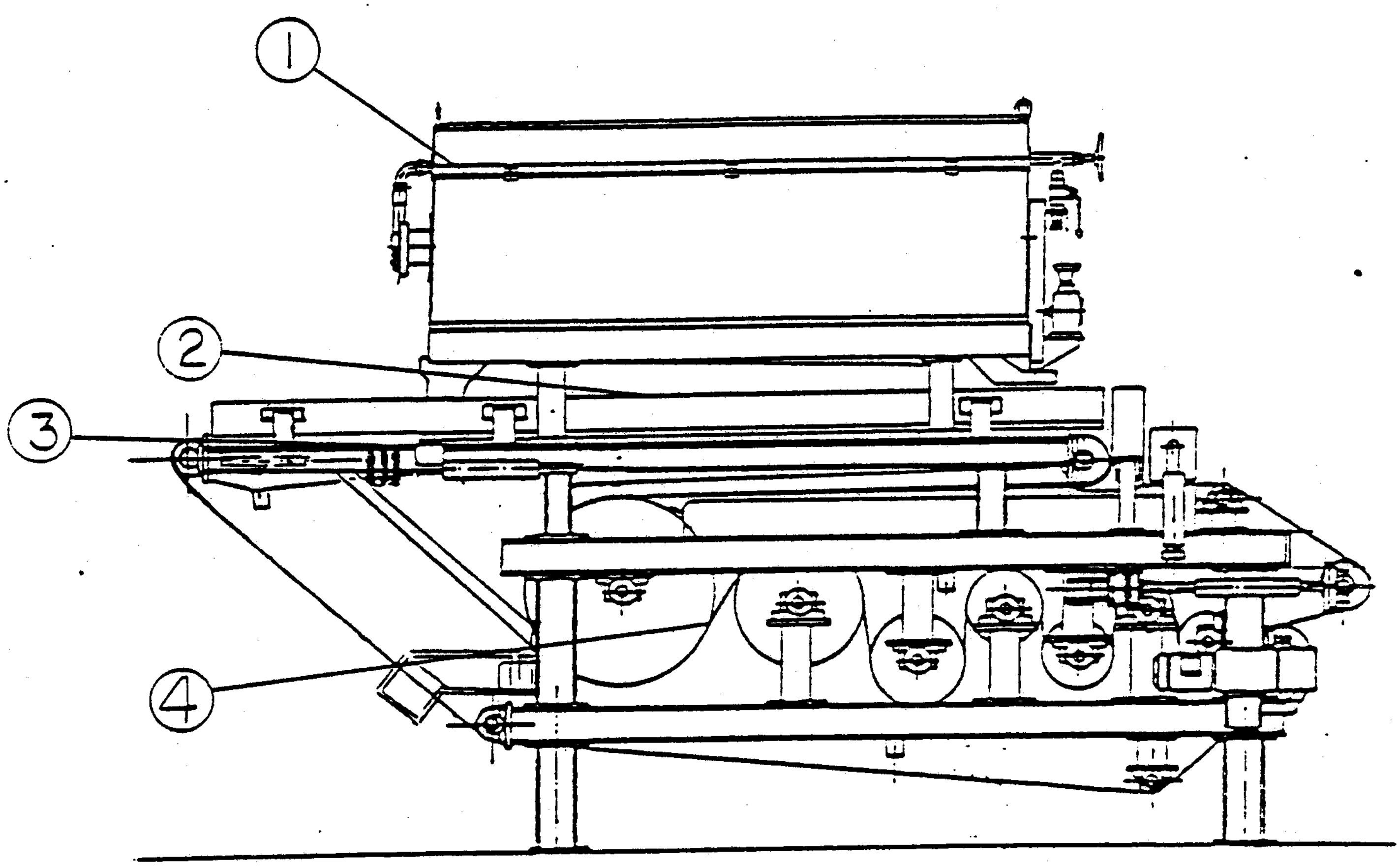
1.0 THEORY OF OPERATION

The CF/SMX-1 employs the dewatering physics of gradual mechanical dewatering. This principle states that the more liquid removed from the sludge, the more stable that sludge becomes, thus allowing the application of greater pressure. This ultimately results in a drier cake as opposed to other dewatering devices. This method of gradual dewatering is accomplished on the CPF/SMX-1 by utilizing four dewatering zones:

1) Rotary Screen Thickner (RST) (Optional)
2) Gravity Zone
3) Wedge zone (Low Pressure)
4) S-roll Zone (High pressure)



Polymer is injected upstream of the RST or Belt Filter Press to cause Flocculation of the solids. (see Polymer Information following Theory of Operation).

The flocculated sludge flows either directly into the headbox or through the RST. The RST is a rotating cylindrical screen that removes free water from sludge by simple gravity drainage. The rotating action is advantageous in that it does not allow solids to mat against the screen, which hinders drainage. The filter media consists of an interwoven polyester screen that is fastened around the cylinder. The sludge then flows into the headbox where it is uniformly distributed across the moving upper belt. The rest of the free water is removed via gravity drainage. Plow chicanes may be added to gently turn the sludge during the gravity drainage phase. The moving belts carries the sludge into the low pressure (wedge) zone, where the upper belt gently converges with the lower belt, gradually applying increasing pressure. The low pressure zone utilizies this form of pressure to remove capillary water from the sludge and thus form a stable cake for the high pressure zone. The SMX-S roll configuration provides surface pressure via a serpentine arrangement whereby belt tension is transformed into increasing surface pressure by deflecting the wire encased sludge around rolls of decreasing diameter. The moving belts then carries the sludge, that is been dried to a cake like consistency, to the drive rolls where it is removed by the doctor blades. The cycle is then repeated.

