



真空平盘过滤机
Vacuum Pan Filter

真空转鼓过滤机
Vacuum Drum Filter

真空皮带过滤机
Vacuum Belt Filter



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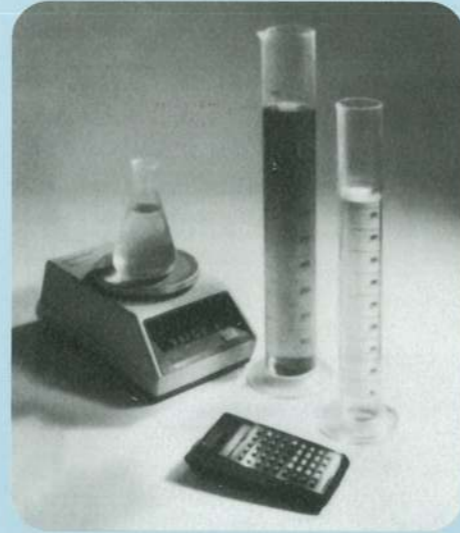
西玛(常州)通用设备有限公司
CEM (Changzhou) Special Equipment Co., Ltd.

CEM offers two types of liquid/solids force separation equipment: Vacuum filters and pressure leaf filters. Each of these products separates liquid from solids, but each accomplishes its objective in a different manner.

Depending on your product and process requirements, one of these methods of filtration can be precisely adapted to meet your needs. It is this broad product capability that enables CEM to analyze your problem and recommend the proper equipment. Frequently, separation can be handled by more than one type filter.

With CEM, you will enjoy the option of selecting the most suitable and most economical equipment for your requirement.

This brochure will introduce you to each of our various continuous vacuum filters.



CEM Service before the sale promises you more efficient, low-cost filtration.

You get the facts in a hurry when you call in your nearest CEM representative. Look for him in the yellow pages under "Filters". Or, contact our home office for a prompt response with the information you need.

Laboratory service

If you're not sure of your filtration requirements, send us a 20 litre sample of the slurry you wish to filter. Our laboratory tests will determine its filtration characteristics, optimum flow rates, correct type and dosage of filter-aid, and other important information. You'll receive our equipment recommendation within a short time.

Custom engineering service

Remote master control panels, vapor tight hoods, special materials of construction, synthetic linings, automatic controls, low head-room tolerance – these are only a few of the refinements that can be designed and built into your vacuum equipment. If it involves liquid/solids separation, we will design a single filter or a complete system to do the job!

Pilot filter service

If you want to do your own testing, we'll be happy to provide you with a pilot scale vacuum filter to operate under your plant conditions. This will give you a first-hand indication of filtrate quality, flow rates and the operating savings that you can expect with production-scale equipment.

Installation, start-up service

A factory-trained expert can be made available to supervise the installation and start-up of your equipment.

Where to Start?

Thousands of vacuum filters are presently in successful operation in the mineral processing, chemical, food processing, pulp & paper and effluent disposal industries – wherever the separation of large amounts of solids from suspension in a liquid slurry is desired. A primary advantage of vacuum filtration is the savings in time and labour through its continuous reliable operation. Depending on the composition of the slurry and the working environment, vacuum filters can process slurries for months at a time without requiring maintenance.

CEM can supply Rotary Drum Vacuum Filters fitted with any of the 5 basic discharge systems – blow-back assisted scraper, string, belt, precoat or roller. We also supply Horizontal Rotary (Pan) Filters and Travelling Belt Filters as required by the process requirements.

Which type and what size vacuum filter do you need? Normally, the answer will be determined in the laboratory, yours or ours.

How big a Filter do you need?

Vacuum filters are available in a variety of sizes, and are rated in square metres of effective filtration area. Determining exactly how big (area) a filter is required for your process depends upon a number of factors, all of which are interrelated:

- (1) filtration rate
- (2) cake loading rate
- (3) desired clarity of filtrate
- (4) nature of solids
 - (a) moisture requirement
 - (b) washing requirement

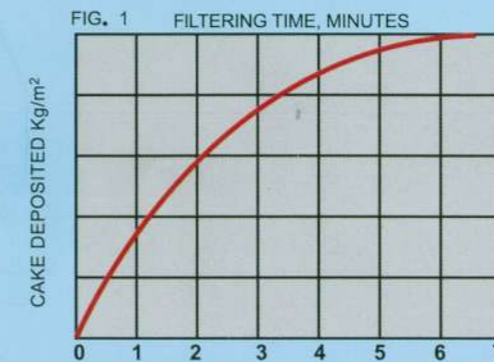
A laboratory analysis of your slurry, utilizing a standard Buchner filter technique, will reveal most of the above characteristics concerning your product – filtration rate, solids build-up, nature of solids and clarity of filtrate. You will then have an accurate idea as to size and type of filter you will need. A test on an appropriate small pilot filter is then made to confirm these findings.

What type of Filter?

The behaviour of any given slurry under vacuum is entirely predictable – every square metre of filter area will filter at a given rate. Once the laboratory tests have been completed, recommendations can be made as to the size and type of filter you will need.

Rotary Drum Vacuum Filters

Belt, string, scraper-assisted blow-back or roll discharge are all applicable where the solids are filterable on themselves. Each requires a cloth, paper, or woven synthetic fabric filter media. The basic difference between these types of filter is the manner in which the cake is discharged, which is determined by the characteristics of the cake itself.



PRECOAT VACUUM FILTERS. This type filter is preferred for those processes requiring a high degree of clarity in the filtered liquid, or where the solids filter poorly on themselves, i.e., some slurry solids "blind" or choke off the filtering action. This type filter requires the use of a filter-aid (normally diatomaceous earth) to build up a filtering cake on the surface of the rotating drum.

Horizontal Rotary Filters

Well suited to the filtration of free-settling, free filtering coarse crystalline or fibrous pulp slurries. They provide rapid dewatering and efficient cake washing at large cake capacities.

Travelling Belt Filters

Also well suited to the filtration of fast draining slurries the Travelling Belt Filter is well suited to applications requiring thorough cake washing (including multi-stage counter-current washing) at high throughputs.

Reserve Capacity

It is wise to purchase a filter offering 10-20% more capacity than your anticipated rate of production. It is a "cushion" that adds little cost to your original order and is instantly available should you ever need it.

Material of Construction

All vacuum filters are available in a wide variety of materials including steel, stainless steel, exotic alloys or rubber covered steel. The corrosive effects of chemicals to be filtered will normally determine the actual material of construction.

The rate of deposition of solids on the various types of filters normally decreases rapidly after the first two or three minutes of filtration. Extending the filtering time beyond such a point deposits so little additional material that it would be inefficient to attempt to filter for a longer period.



Fundamentals of Operation — ROTARY DRUM VACUUM FILTERS

Internal vacuum piping throughout the inside of the filter drum is designed to evenly draw the filtrate and air through the cake. As the drum rotates, a unique face-type valve directs changing vacuum levels, pulsating air and atmospheric pressure in a pre-determined sequence to each drainage section.

The illustrations at right dramatize these various actions during a single rotation of the drum. Figure #1 shows the maximum suction directed to the drainage pipes below the liquid level of the slurry tank. The bulk of filtrate removal occurs at this position. As the drum slowly turns, the cake builds up to its maximum thickness.

B Maximum filtrate removal.

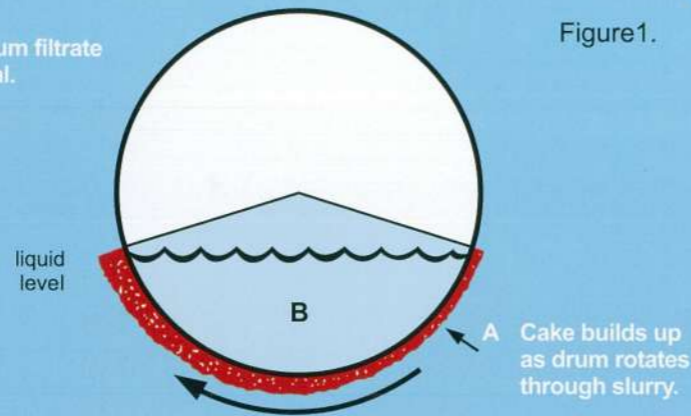


Figure1.

