ATiCO®

ROTARY VACUM FILTER

MODEL NO - AEC378

Instruction Manual

ATICO EXPORT.
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Foreword

Welcome to a value-conscious company, "**ATICO**". We are proud of the advanced engineering and quality construction of our each equipment.

This manual explains the working of equipment. Please read it thoroughly and have all the occupants follow the instructions carefully. Doing so will help you enjoy many years of safe and trouble free operation.

When it comes to service remember that "**ATICO**" knows your equipment best and is interested in your complete satisfaction. We will provide the quality maintenance and any other assistance you may require.

All the information and specifications in this manual are current at the time of printing.

However, Because of "**ATICO**" policy of continual product improvement we reserve the right to make changes at any time without notice.

Please note that this manual explains all about the equipment including options. Therefore you may find some explanations for options not installed on your equipment.

You must follow the instructions and maintenance instructions given in the manual carefully to avoid possible injury or damage. Proper maintenance will help ensure maximum performance, greater reliability and longer life for the product.

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ROTARY VACUM FILTER

OBJECTIVE:

- To study the performance of a Rotary Drum Filter operating under Vacuum.

AIM:

- To determine the specific cake resistance for a given slurry of $CaCO_3$

INTRODUCTION:

A most common type of continuous vacuum filter a rotary drum filter, which consists up a horizontal drum with a slotted face turns at a speed of 1.5 to 2 rev/min in an agitated slurry through a filter medium such as canvas covers the face of the drum., which is partly submersed in the liquid. Under cylindrical face of the main drum is a second smaller drum with a solid surface. Between two drums are radial partitions dividing the annular space into separate compartments. Due to vacuum applied inside the drum, the filtrate is drawn in through the filter medium and the cake is deposited on the outer surface of the drum.

THEORY:

In a continuous Rotary Drum Filter, the feed, filtrate and cake move at steady constant rates. For any particular element of the Filter surface, however, conditions are not steady but transient. The process of filtration consists of cake formation, washing, drying and discharging. The cake thickness is not allowed to increase to large values and therefore the filtration process can be conducted at a constant rate using a constant pressure difference.

A Rotary drum vacuum filter consists of a cylindrical drum partly submerged in the feed slurry. At any instant, a segment of the drum is in position and thus in contact with the slurry. Due to vacuum applied inside the drum, the filtrate is drawn in through the filter medium and the cake is deposited on the outer surface of the drum. As the drum rotates, this segment moves up where it is subjected to dewatering, to washing and finally the cake is removed by the scrapper or doctor

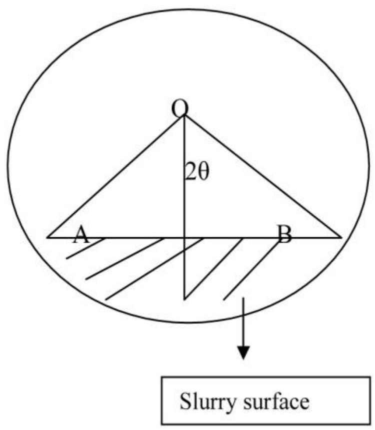
$$\frac{dt}{dv} = \frac{\mu f}{A(-\Delta P)}\left[\frac{\propto v}{A} + R_m\right] \qquad \text{------------ 1}$$

Ingrating:-

$$t = \frac{\mu f}{A(-\Delta P)}\left[\frac{\propto v}{A} \times \frac{v^2}{2} + R_m v\right] \qquad \text{------------ 2}$$

Then $t = f\, t_c$

$$f = \frac{2\theta}{360} \qquad \text{------------- 3}$$



Rate Of filtration = $\frac{v}{t_c}$

Neglecting the filter medium resistance R_m compared to the specific cake resistance $\propto$, Eq 2 can be written as:

$$t = \frac{\mu f}{A(-\Delta P)}\left[\frac{\propto v V^2}{2A}\right] \qquad \text{----------------- (4)}$$

$$(-\Delta P) = \left[\frac{\mu f \propto v}{2t} \times \left(\frac{V}{A}\right)^2\right] \qquad \text{-----------------(5)}$$

$$V = \frac{x}{1-x} \times \frac{\rho_f}{\rho_s} \qquad \text{------------------(6)}$$

DESCRIPTION:

The set-up consists of stainless steel ram moving in gunmetal brackets. The drum is divided in 8 compartments, covered by a SS mesh. A canvas filter is used for filtration. The whole assembly is fitted with a SS trough in which an agitator is provided. To make the unit a self-contained a slurry mixing and feed arrangement, receiver tanks, vacuum pump, control panel are provided.

