■ ■ ■

—

•

/

—

8

—

■

—

2

—

■

—

2

—

•

:

:

(/)	
.	
,	
,	
,	
,	

(/)	
,	
,	
,	
,	
,	
,	
,	
,	
,	
,	

()

()

:

:

()

-

/

/

.

.

:

()

.

:

:

:

-

.

-

.

-

-

-

.

.

.

,

-

.

:

:

:

/

.

: :

(Grab

.Sampler)

: :

.(Grab Sampler)

.

:

.

.

:

:

.

-

-

.

-

.

⋮

.

.

(١) عينات مياه الشبكة:

أماكن اخذ العينات	الكلور المتبقي ملجم /لتر	عكازه المياه بوحداث N.T.U	العدد الاحتمالي للمجموعة القولونية فى ١٠٠ سم	الفحص الميكروسكوبي

٢- محطة المياه :الكلور المتبقي من طرد المحطة (.....) ملجم/لتر

أماكن اخذ العينات	العدد الاحتمالي للمجموعة القولونية فى ١٠٠ سم	البكتيريا العادية فى ١ سم	ملاحظات
<u>الخزانات الأرضية:</u> خزان رقم/ ١ خزان رقم/ ٢ خزان رقم/ ٣ خزان رقم/ ٤ <u>خروج المرشحات:</u> مرشح رقم/ مرشح رقم / مرشح رقم/ 			
العدد الاحتمالي للمجموعة القولونية فى ١٠٠ سم			
حنفية طرد المحطة			

مشترف العمل كيمانى / رئيس المعمل مهندس/ رئيس المحطة مهندس/ رئيس قطاع المياه

()

./ /

()

-

()

)

.(

()

-

.

/

.

/

.

/

)

.(

/

-

,

/

%

,

/

%

,

/

-

.

:

-

:

.

-

(%)

%

.

:

.

:

.

/

-

-

:

$$\frac{100}{\text{و}} \times \text{النسبة المئوية} = \text{و}$$

:

=

=

/

□

□

(-)

■

■

⋮

■

 $(\quad)$

.

.

:

النسبة المئوية = و × $\frac{100}{و} \times \frac{100}{٢٥}$

=

=

/

,

,

(/)

.

,

(,)

(/)

,

:

%

.

(x)

:_____ / /

%)

()

.(

:

()

()

()

()

()

)

,

.()

()

)

" , - ,

• ,

"

- ,

,

,

•

: _____ / /

()

()

•

,

- ١
- ٢
- ٣

(/) %
()
()

()
()

,

/

لسنة ٢٠٠٤

-

)

(

.

:

-

/

.

)

/

.(

/

.

% ,	-
%	-
% ,	-
% ,	-
	-
% ,	-
% ,	-
% ,	-

٣- الخواص الطبيعية
والكيميائية

.

-

/

.

/

$$\frac{1}{2}$$

.

//

.

//

.

//

.

-

.

()

()

Glossary

Acid Rains :

.

Appropriative :

Artisian :

.

Cistern :

()

.

Contamination :

.

Cross Connection :

Detention Time :

.

$$\left(\frac{\left(\frac{\text{Volume}}{\text{Flow Rate}} \right) \left(\frac{\text{Flow Rate}}{\text{Volume}} \right)}{\text{Flow Rate}} \right) = \left(\frac{\text{Volume}}{\text{Flow Rate}} \right)$$

Direct Run off :

.

Drawdown :

.

.

.

.

.

Epidemiology :

)

(

.

Evaporation :

() .

Evapotranspiration :

.

.

.

Geological Log :

)

.

Hydrologic Cycle :

Impermeability :

Infiltration :

Microorganisms :

Non Potable :

Palatable :

.

Pathogenic Organisms :

— —)

() (

.

Percolation :

.

Pollution :

)

.

(

Potable Water :

.

Precipitation :

.

.

.()

.

Prescriptive :

.