As the drum continues to rotate above the tank slurry level (Figure #2), the vacuum level continues to draw liquor from the cake. In Figure #3, the drum is completing the revolution and the valve has vented area B to allow easy removal of the cake (by a number of different means as shown on the following pages).

B Final liquid removal at top of rotation.

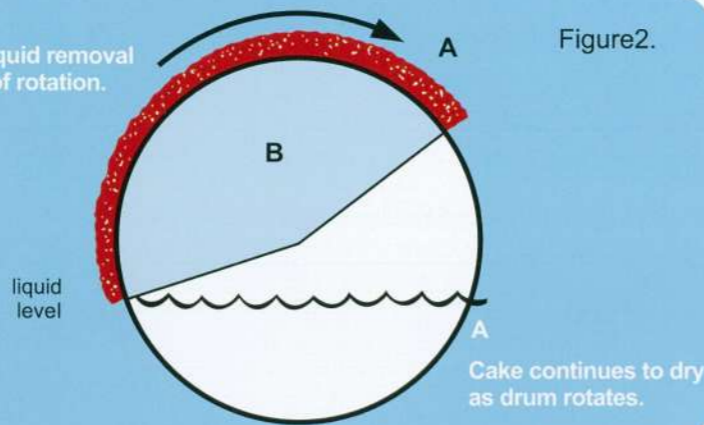


Figure2.

It should be noted that in Figures #1 and #2, the filtrate extracted from the positions marked B can be separated to recover a "strong" and a "weak" liquor, or operate under one or more vacuum levels. This flexibility might be desirable in a situation where the cake (in the position shown in Figure #2) requires washing before removal from the drum.

B Venting takes place to permit cake release.

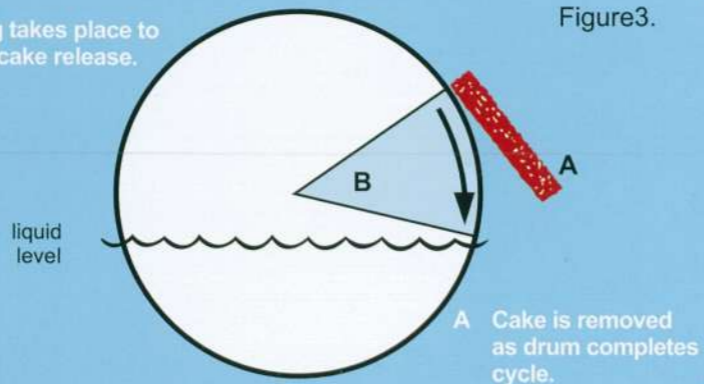
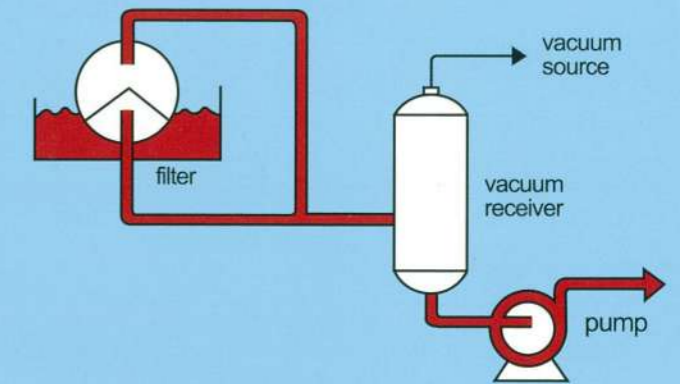


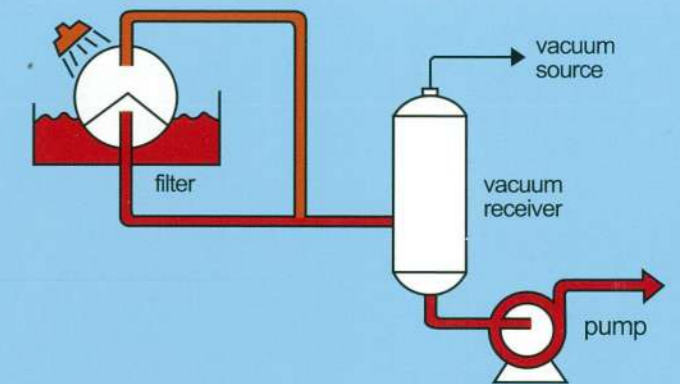
Figure3.

Successful filter operation is dependent on a carefully-engineered choice and layout of accessory components, which are in turn dependent on the demands of the specific application. These diagrams show several basic types of installations commonly in use.

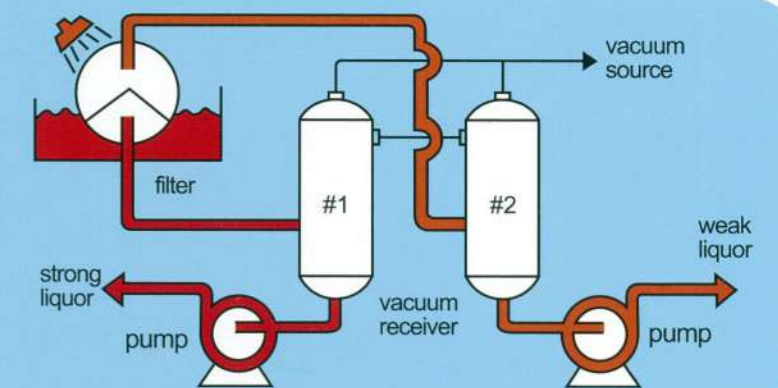


Typical arrangement of accessories where same vacuum is used for forming filter cake, simple dewatering.

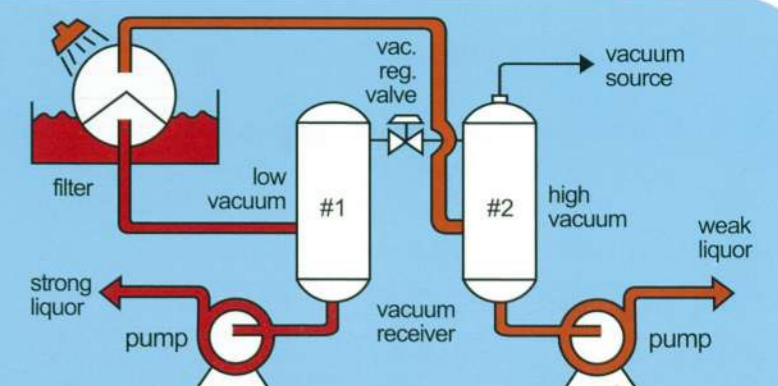
Typical arrangement of accessories where same vacuum is used for forming filter cake, washing and dewatering.



Typical arrangement where a single vacuum level is used and strong and weak liquor is separated.



Typical arrangement of accessories where low vacuum is used for forming filter cake, high vacuum for washing and dewatering, and separation of weak and strong liquor is required.



6 Also along this top portion of the drum travel, any washing or special dewatering operations take place.

5 As sections emerge from the tank, the vacuum dewateres the cake as the drum carries it around to the point of discharge.

4 Vacuum is applied to submerged segments. This causes the mother liquor to flow through filter cloth, internal piping, and valve, while solids are stopped on the outside of the cloth to form the cake.

Dewatering outlet to vacuum system

Filtrate outlet to vacuum system

Vent connection

Agitator

3 As the drum rotates, each compartment goes through the same cycle of operation – filtering, de-watering, and discharging the cake – controlled in repeating sequence by the automatic valve.