POLYMER INFORMATION

Polymers and synthetic, high molecular weight chemicals designed to serve an aid in the requirements of many liquid-solids separation process. Generally, these chemicals are acrylamide-based polymers. Water in a sludge can be classified into three different forms:

1) Free water
2) Capillary water (Intercellular water)
3) Intracellular water (within sludge cells)

A polymer flocculates the solids causing the solids to clump together increasing the size of the flocs. This does three things to aid in dewatering:

1) Concerts capillary water to free water, which drains easily in the gravity and first stage of the wedge zone; thereby decreasing the hydraulic loading and increasing solids throughput.

2) Increases the diameter of the sludge particles (larger flocs) thereby decreasing the amount of small particles extruding through the belt, thus increasing solids capture.

3) Forms a more stable cake, thus allowing more pressure to be applied and increases cake dryness.

Wide variations in the nature of industrial and municipal treatemnet process make it extremely difficult to predict the specific polymer that would be most effective in each application. Therefore, it is often necessary to carry out a series of laboratory test swith several polymers in order to determine the optimum product for a given application.

There are several basic variables that influence the performance of these polymers. The most inportant ones are the ionic character (anionic, nonionic, cationic), level of ionic functionality, and molecular weight.

The ionic nature of polymer is an important characteristic, which, when properly considered, often leads to the selection of more effective materials in a solid-liquid application. It is the ionic nature of polymer which assures that these materials will attach themselves to the suspended particles in the system. This attachment or absorption is a necessary prerequisite for the flocculation phenomena. Therefore, the charge distribution in a particular polymer influence floc size, floc density, and floc shear stability characteristics.

Another important polymer characteristic is the molecular weight of the polymer. As more and more experience in the mechanistic aspect of polymer flocculation is obtained, the one thing that is increasingly evident is that as the molecular weight of a polymer increases, the material becomes increasingly effective as a flocculant. Inorganic chemicals such as ferric chloride, lime, or betonite clay are occasionally used as conditioning agents to enhance pressure stability of the sludge. The conditioning agents may change the charge characteristics of the sludge, so that a different polymer may be required.

Polymers come in two different forms: liquid and solid. Each type has advantages and disadvantages.

Dry Polymers

Advantages	Disadvantages
Long storage time (1 year)	Complex make-up system
Less storage area needed	Dusty (could be hazardous)
Very effective in Cationic range	Must handle manually (lift & pour)
Less transportation cost	Usually more expensive ($/Ton)

Liquid Polymers

Advantages	Disadvantages
Easily made-up	Low storage time (6 mos. 10%)
No handling necessary (pump)	High transportation costs
Fast dissolving rate	Anionic range-usually insufficient
May use bulk storage	Large storage area
Economical	

Polymers, liquid or dry, come in a varying charges and molecular weights. All claims to be the highest molecular weight, and as this is very difficult to determine, it is difficult to compare polymers from different companies by molecular weight. Polymers are usually classified by their ionic nature, i.e., medium high anionic, high cationic, low anionic, etc.

It is important that in mixing dry polymers prior to use with the ARUS-ANDRITZ CPF, that the solution should be mixed with clean water, free of suspended matter and dissolved organics.The PH of the water should be around neutral. Although increased temperatures will facilitate the rate of solutions, temperatures higher than 105 degrees Farenheit should be avoided to prevent flocculant degradation.

An eductor system should be used in mixing dry polymers. These can be obtained from polymer manufacturers. Another stock solution should be about 0.5%. Anionic polymers should be mixed at 0.25% as their viscosity is usually much greater than the cationic polymers. Liquid polymers should be prepared from 1-2.5% (by weight). Before application to the sludge, the polymer should be diluted to 0.1%. This should be done with a dilution T installed after the metering pump. Injecting the polymer at this consistency insures complete mixing of the polymer molecules with th sludge. If the polymers were to be injected to a higher consistency,(0.5% for example), the polymer molecules would tend to "string along" with one another, therefore decreasing the efficiency and decreasing cost.

Polymers flocculate solids irreversibly and quickly. It is important to inject the polymers effectively, because only then is it possible to obtain maximum efficiency. Uniform distribution of the polymer in the sludge at the feeding point and immediately thereafter is essential, and excessive stress of the already formed flocs must be avoided. This is considered in the design of the CPF. A polymer injection point is supplied on the stainless steel inlet pipe prior to the mixing drum. The mixing drum is stainless steel driven by a variable speed drive. Baffles are on the inside of the drum., and as the drive turns, the sludge is gently mixed with the polymer before being distributed on the belts.

It should be noted that even though an injection point is supplid with the CPF, more injection points should be placed upstream from the CPF. On extremely thick sludges (4-10%, O.D.) a considerable amount of mixing will be necessary to insure complete flocculation. Sometimes this is done by injecting the polymer before a positive displacement pump; Moyno's have been used. This action helps to mix the sludge with the polymer without shearing the floc. Inline chemical mixers have been used with succes, especially for mining slurries.

When dewatering high consistency sludges, it is also important that the polymer be diluted to at least 0.1%. When working with dilute slurries (1-2%) , the polymer may be injected at 0.25 to 0.5%. The excess water in the sludge acts as a dilutant, and therefore, no external dilutant, and therefore, no external dilution water is needed. This cuts down on water consumption and decreases the already excessive hydraulic loading of the sludge.