()

Raw Water

:

·
·

Riparian

:

·

Safe Water

:

·

Safe Yield

:

· ()

Sanitary Survey

:

·

Sewage

:

·

Short Circuiting

:

.

Topography

:

.

Transpiration

:

.

Tri halo methane

:

()

.

.

Turbidity

:

.

Turbidity Units

:

()

NTU

JTU

.

Wastewater :

)

(

.

.

Water Shed :

.

Zone of Aeration :

.

Zone of Saturation :

.

Adsorption :

.

Aeration :

.

Aerobic :

.

Algae :

.

Algal Bloom

:

.

Aliphatic Hydroxy Acids

:

.

Anaerobic

:

.()

Anion

:

()

.()

Biochemical Oxygen Demand (BOD)

:

.

BOD

Cathodic Protection

:

()

.

()

Cation

()

.(+)

Coliform

()

()

.

.

Colloids

()

.

Complete Treatment

.

.

Conductivity

.

()

Decay

()

()

.

Density

$$\frac{\text{Density}}{(\text{ }^\circ \text{C})} = \frac{\text{Density}}{(\text{ }^\circ \text{C})}$$

Detention Time

$$\frac{\text{Detention Time}}{(\text{ }^\circ \text{C})} = \frac{\text{Detention Time}}{(\text{ }^\circ \text{C})}$$

Diatom

$$\frac{\text{Diatom}}{(\text{ }^\circ \text{C})} = \frac{\text{Diatom}}{(\text{ }^\circ \text{C})}$$

Electrolite

.

Eutrophic

.

Flushing

.

Head

.

Inorganic

.

.

Littoral Zone

.

.

.

.

Milligram per liter

(/)

.

Nutrient

.

.

Organic

)

.(

Oxidation

.

PH

()

$$Ph = \log 1/h \quad 1/h = ph$$

. : ()

- . .

Potable water

.

Precipitate

()

.

.

Reaeration

.

.

.

Reagent

.

Secchi disc

.

Septic

.

Reduction

()

()

Sequestration

()

()

.()

Sewage (Wastewater)

()

.

Stratification ()
()

Thermal Stratification

Trihalomethane ()
()

Alkalinity

Anionic Polymer

Apparent Color

Batch Process

Buffer

()

.

Cationic polymer

.()

Coagulants

()

.

Coagulation

()

.

Color

()

.

Composite Sample

()

.

.

Continuous Sample

()

.

Disinfection By-product

()

.

Diversion

.

Floc

.

Flocculation

.

Grab Sample

()

.

Head Loss

.()

Jar Test

()

Laundering Weir

V

.()

Molecular Weight

.()

Particle Count

.

Raw Water

()

.

.

.

.

Sludge

.

Specific Gravity

o

.

.

.

.

Supernatant

.

Total Organic Carbon

.

True Color

.

Whatman no. 40

Turbidity meter

.

Weir

Clarifier

Complete Treatment

Dewater

Direct filtration

Effluent

Influent

Surface Loading

Over Flow

$$\frac{Q}{A} = \frac{Q}{\pi D^2 / 4} =$$

Absorption

)

.(

Activated Carbon

()

.

Back Washing

.

Air Binding

Base Metal

Conventional Filtration

Particulate

Permeability

Pare

sensitivity ()

Bacteria

Breakpoint Chlorination

.

Catalyst

)

.(

Chloramines

.

Chlorination

.()

Chlorine Demand

()

pH ,

.

Residual Chlorine

()

.

Chlorine Requirement

.

.

DPD

.

Disinfection

.