UTILITIES REQUIRED:

- Electricity Supply: Single phase, 220 V AC, 50 Hz, 5-15 amp socket with earth connection.
- Water Supply (Initial fill).
- Drain required.
- $CaCO_3$: 10 kg.

EXPERIMENTAL PROCEDURE:

- Prepare slurry of $CaCO_3$ in water of known concentration.
- Allow the Slurry to pass through the filter and start the vacuum pump. Fix the pressure gauge reading ($-\Delta P$) at one value and record the filtrate collected in the receiver for known amount of time. Record the volume of filtrate collected for the known amount of time at least 4 times at the same ($-\Delta P$) and take the average of the three concurrent readings.
- Increase the ($-\Delta P$) by slightly closing the air by pass line and repeat step 2.
- Repeat step 3 for at least 4 ($-\Delta P$).
- Allow air to enter the drum and stop the vacuum pump. Remove the cake deposited and wash the filter assembly.
- During steps 3-4-5, collect the wet cake deposited/ rev of the drum.

OBSERVATION & CALCULATION:

DATA:

D = 0.25 m

L = 0.35 m

A = 0.275 m^2

D_F = 0.215 m

A_F = 0.0594 m^2

θ = 68.284

ρ_F = ------------- kg/m^3 (From data book)

ρ_S = ------------- kg/m^3 (From data book)

μ_F = ------------- Ns/m^2 (From data book)

OBSERVATION TABLE:

Sr.No.	N (R.P.M)	$-\Delta P$ (mmHg)	h (m)	t_c (sec)

Plot $(-\Delta P)$ vs $(V/A)^2$ on a simple graph and measure the scope

Calculation:

$(-\Delta P)$ = --------------mmHg = --------------- /(760×101.3)= -------------kN/m^2

$$X = \frac{Kg\ of\ Solid}{Kg\ of\ water + Kg\ of\ solid} =$$

$$v = \frac{X}{1-X} \times \frac{\rho_F}{\rho_S} =$$

$V_F = A_F \times h$, m^3 = -------------m^3

$V' = \frac{V_F}{T}$, m^3/sec = ------------- m^3/sec

$V = V' \times t_c$, m^3 = ------------- m^3

$f = \frac{2\theta}{360}$ = -------------------

$t = t_c \times f$, sec = --------------sec

$A = \pi DL$, m^2 = ---------------m^2

$L_c = \frac{V \times v}{A}$, m = --------------m

$\alpha = \frac{2 \times t \times slope}{v \times \rho_F \times \mu_F}$, m/kg = ----------------m/kg

NOMENCLATURE:

A	=	Area of drum, m^2
A_F	=	Cross sectional area of filtrate tank, m^2
D	=	Drum diameter, m
D_F	=	Diameter of filtrate tank, m
f	=	fractional submergence
h	=	Rise in water in filtrate tank, m
L	=	Drum length, m
L_c	=	Thickness of cake, m
$-\Delta P$	=	Pressure drop (vacuum gauge reading), N/m^2
T	=	Time of filtrate collection, sec
t_c	=	Time for one revolution, sec
t	=	Time for cake formation, sec
v	=	Voidage or porosity of the bed.
V_F	=	Volume of the filtrate, m^3
V'	=	Rate of filtration, m^3/sec
V	=	Volume of filtrate in one revolution, m^3
X	=	mass fraction of the solid in slurry
ρ_f	=	Density of the filtrate, kg/m^3
ρ_S	=	Density of the solid, kg/m^3
α	=	Specific cake resistance
μ_F	=	Viscosity of Filtrate, Ns/m^2

PRECAUTION & MAINTENANCE INSTRUCTIONS:

- Proper cleaning is must of drum and its clothes.
- Feed slurry is filtered before feeding it into the tank.
- Low flow is best for operating it.
- Vacuum pump connections should be correct & properly tight.

TROUBLESHOOTING:

- If the slurry is overflow from the drum slow down the feed inlet rate.
- If the vacuum is not proper than check the vacuum and tight the screw which are on the vacuum connecting plate.
- For constant pressure operate the ball valves during experiment if it fluctuates.