I. Polymers

A. Manufacture

1. Three types of polymer

a. polycrylamide
   - synthesized from petroleum
b. polyethylene oxide
   - synthesized from petroleum
c. guar gum derivative
   - natural

2. Polymer Synthesis

With starting molecules of acrylamide or ethylene oxide and the correct conditions of heat and PH, the individual units, molecules, are lenked together in a chain. The more molecules, the longer the chain will be. Each molecule has a weight: the moleculare weigth. The combined weights of all the molecules gives the molecular weight of the polymer. Polymer means many molecules.

B. Polyelectrolytes

- Cationic, Anionic, Nonionic - Figure 1

1. Charge type

a. cationic - positive
b. anionic - negative
c. nonionic - no charge

2. Relative charge density

- Each individual molecule (link) along the length of the molecular chain may have a positive, negative or no charge.

a. If only a few of the molecules in a molecular chain have a positive or negative charge, then the charge density is very low.

b. If all of the molecules in a molecular chain have a positive or negative charge, then the charge density is extremely high.

c. If approximately half the molecules in a malecular chain have a positive or negative charge, then the charge density is medium.

d. When none of the molecules in the molecular chain have any charge, the polymer is nonionic.

e. Relative charge density can be described as a percent of total molecular chain (% charge).

- 0%, no charge density, nonionic
- 1-20%, very low charge density, cationic or anionic
- 21-40%, low charge density, cationic or anionic
- 41-60%, medium charge density, cationic or anionic
- 61-80%, high charge density, cationic or anionic
- 81-100%, extremely high charge density, cationic or anionic

3. How Polymers Function

As mentioned earlier, polymers have either a positive charge (cationic), a negative charge (anionic), or no charge (nonionic). Similarly, all sludge or slurry particles have a positive, negative, or no charge. A polymer with positive charges along its molecular chain attracs slurry particles that have negative charges. A polymer with negative charges along its chain attracs slurry particles that have no charges. Figure 2.

4. Polymer Companies

Competition is intense. All companies manufacture polymers as powders, emulsions and liquids. Some specialize in powders; some specialize in emulsions and some in liquids. After sales, service is an iportant aspect for customer consideration.

5. Prices for polymers are dependent on cost of manufactoring. The process of contructing the lomg molecular chains from small molecules produces the polymer in a liquid form. As a liquid, the active solids are low in content.

a. Polymers are sold as liquids directly from the manufactoring process

b. Emulsifiers can be added to the liquid so that the active solids will be concentrated. Emulsifying the liquid polymer adds to the cost of manufactoring; therefore the price of an emulsion is higher than for a liquid.

c. The liquid polymer, directly from the manufactoring process, can be dehydrated and sold as a powder. The process of preparing the powder, heating and grinding, adds to the cost of manufactoring; therefore, the price for a powder is higher than for an emulsion and much higher than for a liquid.

d. Another factor in determining polymer price is charge density. Manufactoring costs increase as the charge density increases. High charge density polymers cost more than low charge density polymers.

e. Cationic polymers are generally priced higher than anionic and nonionic polymers.

C. Polymer Solution Preparation

1. Mix Concentrations

a. liquid: 3-10% by weight, 10% is the extreme limit
b. emulsion: 0.5-1% by weight
c. powder: 0.1-0.5% by weight

2. Density

When preparing a solution from a powder polymer and no weighing scales are available, the density will indicate how much volume in certain weight will occupy. g/ml, lbs/gal, lbs/ft3.

3. Viscosity

The percent concentration of a polymer solution is limited by its viscosity. The percent solutions for powders, emulsions, and liquids that were recommended earlier were based upon their viscosity.

4. Mixing Time

- Mix until fisheyes and lumps are dissolved

a. liquid: 5-15 minutes
b. emulsion: 15-30 minutes
c. powder: 15-49 minutes

5. Mixing Energy

- Excessive RPM's will shear the polymer molecular chains

6. Polymer Aging

If kept dry, powders will last years. Liquid and emulsion polymers will not last longer than six months.

7. Polymer Mix Water

Mix water should be free of suspended solids and low in dissolved solids.

D. Polymer Uses

1. Application to sludge or slurry

a. dosages

Liquid polymers require much higher dosages to flocculate a slurry than to powders though the cost are equivalent. Emulsion polymers require a lower dosage to flocculate a slurry than do liquid polymers, but emulsion polymers require a higher dosage than a powder. Example: $20/Ton conditioning costs prices: Powder $2/lb, Emulsion-$1/lb, Liquid-$0.10/lb.

$ 20/Ton x 1X/$2 = 10lbs/ton
$ 20/Ton x 1X/$1 = 20lbs/ton
$ 20/Ton x 1X/$0.10= 200 lbs/ton

b. Polymer dilution water

By diluting the polymer solution prior to mixing the polymer with the slurry, flocculation will occur with greater efficiency; no polymer will be unused.

c. Polymer/Slurry mixing energy

Excessive RPM's will shear the slurry particles from the polymer

d. Effects of slurry on polymer

PH of slurry: no effect for nonionics
no effect above PH 5 for anionic
some cationics effected above PH 8

Cold: increases viscosity of polymer; therefore, reducing mixing efficiency

: concentrated, liquid or emulsion polymers may be harmed by freezing

Heat: will not degrade polymers
Heat above 100°F will degrade polymer causing polymer consumption to rise

E. Specific applications

1. Municipal - usually medium to high cationic
2. Pulp and paper - usually low to medium cationc
3. Mining - usually low to high anionic; may require anionic
   as cationic as dual system

4. Industrial - cationic and anionic

II. Inorganic Reagents (coagulants)

A. Lime (calcium oxide or calcium hydroxide)

1. Sold as a powder or in solution
2. Price: approx. $ 0.10/lb
3. Used to raise PH of a sludge or slurry
4. May react with sludge to form a microfloc for clarification
5. When mixed with sludge prior to polymer conditioning, may lower
   polymer consumptio, but will not usually change polymer charge type.