2 The surface of the drum is divided into shallow compartments which are connected by pipelines to an automatic valve so that vacuum can be applied individually to each.

A molded plastic drainage grid separates the cloth from the drum so that there is space for the mother liquor to drain from all parts of the compartment into the drain line.

CONTINUOUS ROTARY VACUUM FILTER:

1 consists essentially of a cloth-covered drum revolving in a tank filled with the slurry to be filtered. Agitator, oscillating gently back and forth under drum, keeps solids in suspension.

7 When all mother liquor that the particular filter cake will give up has been removed, the automatic valve cuts off the vacuum, and the cake is discharged from the drum.

STRING DISCHARGE:

8 Endless strings spaced about 12mm apart pass around the drum. The cake is built up over these strings so that, as they leave the drum, the cake is lifted away from the cloth by the strings.

The strings then pass around the discharge roll. At this point the cake is freed from the strings. The strings are then fed back over another roll to the underside of the drum.

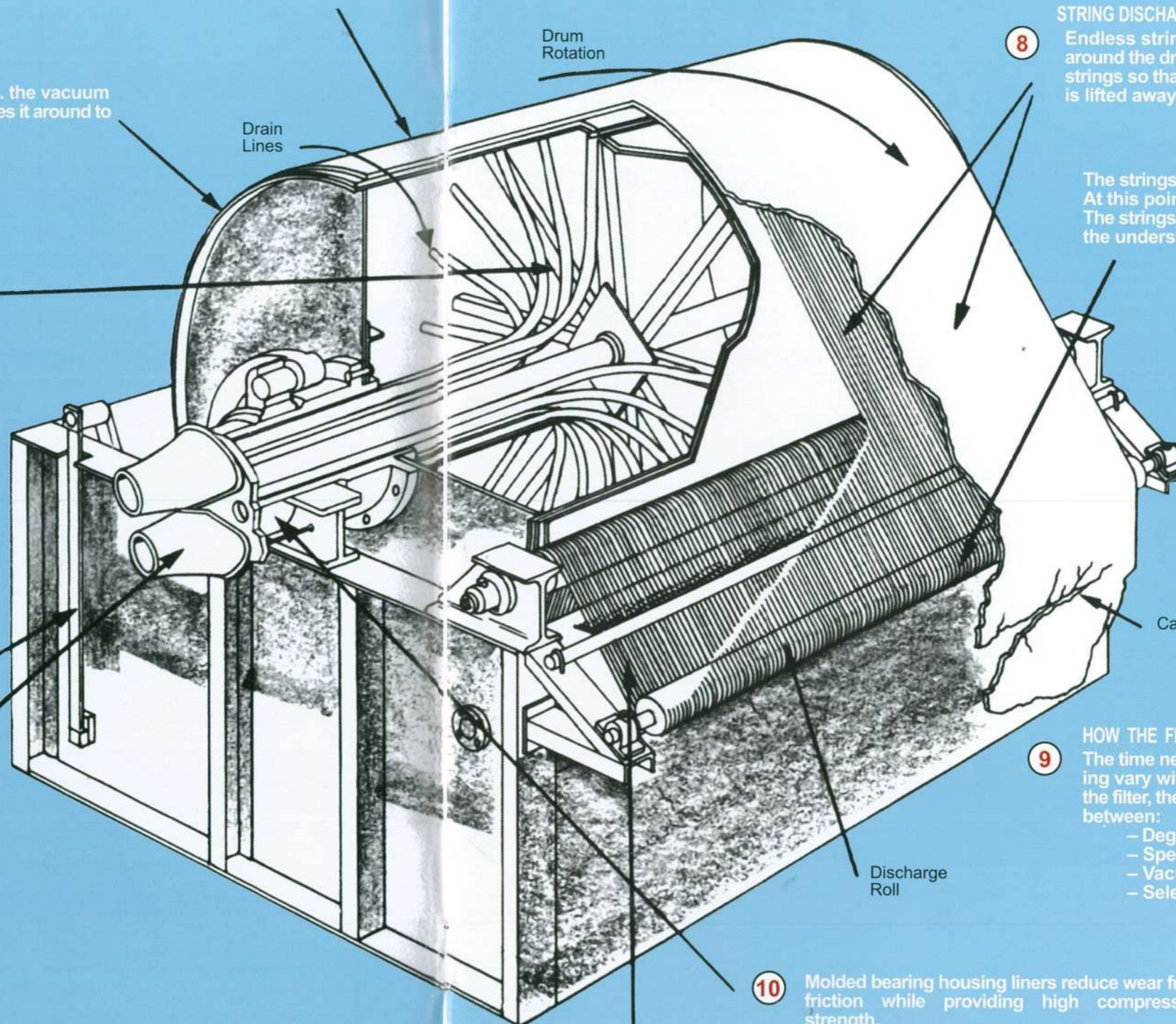
HOW THE FILTERING IS CONTROLLED:

9 The time necessary for filtering and for dewatering vary with the particular slurry. In designing the filter, these needs are filled by proper balance between:

- Degree of submergency of drum
- Speed of rotation of drum
- Vacuum
- Selection of filter medium

10 Molded bearing housing liners reduce wear from friction while providing high compression strength.

Strings returning to underside of drum through aligning comb.



Belt Discharge

Filters yield excellent results

Belt discharge rotary drum vacuum filters feature an endless cloth filtering media that removes cake from the drum and transports it to the discharge roll. The cake is supported at all times by the belt, making it possible to discharge a considerably thinner or weaker cake than with any other system.

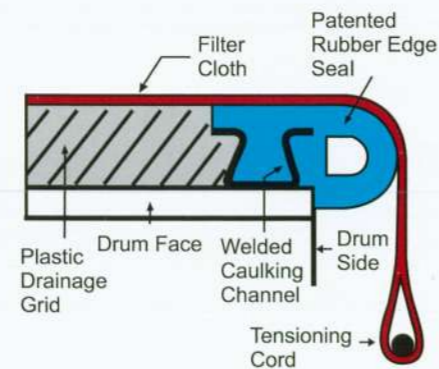
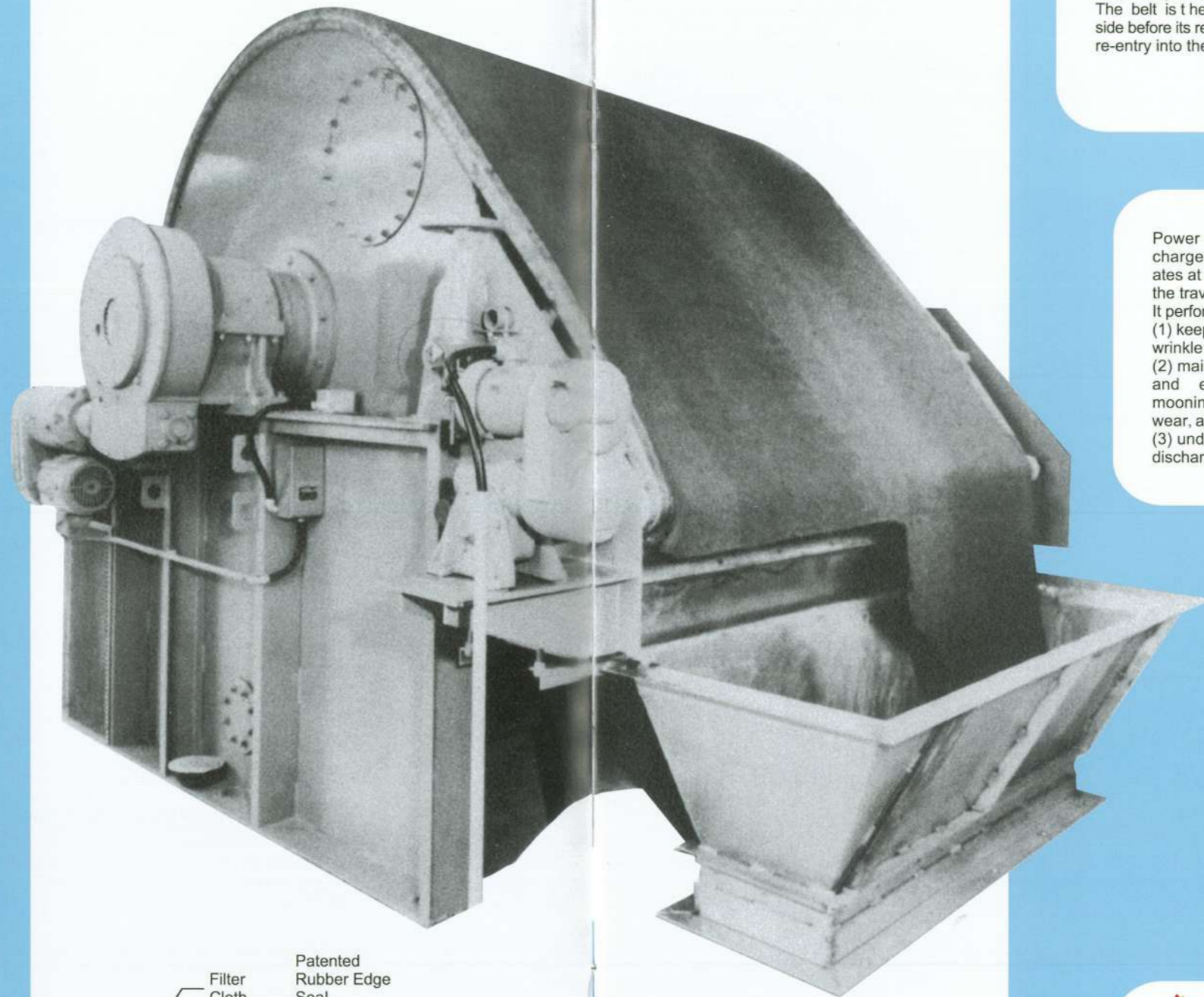
A big advantage of the Belt discharge filter is that its design permits backwashing of the filter cloth after cake discharge without mixing the wash residue with the material to be filtered. This maintains an outstanding level of filtration quality and efficiency.