()

()

(Unit Conversion)

Standard Prefixes			
Prefix used in code	Prefix for written unit	Multiplier	Comments
da-	deka-	10	
h-	hecto-	10 ²	
k-	kilo-	10 ³	
M-	mega-	10 ⁶	
G-	giga-	10 ⁹	
T-	tera-	10 ¹²	
d-	deci-	10 ⁻¹	
c-	centi-	10 ⁻²	
m-	milli-	10 ⁻³	
mu-	micro-	10 ⁻⁶	
n-	nano-	10 ⁻⁹	
p-	pico-	10 ⁻¹²	
f-	femto-	10 ⁻¹⁵	

IMPERIAL

Length	Area	Capacity	Weight
1 mile = 1760 yards 1 mile = 8 furlong 1 furlong = 10 chains 1 chain = 4 rods 1 rod = 5 1/2 yards 1 yard = 3 feet 1 foot = 12 inches	1 sq. mile = 640 acres 1 acre = 4840 sq. yard 1 sq. yard = 9 sq. feet 1 sq. foot = 144 sq. inches	1 gal. = 4 quarts 1 quart = 2 pints 1 pint = 4 gills 1 pint = 34.6774 inches ³ 1 gill = 5 fl. oz. 1 fl. oz. = 8 fl. drachms 1 US gal = 0.8327 gal 1 US pint = 0.8327 pint 1 US pint = 16 fl. oz. 1 yard ³ = 27 feet ³ 1 foot ³ = 1728 inches ³	1 ton = 20 cwt 1 ton = 2240 lb. 1 ton = 1.12 US ton 1 cwt = 4 quarters 1 quarter = 2 stone. 1 stone = 14 lb. 1 lb. = 16 oz. 1 oz. = 16 drams 1 oz. = 437.5 grains 1 US ton = 2000 lb.

METRIC

Length	Area	Capacity	Weight
1 km = 10 hm 1 km = 1000 m 1 hm = 100 m 1 m = 10 dm 1 dm = 10 cm 1 cm = 10 mm	1 km ² = 100 hectares 1 hectare = 100 ares 1 are = 100 m ² 1 m ² = 100 dm ² 1 dm ² = 100 cm ² 1 cm ² = 100 mm ²	1 m ³ = 1000 litres 1 litre = 1 dm ³ 1 litre = 1000 cc 1 litre = 1000 ml	1 tonne = 1000 kg 1 kg = 1000 g 1 g = 1000 mg

IMPERIAL to METRIC

Length	Area	Capacity	Weight
1 mile = 1.609 km 1 yard = 0.9144 m 1 foot = 0.3048 m 1 inch = 25.4 mm	1 sq. mile = 2.59 km ² 1 acre = 0.4047 hectares 1 acre = 4046.86 m ² 1 sq. yard = 0.8361 m ² 1 sq. foot = 0.0929 m ² 1 sq. inch = 645.16 mm ²	1 gallon = 4.5461 litres 1 US gallon = 3.785 litres 1 pint = 0.5683 litres 1 cu. inch = 16.3871 cm ³	1 ton = 1.016 tonnes 1 lb. = 0.4536 kg 1 oz. = 28.3495 g 1 US ton = 0.9072 tonnes

METRIC to IMPERIAL

Length	Area	Capacity	Weight
1 km = 0.6214 miles	1 km ² = 0.3861 mile ²	1 litre = 0.22 gal.	1 tonne = 0.9842 ton
1 m = 1.0936 yards	1 km ² = 247.105 acres	1 litre = 0.2642 US gal.	1 tonne = 1.1023 US ton
1 m = 3.2808 feet	1 hectares = 2.4711 acres	1 litre = 1.7598 pint	1 kg = 2.2046 lb.
1 mm = 0.0394 inches	1 m ² = 10.7639 feet ²	1 m ³ = 219.969 gal.	1 kg = 35.274 oz.
	1 mm ² = 0.0016 inches ²	1 m ³ = 35.3147 feet ³	

TEMPERATURE

Deg. C to deg. F	Deg. F to deg. C
deg. C x 9/5 + 32 = deg. F	(deg. F - 32) x 5/9 = deg. C