B. Ferric Chloride

1. Sold in solution
2 Price: no answer
3. Will form a microfloc for clarification when added to most
   organic sludges.
4. When mixed with sludge prior to polymer conditioning, will lower
   PH & usually change polymer requirements (charge and consumption)

C. Alum

1. Sold in solution
2. Price: approx. $ 15/lb
3. Will effect sludge in a manner similar to Ferric Chloride

Figure 1 Cationic, Anionic, Nonionic Charge

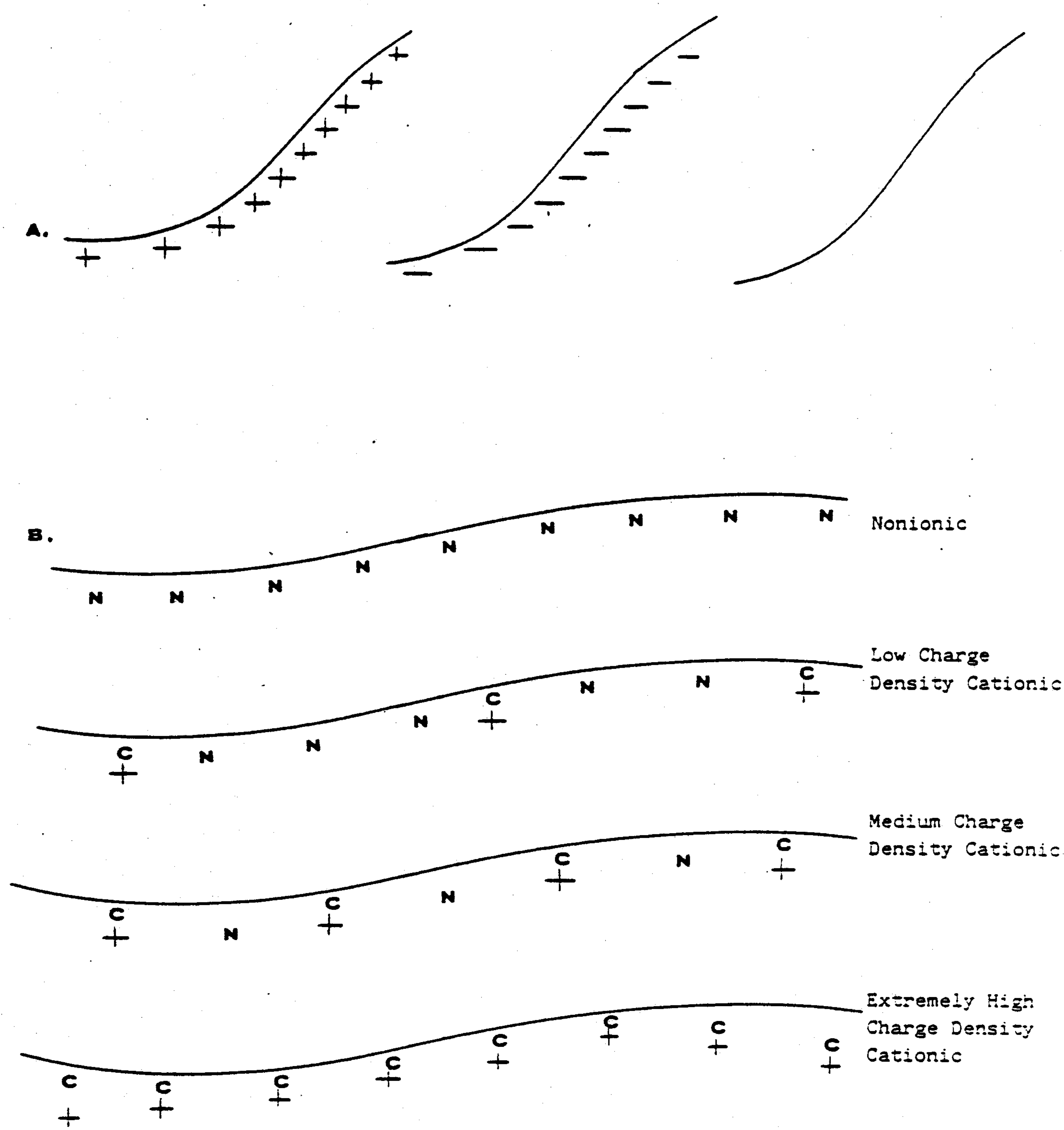
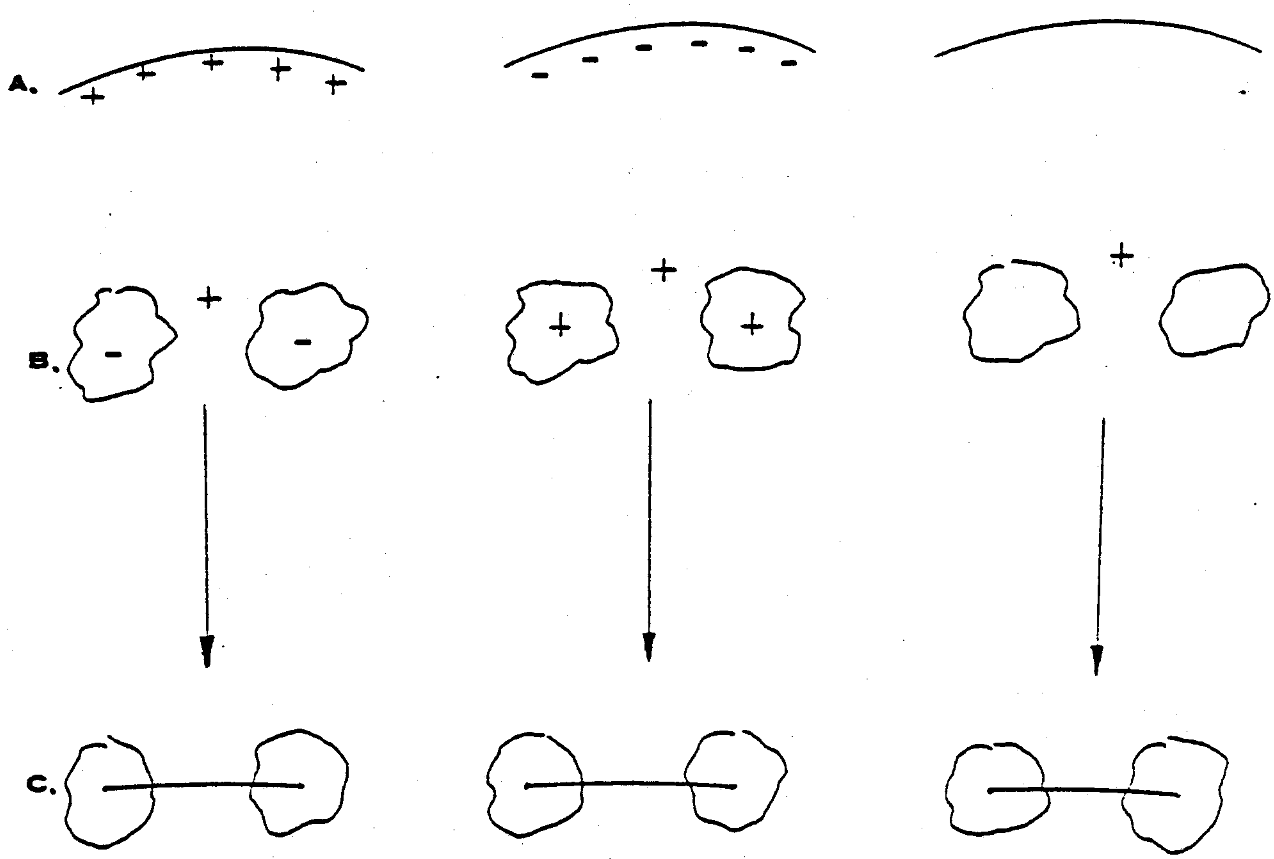