Generally speaking, this type of discharge functions best with slurries that can produce about 3mm of cake in at least 30 seconds of filtration time. The effluent clarity, depending on the composition of the slurry, is not as good as with certain other types of discharge described on the following pages.

The fully adjustable return roll is controlled by screw hand wheels located at each end of the roll. Entire take-up mechanism is located outboard of the support brackets for easy access.

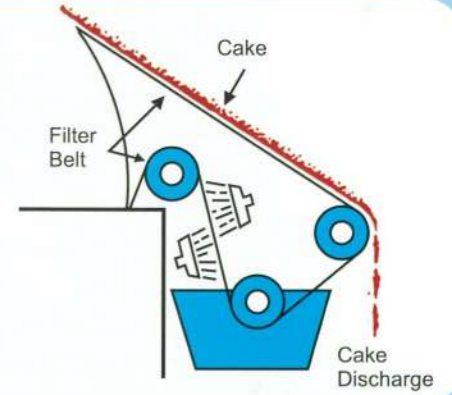
Filter cloths – custom made in our own fabric shop – are available in most synthetic fabric materials. The unique Belt discharge design, including patented tracking devices, greatly reduces belt wear. Belt replacement is easy and surprisingly low in cost. Fitted with sewn, plastic zipper or clipper lacing closures.

If required, the filter can be equipped with spray wash assembly, compression and wash assembly, automatic and/or remote controls. All discharge mechanisms are quickly adjustable.

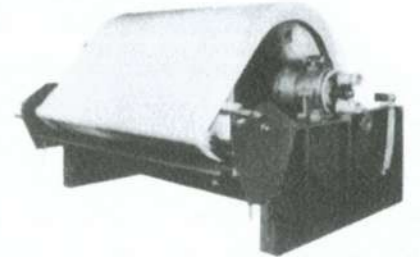


Patented soft rubber edge seal and drainage division strip caulking gives a tight, leak-resistant surface against which the filter cloth is sealed. "Wrap around" filter cloth over drum edge contains plastic cord which is drawn tight to keep belt sealed to drum and maintain tension around entire periphery of drum. Eliminates costly, troublesome tracking mechanisms and sensors.

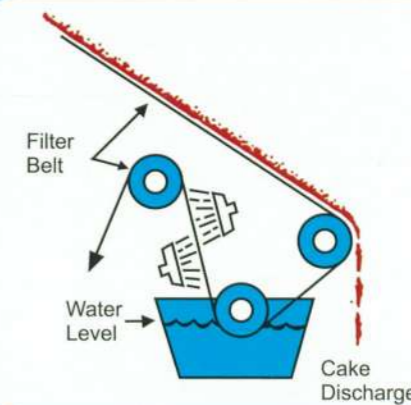
With this type filter, the filter belt (or media) supporting the cake is drawn away from the drum face for discharge. As the belt turns at a sharp angle over the discharge roller, the cake breaks away to drop freely into a receptacle. The belt is then backwashed on each side before its return to the drum face and re-entry into the slurry tank.



Power driven variable-speed discharge roll with raised helix operates at a speed slightly faster than the travel of the filter cloth. It performs three functions:
 (1) keeps the cloth belt straight and wrinkle free,
 (2) maintains proper cloth tension and eliminates so-called de-mooning bars which increase belt wear, and
 (3) undulates the cloth to assist in discharge of sticky cakes.



While the edges of the belt are off the drum, they are tracked by plastic guide idlers at each end of the belt rolls. Exclusive feature.



The trough roll is partially submerged to eliminate the possibility of belt sag due to wash water accumulation. This roll can operate on water lubricated nylon bearing journals for minimum maintenance in corrosive environments.

String discharge

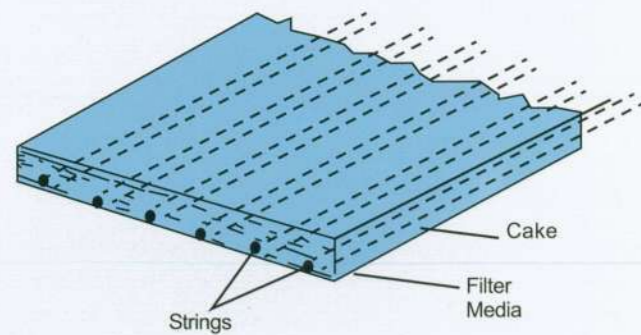
The basic advantage of this method of cake discharge is its simplicity of operation and elimination of possible smearing or blinding of the filter media by cake discharge.

The clarity of the effluent is at a maximum because the filter media is caulked directly to the drum surface. This completely prevents leakage or by-passing of any unfiltered slurry. Only the strings move away from the drum, carrying with them the cake for removal.