CONVERSION TABLE OF THE VARIOUS UNITS USED IN SCIENCE, ENGINEERING AND INDUSTRY (alphabetically arranged)

Multiply	By	To obtain
acres	43560	square feet
	4046.85	square meters
	4840	square yards
amperes	0.1	abamperes
ampere-hour	0.037 311 7	faraday
	3600	coulomb
ampere turns	1.2566	gilberts (magneto motive force)
angstroms	10^{-8}	centimeters
	0.0001	microns
	10^{-10}	meters
atmospheres	76	centimeters of mercury
	760	torts (mms of mercury)
	29.921	inches of mercury
	33.8985	feet of water
	1.033227	kilograms per square centimeter
	14.696	pounds per square inch
	1.013250	bars
	101.325	kilonewton per square meter
atomic mass units (amu)	1.66×10^{-24}	grams
	1.49×10^{-10}	ergs
	93 1.494	mev (million electron volts)
barrels	5.6146	cubic feet
	34.97	imperial gallons
	42	U.S. gallons
	158.987	liters
barrels per hour	0.1589	cubic meters per hour
barrels per day (oil)	50	tons per year (depending on the density of the oil)
bars	1.01972	kilograms per square centimeter
	10^{-5}	pascals (newtons per square meter)
	10^{-6}	barye
	0.986923	atmospheres
British thermal units (Btu)	778.2	foot-pounds
British thermal units	1055.05585	joules
	0.000293	kilowatt-hours (Kwh)
	0.252	kilocalories
British thermal units per second	1.416	horsepower
British thermal units per pound	2.326	joules per gram
bushels (Imperial)	4	pecks
calories	4.186	joules
candela per square centimeter	Π (3.1416)	lamberts
Celsius (centigrade) degree	1.8	Fahrenheit degree
centares	1	square meters
	10.76	square feet
Centiliters	0.01	Liters
Centimeters	0.3937	inches
	0.0328083	feet
	0.01094	yards
	10	Millimeters
	10^8	angstroms
centimeters of mercury	5.352391	inches of water

Multiply	By	To obtain
	0.193368	pounds per square inch
	27.84507	pounds per square foot
	135.951	kilograms per square meter
centimeters per second	1.9685	feet per minute
	0.036	Kilometers per hour
	0.02237	miles per hour
coulombs	0.1	abcoulombs
	6.24151×10^{18}	electron charges
	3×10^9	statcoulombs
cubic centimeters	0.001	liters
	0.06102338	cubic inches
	0.00003532	cubic feet
	0.000264	gallons
cubic decimeters	1	litres
cubic feet	1728	cubic inches
	7.480519	U.S. gallons
	6.288	imperial gallons
	28316.8466	cubic centimeters
	28.316846	litres
cubic feet of water	62.42833	pounds
cubic feet per minute	0.1247	U.S. gallons per second
	0.471704	litres per second
cubic inches	16.387064	cubic centimeters
cubic inches	0.0163876	litres
cubic kilometer	10^9	cubic meters
cubic meter	10^6	cubic centimeters
cubic meters (steres)	61023.3753	cubic inches
cubic meters	35.314455	cubic feet
	264.17	U.S. gallons
	219.97	imperial gallons
	6.2989	barrels (bbl)
	999.98	litres
	1.308	cubic yards
cubic meters per hour	151	barrels per day
cubic yards	27	cubic feet
	0.7646	cubic meters
decigrams	0.1	grams
	1.543	grains
decimetres	0.1	metres
	3.94	inches
degrees arc	0.01745329	radians
	1.1111	grades
dynes	10^{-5}	newtons
	2.247×10^{-6}	pounds
dyne-centimetres	1	ergs
dynes per square centimetre	9.86923×10^{-6}	atmospheres
	10^{-6}	bars
	1	barye(s)
	0.1	newton per square metre (pascal)
electron charge	1.602177×10^{-19}	coulombs
	4.803242×10^{-10}	la statcoulombs
electron volts (eV)	1.602177×10^{-19}	joules
electrostatic units of potential	300	volts
ergs	10^{-7}	joules
	2.38846×10^{-8}	calories
	6.241506×10^{-5}	megaelectron volts (MeV)
ergs per second	10^{-7}	watts