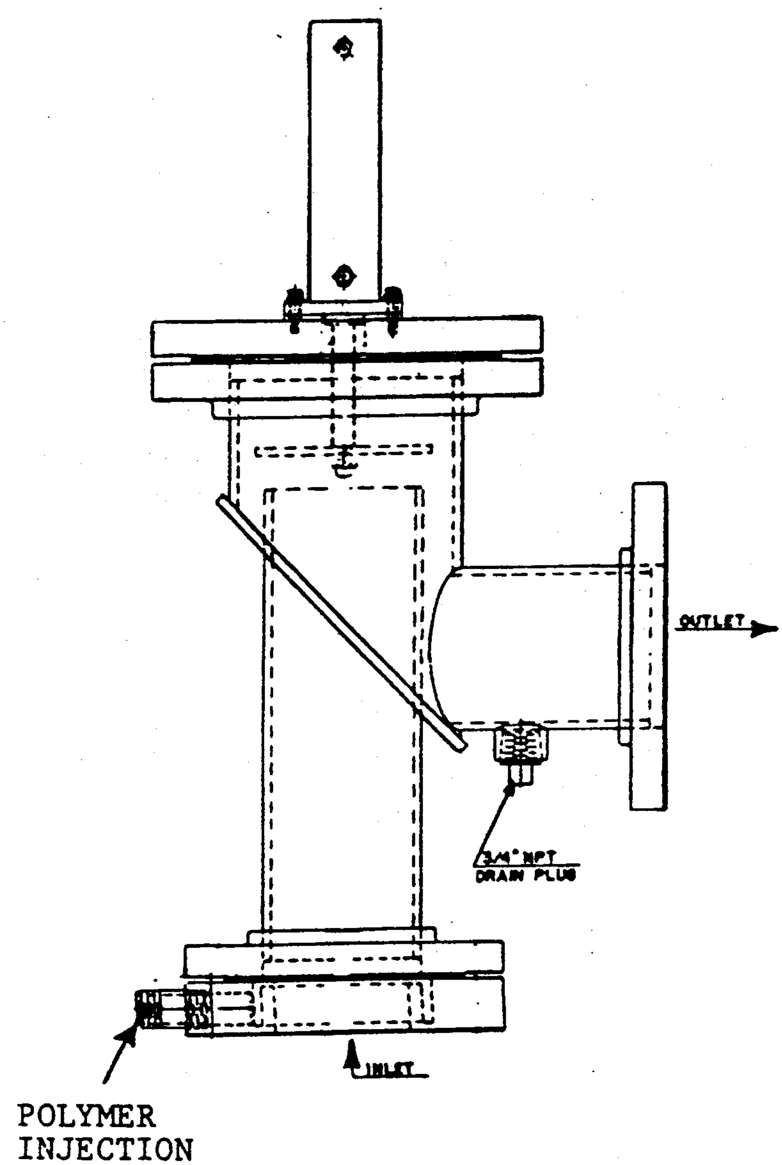
Figure 2 Charge neutralization and Sweeping effect