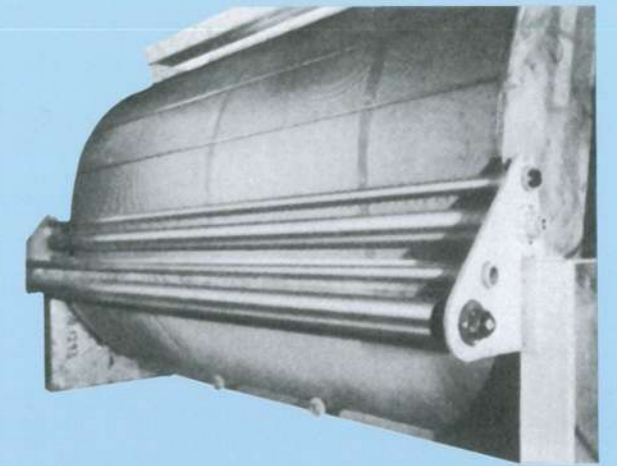
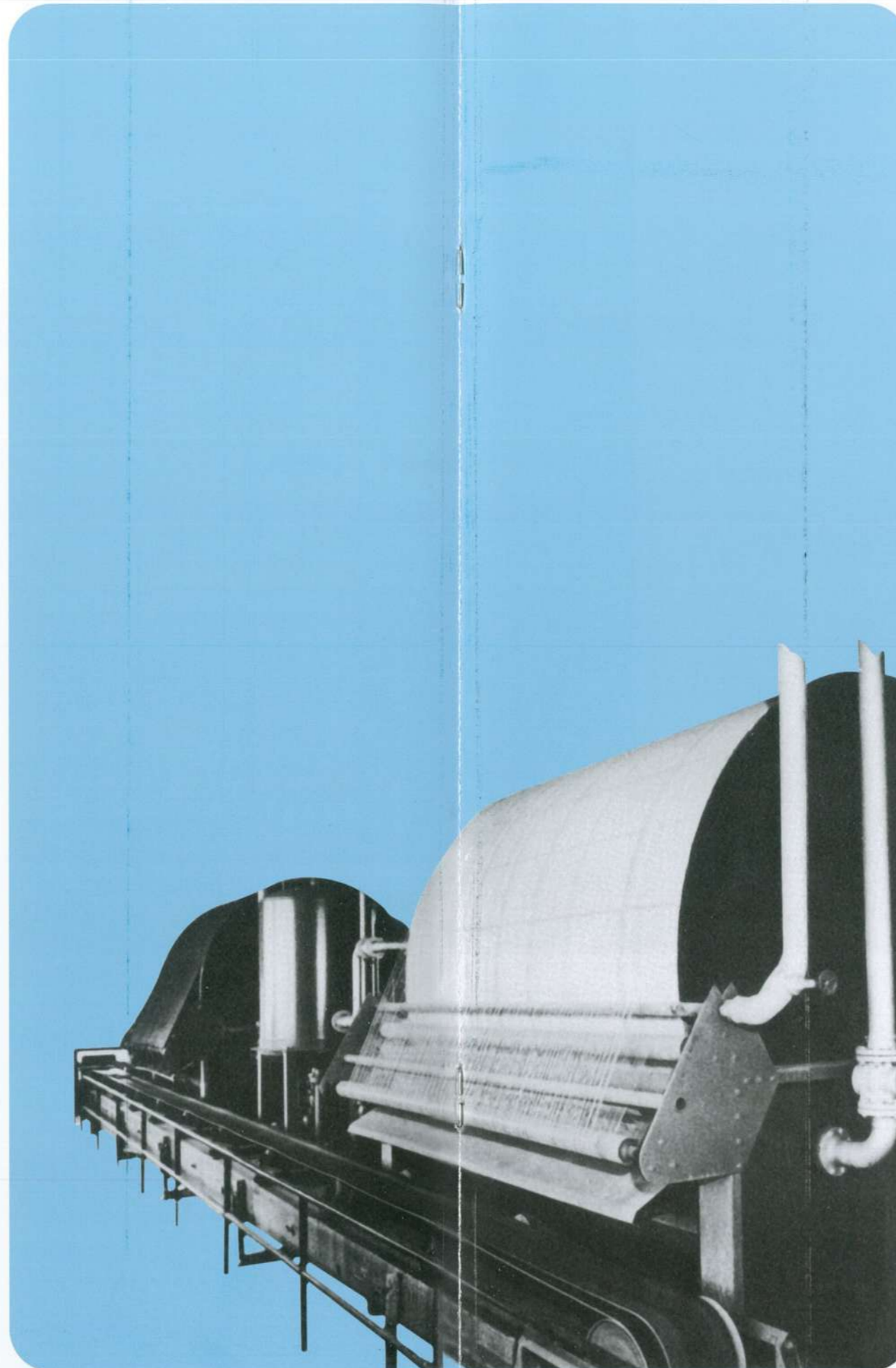
Although it can handle cakes as thin as 2mm or as thick as 25mm, this method of discharge finds its widest application with those slurries that can produce a gelatinous or other cohesive cake of about 3mm thickness in at least 130 sec. of filtration time; also, where blinding of the filter cloth is not a problem and constant washing of the filter media is not required. (Washing the media to recondition it is a problem with this type filter because the wash water cannot be segregated from the slurry and because the cloth can be washed from the outside only.)

Filter media life is normally at a maximum on a string discharge filter since in use it is neither moved nor abraded in any way. This permits use of lighter cloth which gives optimum filtration performance by minimizing filter resistance of the cloth. Naturally, a lighter weight cloth also costs less to replace.

A string discharge filter permits use of a much lighter weight filter media because the cloth is caulked directly to the drum and is not subject to abrasive movement. It is particularly effective in situations where maximum cake dryness is desired.

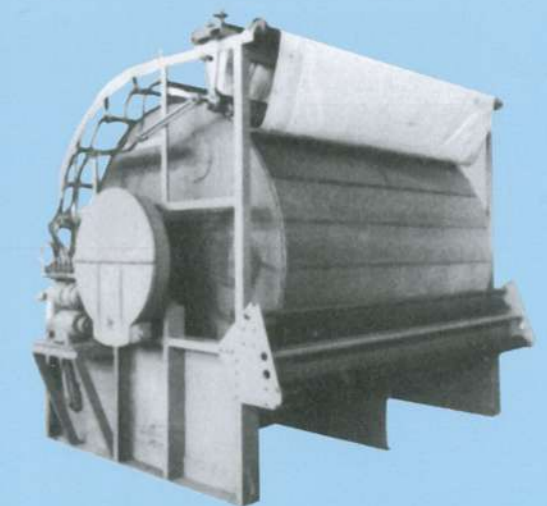


The strings are essentially a lifting device for cake removal, providing a clean, uninterrupted cake discharge. The strings are imbedded in the cake during the filtering cycle, helping to support and reinforce the cake.



Guide pins on the aligning comb keep strings separated on 12mm centres. No other aligning mechanisms are required, nor are additional adjustments needed after the filter is put into operation.

It is not necessary to remove any strings to install a new filter cloth. It is simply introduced to the drum inside the strings (in discharge position) and the drum inched around until the ends meet. The cloth is then caulked to each side of the drum and to the joint where the cloth ends overlap, completely sealing the cloth to the drum face. (See photo to left.)



String Discharge Rotary Vacuum Drum Filter fitted with belt washing and compression rolls, allowing flooding of the cake and preventing cake cracking (and resultant channelling). The compression mechanism produces low moisture content filter cakes of uniform thickness with reduced vacuum requirements as there is less air leakage.