Multiply	By	To obtain
faradays	96485.31	coulombs
farads (coulombs/volt)	9 x 10 ¹¹	electrostatic units of capacitance
feet	30.48006	centimetres
	12	inches
feet (= 30.48 centimetres)	0.3048	metres
feet	0.3333	yards
feet of water	0.88	inches of mercury
	0.29 5	atmospheres
	0.43353	pounds per square inch
feet per minute	0.0113636	miles per hour
	0.508	centimetres per second
feet per second	0.5920858	knots
	0.681818	miles per hour
	1.09728	kilometres per hour
fluid ounces (U.S. liquid measure)	29.573	cubic centimetres
	8	fluidrams (U.S.)
fluid ounces (imperial)	28.413	cubic centimetres
	8	fluidrams (British)
fluidrams (U.S. liquid measure)	60	minims (U.S.)
	3.696	cubic centimetres
fluidrams (imperial)	60	minims (British)
	3.5516	cubic centimetres
foot-pounds	0.04213	joules
foot-pounds (ft lb)	1.3554	joules (watt-seconds)
foot-pounds	0.138255	metre-kilograms
	1.35582	newton metres
foot-pounds per second	0.00136	kilowatts
	0.00182	horsepower
gallons (U.S. gallons)	0.83268	imperial gallons
gallons (U.S.)	0.13368	cubic feet
gallons (imperial) (= 1.201 U.S. gallons)	0.1605	cubic feet
gallons (U.S.)	3.785411	litres
	4	quarts
gallons (imperial)	0.0285	barrels
gallons (imperial)	4.5461	litres
gallons (U.S.)	0.023809	barrels
gallons (U.S.) per mile	2.8247	litres per kilometre
grams	15.43236	grains
	5	carats
	0.035274	ounces
	0.00224623	pounds
	6.85x10 ⁻⁵	slugs
	1000	milligrams
	0.001	kilograms
	10 ⁻⁶	tons (metric)
	980.665	dynes
	6.022 x 10 ²³	avograms
gram calories	4.1855	joules
	0.003968	British thermal units
grams per cubic centimeter	8.345	pounds per (U.S.) gallon
	62.42833	pounds per cubic foot
grams per square centimeter	0.0361	pounds per square inch (psi)
	0.00096784	atmospheres
	0.000981	bar
	10	kilogram per square metre
	0.0142233	pounds per square inch
	0.73556	millimetres of mercury

Multiply	By	To obtain
hectares	2.471	acres
hectares	100	ares= 10 ⁴ square metres
horsepower	0.7457	kilowatts
	0.7068	British thermal units per second
	33000	foot-pounds per minute
	550	foot-pounds per second
	745.7	watts
	0.178 1	kilocalories per second
	1.013872	metric horsepower
horsepower (metric)	75	kilogram metres per second
	735.499	watts
horsepower	2545.06	British thermal units (Btu) per hour
hundredweights (short)	100	pounds
	45.3592	kilograms
hundredweights (long)	112	pounds
	50.8023	kilograms
inches	0.08333	feet
	2.54	centimetres
	1000	mils
inches of mercury	0.033421	atmospheres
	33.8639	millibars
	13.5951	inches of water
	0.491157	pounds per square inch
	0.03453	kilograms per square centimetre
inches of water	0.073556	inches of mercury
	0.1868324	centimetres of mercury
	0.0361275	pounds per square inch
	0.00246	atmospheres
joules (watt-seconds)	0.2388	calories
joules	10 ⁷	ergs
	6.241506x 10 ¹⁸	electron volts (eV)
	0.23892	gram-calories
	2.77778 x 10 ⁻⁷	kilowatt-hour
	6.241506 x 10 ¹²	megaelectron volt (MeV)
	0.7376	foot pounds
kilocalories	3.96707	British thermal units
kilocalorie per mole	4.3393	electron volts
kilograms	2.204622	pounds (avoirdupois)
	2.679	pounds (troy)
	70.931	poundals
	1000	grams
	15432.361	grains
	35.27396	ounces (avoirdupois)
	10 ⁻³	tons (metric)
kilogram-metres	7.233	foot-pounds
	9.8066 x 10 ⁷	ergs
kilogram-metres per second	9.8066	watts
kilogram of force	9.8066	newtons
kilograms per square centimetre	0.96784	atmospheres
	0.98066	bar
	28.958	inches of mercury
	73.556	centimetres of mercury (standd)
	14.2234	pounds per square inch (psi)
kilojoule per mole	1.03642 x 10 ⁻²	electron volts
kilometres	10 ⁵	centimetres
	0.62137	miles