2.0 DESCRIPTION OF THE SMX

2.1 TURBO VORTEX MIXER

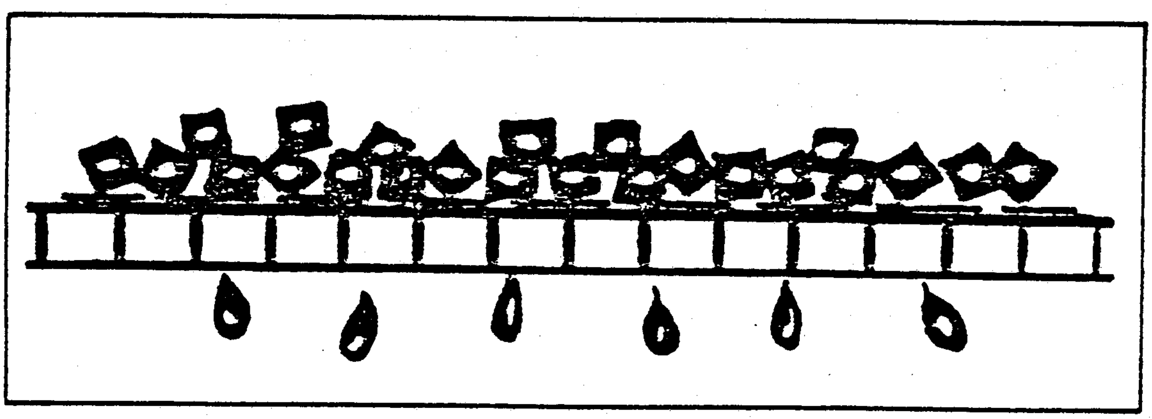
The Turbo mixer is an in line Vortex mixer used to mix sludge and polymer prior to intruduction into the distribution headbox. The mixing takes place by the flash mixing of the sludge and polymer. This is done by introducing the diluted polymer through a tangetial injection ring just prior to the inlet flange to the mixer. Within the mixer, the sludge/polymer mixture is then deflected against a mechanically loaded plunger, causing the mixing and turbulence necessary for flocculation. The flocculated mixture then exits through the discharge port and into the Rotary Screen Thickener or gravity section on the distribution headbox.

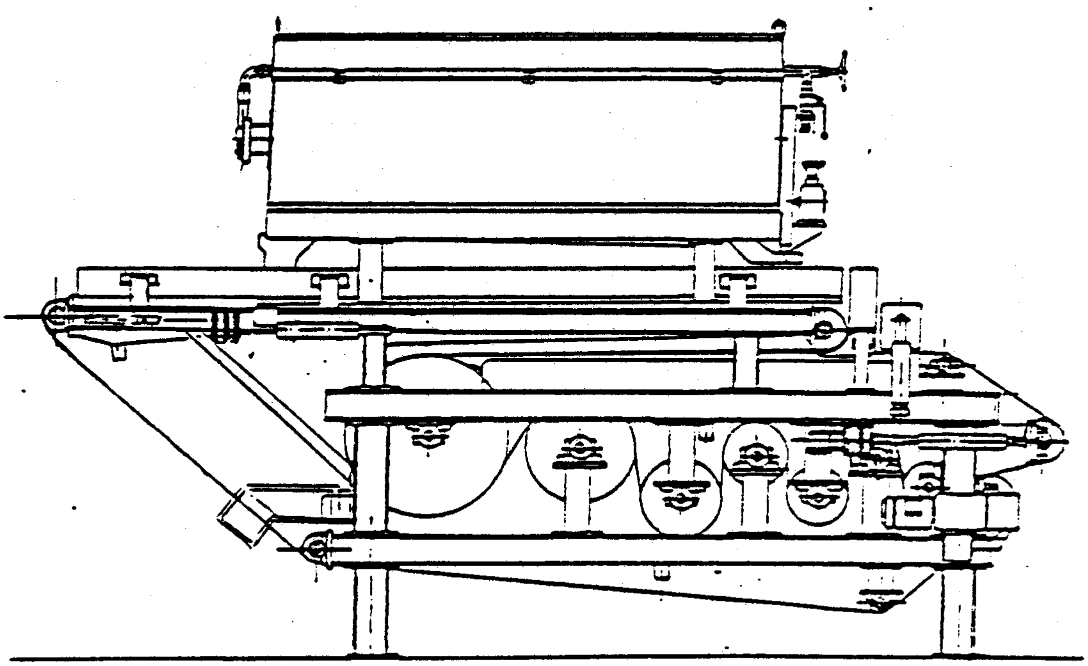


2.2 GRAVITY ZONE

This is perhaps the most important stage in sludge dewatering with a belt press. A good flocculation to insure quick dewatering in this stage is very important. It is for this reason, the gravity dewatering section is left open. Simple vision monitoring of this stage will almost always insure proper dewatering in the final stages. No mechanical pressures are being applied at this point. Even so, as much as 60% of the water will leave during this first stage.