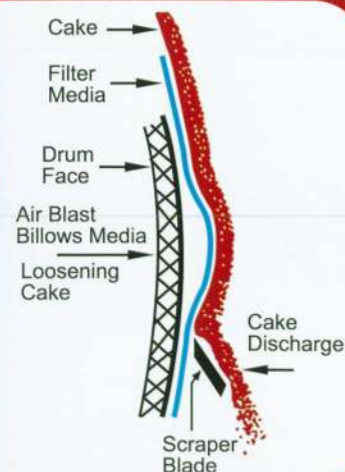
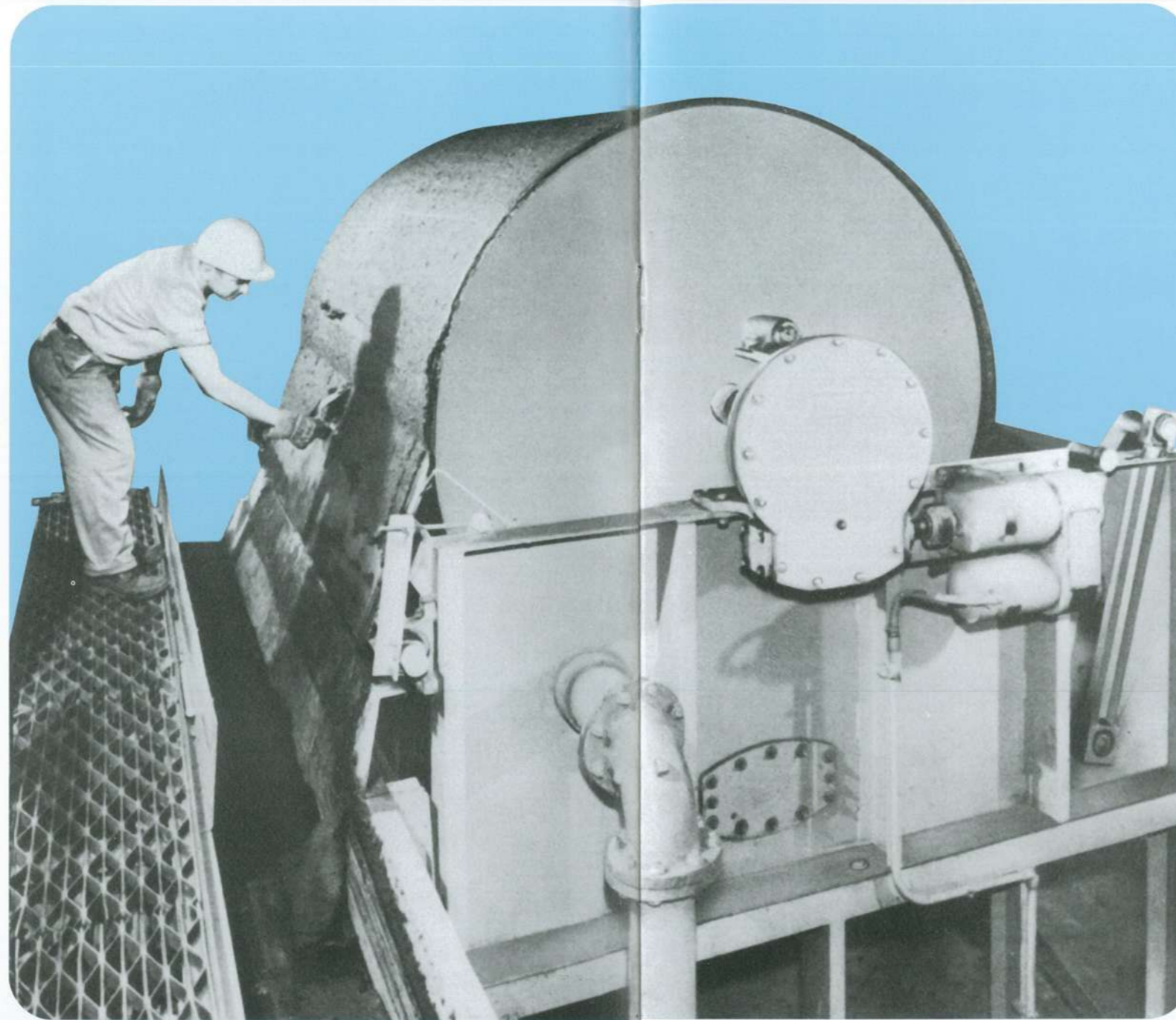
Scraper-assisted blow-back discharge

This method, and the Roller discharge featured on the opposite page, are similar in basic operation. Only the method of discharge is different and the choice is, once again, determined by the physical properties of the cake involved.

The scraper discharge is normally recommended for those applications resulting in a granular or crystalline cake. Some solids form cakes that crack readily in dewatering or for some reason are not easily removed from the filter media by other means of discharge. In these cases, action of the scraper-assisted blow-back can make continuous rotary vacuum filtration feasible.

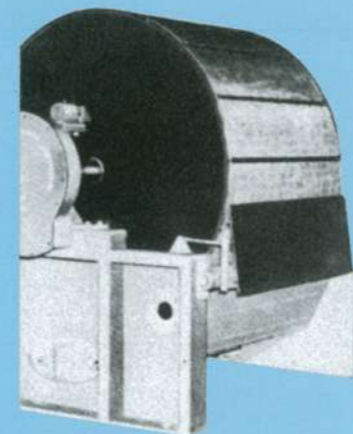
As with the previous methods of discharge, the formation of 3mm of cake in at least 130 seconds is desirable. Also important is the selection of a media that releases the cake readily, and solids that are not "greasy" or easily shocked by mechanical handling.

Clarity of the effluent is generally good.



As the drum and filter cloth rotate toward the discharge blade, air pressure "billows" the cloth gently releasing the cake. This action keeps cloth wear at an absolute minimum while effecting a clean discharge and greatly reducing any opportunity for the cloth to blind off.

Blades are fully adjustable and sectionalized for easy replacement.



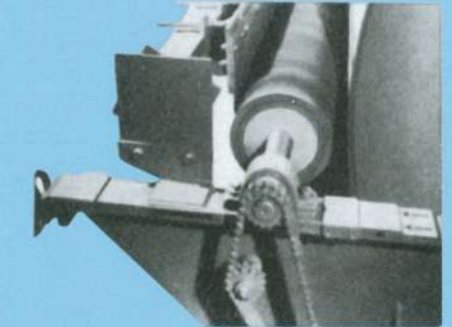
Note: For pictorial clarity, safety guards are shown removed. Guards must not be removed when machine is in operation.

Roller discharge

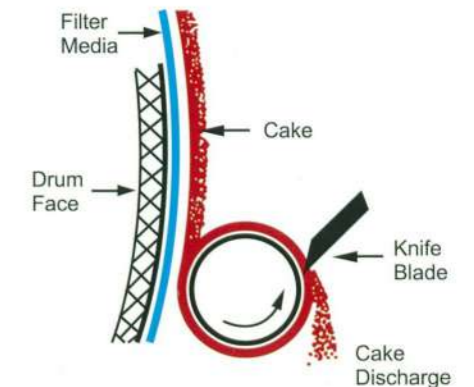
This discharge finds very infrequent application, yet makes continuous filtration possible when all other methods fail.

Roller discharge is effective for recovering solids that are relatively sticky to the touch. These solids normally adhere to themselves but will not respond to other means of discharge. Cakes as thin as 1 mm have been successfully handled in this manner. However, it is essential that the slurry has little or no tendency to blind the filter media since it cannot be flushed clean.

Effluent clarity: good.