Multiply	By	To obtain
	0.53956	nautical miles
	0.6213712	statute mile
kilometre per hour	27.7777	centimetres per second
	0.9113426	feet per second
	54.68	feet per minute
	0.9113	feet per second
	0.539	knots
kiloton (of energy)	4.1868×10^{12}	joules
kilowatts	0.9478	British thermal units per second
	3412.1418	British thermal units per hour
	8.59845×10^5	calories per hour
	737.6	foot-pounds per second
	1.341	horsepower
kilowatt hour	3412.1418	British thermal units
	3.6×10^6	joules
knots	1	nautical miles per hour
	1.68781	feet per second
	1.15155	miles per hour
	1.852	kilometres per hour
	0.51444	metres per second
lumen per square centimetre	1	Lumen per square centimetre
litres	1000	cubic centimetres
	61.023	cubic inches
	0.0351	cubic feet
	0.006289	barrels
	0.2199	imperial gallons
	0.2642	U.S. gallons
	0.908	quarts (dry measure)
	1.0567	quarts (liquid measure- U.S.)
	1.137	quarts (liquid measure-U.K.)
litres per second	2.11888	cubic feet per minute
lumen	$0.07957 (= \frac{1}{4\pi})$	candela
lumen per square centimetre	1	lambert
	1	phot
lumen per square metre	1	
maxwell	1	gauss per square centimetre
	10^{-8}	volt-seconds
	10^{-8}	weber
maxwell per square centimetre	1	gauss
megaton (of energy)	4.1868×10^{15}	joules
metres	39.37	inches
	3.28084	feet
	1.093611	yards
	4.97	links
	0.5468	fathoms
	0.199	rods
	100	centimetres
	1000	millimetres
	10^{10}	angstroms
metres per second	2.237	miles per hour
	3.6	kilometres per hour
	196.85	feet per minute
	1.94384	knots
microgram	10^{-6}	grams
micrometre	10^4	angstroms

Multiply	By	To obtain
	10^{-4}	centimetres
microns	10^{-6}	metres
	10000	angstroms
miles (geographic)	1.852	kilometres
	6076.115	feet
miles (statute)	5280	feet
	1760	yards
	8	furlongs
	1.609344	kilometres
	0.8683925	nautical miles
miles (nautical-international)	1.852	kilometres
miles (nautical-U.K.)	1.85318	kilometres
miles per hour	1.4667	feet per second
	0.868976	knots (nautical miles per hour)
	0.447	metres per second
	88	feet per minute
	26.8224	metres per minute
millibar	1000	barye
milligram	10^{-3}	grams
	0.005	carats
	0.01543	grains
millilitres	1	cubic centimetres
millimetres	0.03937	inches
	1000	microns
	0.001	metres
	0.04	inches
millimetres of mercury	0.00131579	atmosphere
	0.0013332	bar
	1333.22	dyne per square centimetre
	1	torr
million electron volt	1.60219×10^{-13}	joules
mils	0.001	inches
nanometre	10	angstrom
	10^{-9}	metres
newtons	10^5	dynes
newton	7.233	poundal
	0.22481	pound (force)
newton-metres	10^7	dyne-centimetres (ergs)
	1	joules
	0.737562	foot-pounds
ohm	1	electromagnetic units
	2.997925	electrostatic units
	1	gilbert per centimetre
	10^9	abohm
	1.11265×10^{-12}	statohm
ounces (avoirdupois)	28.3495	grams
	437.5	grains
	0.9115	ounces (Troy)
ounces (troy, apothecary)	31.10347	grams
	20	pennyweight
	24	scruples
	1.097143	ounces (avoirdupois)
ounces (U.S. fluid)	29.5735	cubic centimetres
	8	drams
Pascals	10	dynes per square centimetre
	10^{-5}	bars
poise	1	gram-centimetre per second