Several rows of horizontal chicanes may be added in the gravity zone. The horizontal chicane gently turns the sludge to create void areas in which the free water drains through the belt.

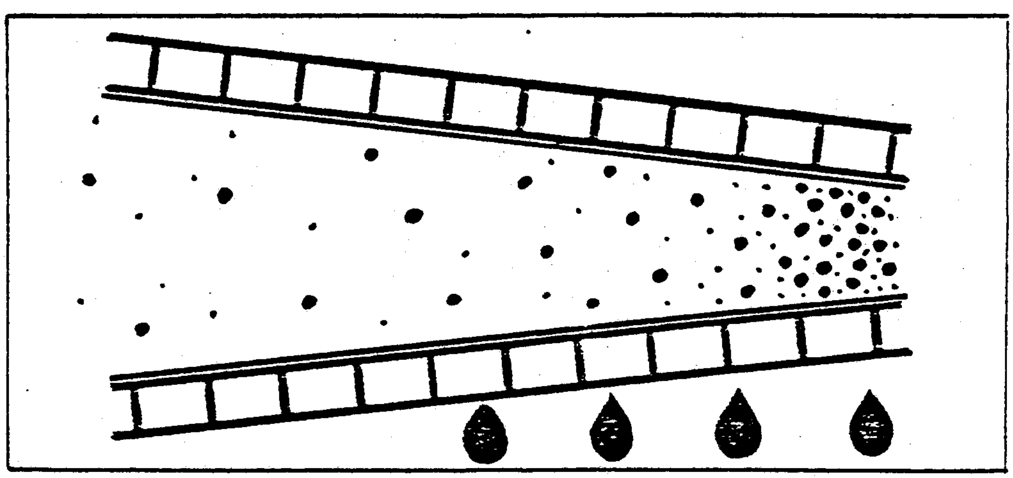




2.3 WEDGE ZONE

In this stage, mechanical pressure is applied by means of a descending wedge. The bottom grid is fixed on an horizontal plane while the upper grid is mounted on a moveable frame, allowing for changes in angle, which in return varies the pressure in the wedge. The angle formed in the wedge ranges from 1-2°. The sludge is contained in the wedge zone by means of lateral seal, (PVC or Aluminum). When starting up a machine, the most important detail to look for in the wedge, is to make sure that stabilization of the sludge is reached before entering the "S" or high pressure section. If the proper stabilization is not reached, this can be easily detected. Extrusions of the sludge will occur just prior to the high pressure "S" section. This problem can be corrected either by changing the velocity of the wires, changing the polymer rate, changing the sludge feed rate, or changing the angle of the wedge itself. In most cases, only one of the mentioned changes need be made. It would be advisable however to systematically check-out each factor and change the one which will best fit your operational needs.

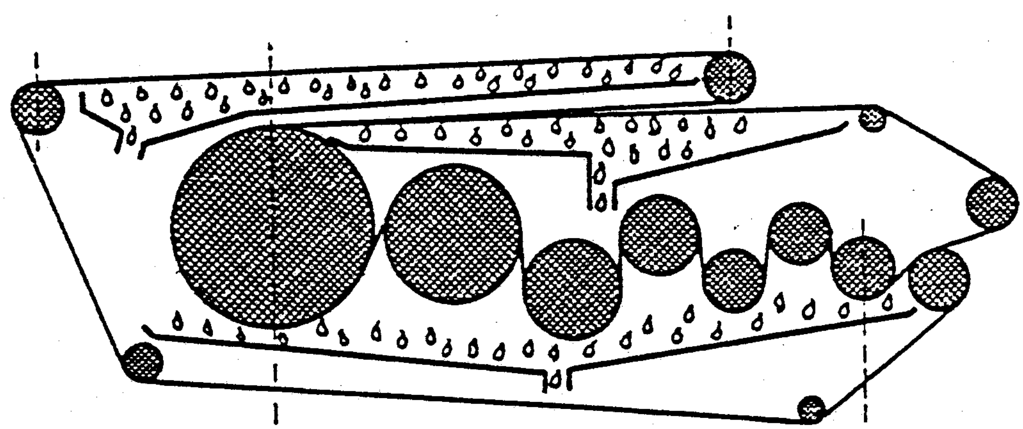
WARNING: When making adjustement to the wedge, make sure that belts are not moving. Never work on a machine while it is in operation !!!