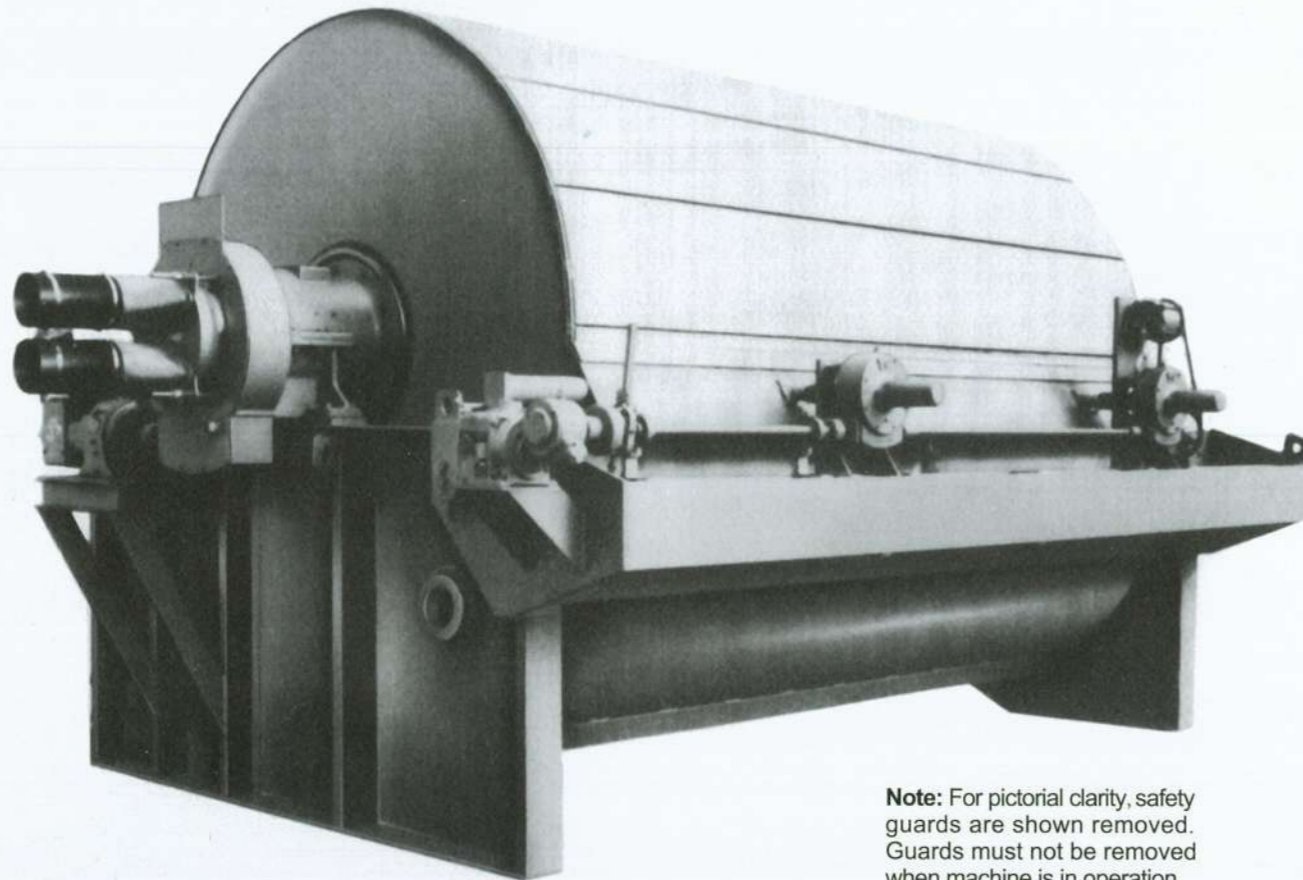


The roller acts very much along the same principle as that employed by an offset printing press. When the roller and cake make contact, the cake tends to stick to the new surface more than the filter media, resulting in a smooth transfer of cake-to-roller the full length of the filter drum. The cake is then peeled from the roller by an idler knife blade.



Precoat Filters

Precoat filters generally are used with processes that require a high degree of filtrate clarity, or slurries that cannot form a dischargeable cake in a reasonable time. The latter would include high binding or difficult-to-filter solids having sticky, slimy, gummy or near colloidal characteristics. Such slurries usually contain a solids concentration of less than 1%.



Note: For pictorial clarity, safety guards are shown removed. Guards must not be removed when machine is in operation.

- Precoat filters are provided with a graduated scale to show extent of knife travel.
- Knife travel limit switches are provided to shut off the knife advance mechanism to avoid possible damage to drum and filter media, and to limit knife return.
- Optional cake thickness detector can be set to automatically stop build-up of precoat at a prescribed thickness. This permits operation on a timed basis.
- Blade movements are motorized, including rapid forward and reversing speeds.

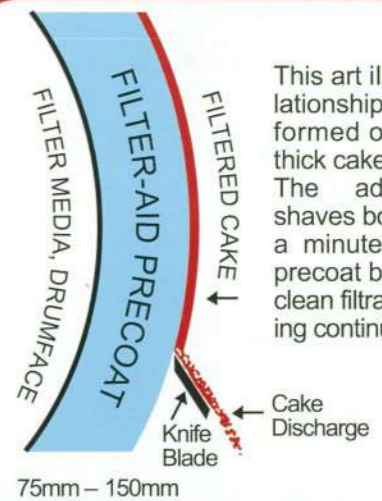
This method of continuous filtration requires the use of a filter aid for the purpose of building up a filter bed to remove the solids, which are not filterable on themselves. Filter aids – inert substances in that they will not dissolve or otherwise contaminate the filtrate – can be diatomaceous earth, pearlite, cellulose or combinations thereof. These must be mixed with water in a precoat tank before introduction to the filtering system.

The filter aid is drawn to the drum face until a cake (usually 75mm to 150mm) has formed. The filtering cycle then proceeds and the solids accumulate against the outside surface of the precoat cake.

An automatic knife blade, advancing at a speed of 0.25mm to 0.8mm per minute, shaves the thin cake for discharge. A minute part of the filter aid surface is also removed to present a continually fresh filtration surface to the slurry. In this manner, the filtration cycle may last from several hours up to a full week or more.

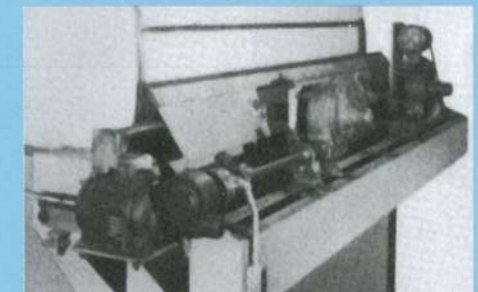
Precoat filters provide a maximum degree of filtrate clarity. However, it is not possible to save the cake for further processing due to the inclusion of filter aid with the discharged cake.

The cake can be washed or sweetened off before the shaving operation if desired. Cake is then automatically discharged from the filter in dry form to a hopper or screw conveyor.

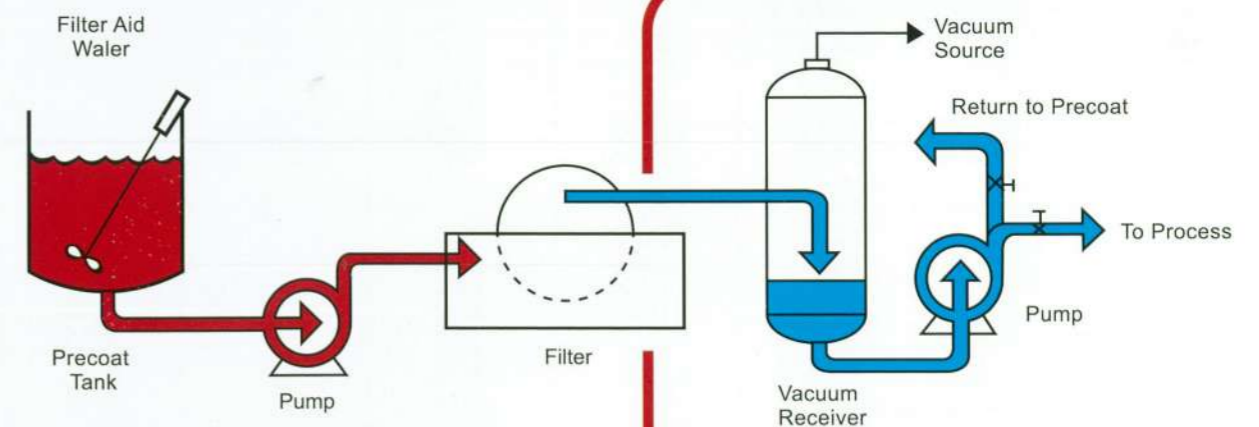


This art illustrates the relationship of the thin cake formed on the relatively thick cake of filter aid. The advancing knife shaves both the cake and a minute portion of the precoat bed to maintain a clean filtration surface during continuous operation.

The automatic knife advance is infinitely variable between the advancing speeds of 0.25mm and 0.8mm per minute. The blade itself is made of tough, long-lasting stellite alloy for minimum wear and maintenance.