Multiply	By	To obtain
pounds (avoirdupois)	1.215	pounds troy
	256	drams (avoirdupois)
	0.03 108	slug
	0.45359	kilograms
pounds (or pounds avoirdupois)	16	ounces
pounds	7000	grains
pounds per cubic foot	0. 1337	pounds per U.S. gallon
	16.01837	kilograms per cubic metre
	0.0 1602	grams per cubic centimetre
pounds per cubic inch (psi)	27.68	grams per cubic centimetre
pounds per square inch	2.036	inches of mercury
	2.309	feet of water at 16°C
	70.307	grams per square centimetre
	6894.757	pascals
	0.06805	atmospheres
pounds troy	240	pennyweights
	5760	grains
	0.3732	kilograms
radians	57.29578	degrees arc
radians per second	0. 159155	revolutions per second
	9.8493	revolutions per minute
revolutions	6.283 185	radians
revolutions per minute	0.10472	radians per second
square centimetres	0.0001	square metres
	0.155	square inches
	0.001076	square feet
square feet	929	square centimetres
	144	square inches
	0.092903	square metres
	0.111	square yards
square inches	6.45 1626	square centimetres
	0.0069	square feet
square kilometres	0.386 1	square miles
	10 ⁶	square metres
	247.1	acres
square links	62.726	square inches
square metres	10.76	square feet
	1.195985	square yards
	1550	square inches
square miles	640	acres
	258.9	hectares
	2.5899	square kilometers
square mils	1 x 10 ⁻⁶	square inches
square yards	0.836	square metres
stoke	1	square centimetre per second
	10 ⁻⁴	square metres per second
tons	20	hundredweights
tons (long)	2240	pounds (avoirdupois)
	1.0 1605	metric tons (tonne)
tons (short)	2000	pounds (avoirdupois)
	0.9072	tonne
tons (metric)	10 ⁶	grams
	1000	kilograms
	0.9842	long tons
	1.102	short tons
tons (of refrigeration)	72574.8	kilocalories per day
volt (joule/coulomb)	0.00333	electrostatic units of potential

Multiply	By	To obtain
volts	10^8	abvolts
volts	0.0033356	statvolts
watts (joules per second)	10^7	ergs per second
watts	3 412 14	British thermal units per hour
	0.001341	horsepower
	860.1123	gram-calories per hour
watt-seconds	10^7	ergs
	1	joules
weber	10^8	maxwells (of magnetic <i>flux</i>)
webers	1	volts per second
yards	0.9144	metres
	0.5	fathoms
	3	feet



USAID | **EGYPT**
FROM THE AMERICAN PEOPLE



أعد هذا الدليل مشروع دعم قطاع المياه و الصرف الصحي الممول من الوكالة الأمريكية للتنمية الدولية بموجب عقد رقم 3 EPP-I-00-04-00020-00, Order No. 3 بالتعاون مع الشركة القابضة لمياه الشرب و الصرف الصحي

www.egyptwwss.org