NOTE: For pictorial clarity, safety guards are shown removed. Guards must not be removed when machine is in operation.



Typical schematic drawing of a precoat filter system, including precoat tank, filter, vacuum receiver and pumps.

SPECIFICATIONS

ROTARY DRUM VACUUM FILTERS

Drum Diameter	Drum Length	Filtering Area Sq. Metres	Approximate Overall			Approx. Weight * Kgs.
			Length	Width *	Height	
915 mm	305 mm	0.87	1220 mm	1475 mm	1295 mm	900
915	610	1.7	1525	1475	1295	1000
915	915	2.6	1980	1780	1220	1110
915	1220	3.5	2285	1780	1220	1230
915	1525	4.3	2590	1780	1220	1340
915	1830	5.2	2895	1780	1220	1500
1525	1220	5.8	2440	2490	1880	2860
1525	1525	7.3	2745	2490	1880	3040
1525	1830	8.7	3050	2490	1880	3220
1525	2135	10.2	3350	2490	1880	3380
1525	2440	11.6	3660	2490	1880	3585
1830	1830	10.5	3050	2920	2210	3945
1830	2440	14	3660	2920	2210	4535
1830	3050	17.5	4270	2920	2210	5125
1830	3660	21	4880	2920	2210	5800
2440	2400	18.6	4090	3505	2945	6170
2440	3050	23.3	4700	3505	2945	6940
2440	3660	28	5310	3505	2945	7620
2440	4270	32.6	5920	3505	2945	8300
2440	4880	37.3	6530	3505	2945	8980
3050	3050	29.1	4700	4115	3555	9935
3050	3660	35	5310	4115	3555	10800
3050	4270	40.8	5945	4115	3555	11660
3050	4880	46.7	6530	4115	3555	12520
3050	5490	52.5	7140	4115	3555	13610
3050	6100	58.3	7750	4115	3555	14500
3660	3660	42	5335	4725	4165	11930
3660	4270	49	5945	4725	4165	12930
3660	4880	56	6555	4725	4165	13970
3660	5490	63	7160	4725	4165	15100
3660	6100	70	7770	4725	4165	16170
3660	6710	77	8380	4725	4165	17150
3660	7315	84	8990	4725	4165	18210
4270	4270	57.3	6860	5180	4880	15425
4270	4880	65.5	7470	5180	4880	16560
4270	5490	73.6	8080	5180	4880	17960
4270	6100	81.8	8690	5180	4880	18825
4270	6705	89.9	9300	5180	4880	19960
4270	7315	98.1	10060	5335	4880	21320
4270	7925	106.3	10670	5335	4880	22910
4270	8535	114.5	11280	5335	4880	24155
4270	9145	122.7	11890	5335	4880	25400
4880	6100	93.5	9200	5920	5600	20570
4880	7320	112.2	10420	5920	5600	25800
4880	8540	130.9	10740	6100	5600	30100
4880	9750	149.5	12850	6100	5600	34400
4880	10975	168.2	14100	6100	5600	39500
4880	12195	187	15300	6100	5600	42100
4880	13415	205.7	16500	6100	5600	46300
4880	14635	224.4	17800	6100	5600	49400
4880	15850	243	19000	6100	5600	53500

The data presented in this bulletin is for informational purposes only.
*Less discharge apparatus.

Laboratory & Pilot Testing Facilities

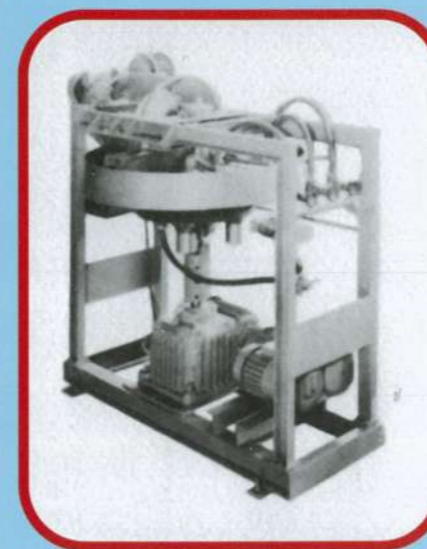
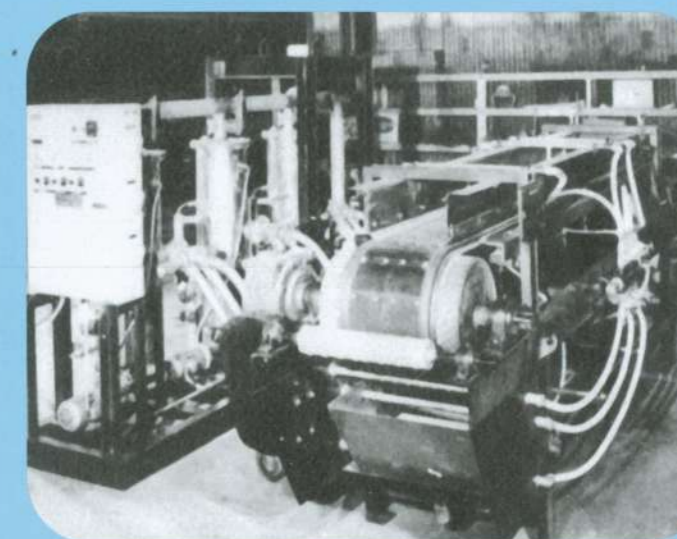
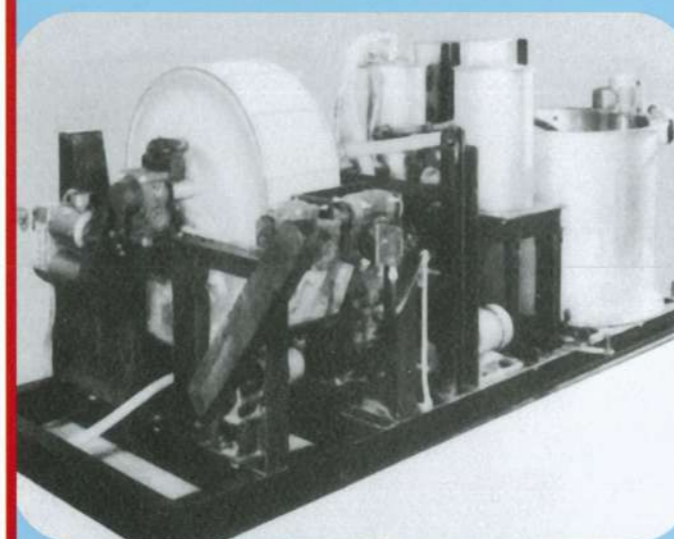
Due to the need for the accurate determination of filtration rates and characteristics for each individual application, Indeng has a major investment in both laboratory and pilot scale equipment.

Standard measuring equipment used includes, moisture meters, drying ovens, electronic scales, pressure gauges, etc.

The laboratory is operated by qualified personnel experienced in filtration in order to ensure that the optimum solution to your process problem is found.

The laboratory is well equipped to determine filtration rates and characteristics using specialized test apparatus (designed and manufactured by Indeng) which ensures the closest possible laboratory simulation of the type of vacuum filter being studied.

Filtration test-work is usually carried out free of charge unless extended test-work is required.



The pilot scale equipment available includes 0.9 square metre Rotary Vacuum Drum Filter stations; 0.9 square metre Travelling Belt Filter stations and an 0.7 square metre Horizontal Rotary (Pan) Filter.

Pilot scale equipment is used for on-site evaluations and determinations in order to confirm the data obtained in the laboratory (such as filtration rates, optimum wash consumption and discharge characteristics) under actual operating conditions with fresh feed taken directly from your process plant.

Pilot equipment is usually supplied free of charge for an initial period and is subject to a small rental charge for extended use.

Our experienced filtration engineers are available on-site to assist with start-up and determination of the filtration parameters when required.