2.4 "S" SECTION

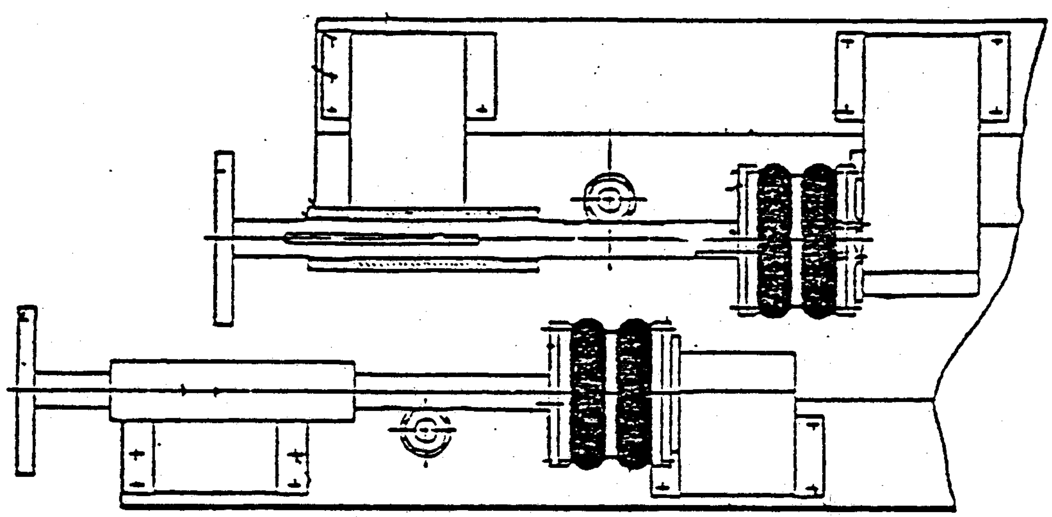
This is the last stage of dewatering.This is also the stage in which the highest possible pressures are exerted.

The SMX-I (S-8) machines are equipped with an eight (8) roll S-section. This is "S" module which is surface pressure, achieves the high pressure through a serpentine wrap. This arrangement allows for ever increasing surface pressure by deflecting the wire encased sludge around rolls of decreasing diameter.



2.5 BELT TENSIONING DEVICE WITH PARALLEL GUIDE

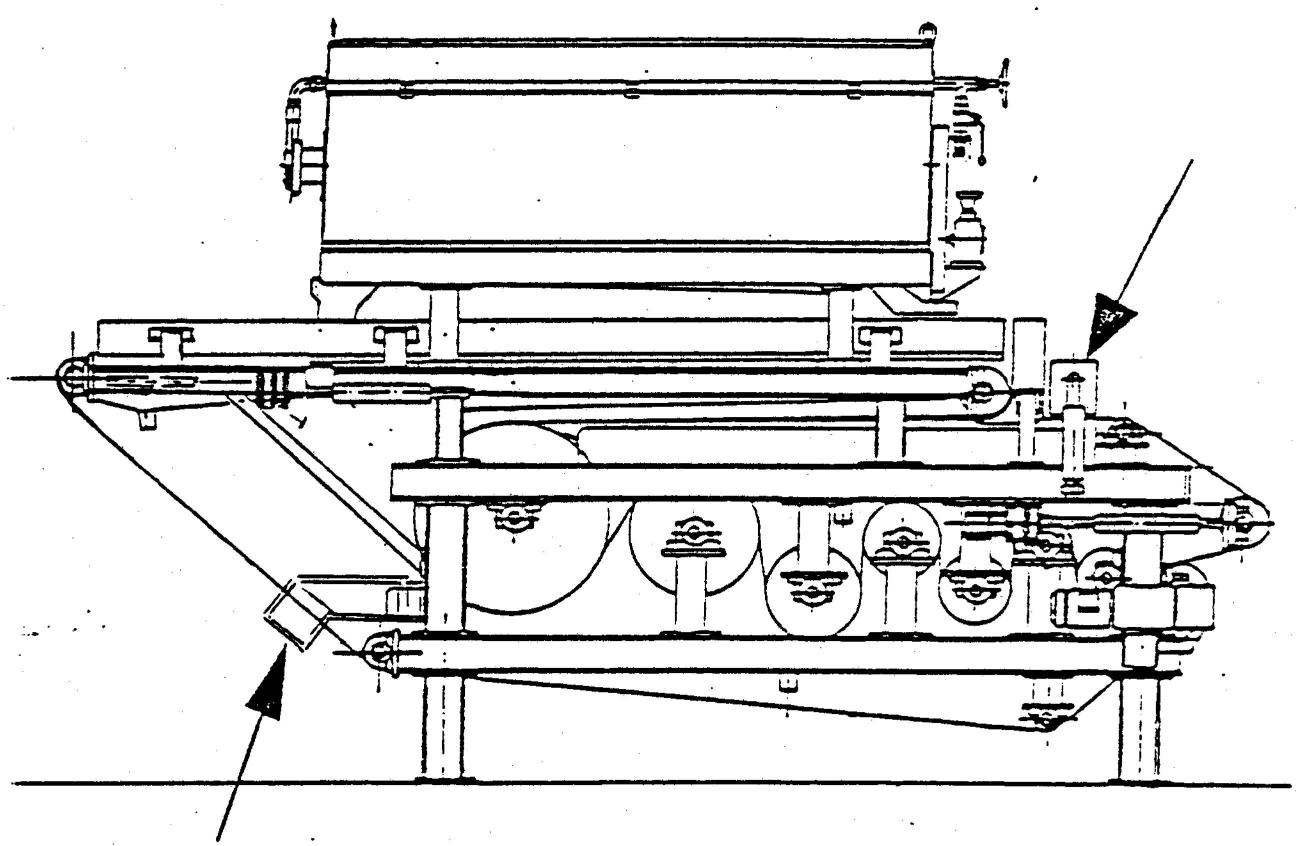
Belt tensioning is made by means of air bellows. For details on pneumatic force generated, please refere to the belts tension charts located on the pneumatic control panel.To insure parallel travel of the breast roll during belt tensioning operations, a shaft assembly with a gear insert on each end interlocks the two (2) air bellows together. Since this assembly is preset at the factory no adjustement is necessary . A handcranck or wrench is provided to manually adjust the rolls during the belt change operation.



2.6 BELT CLEANING DEVICE

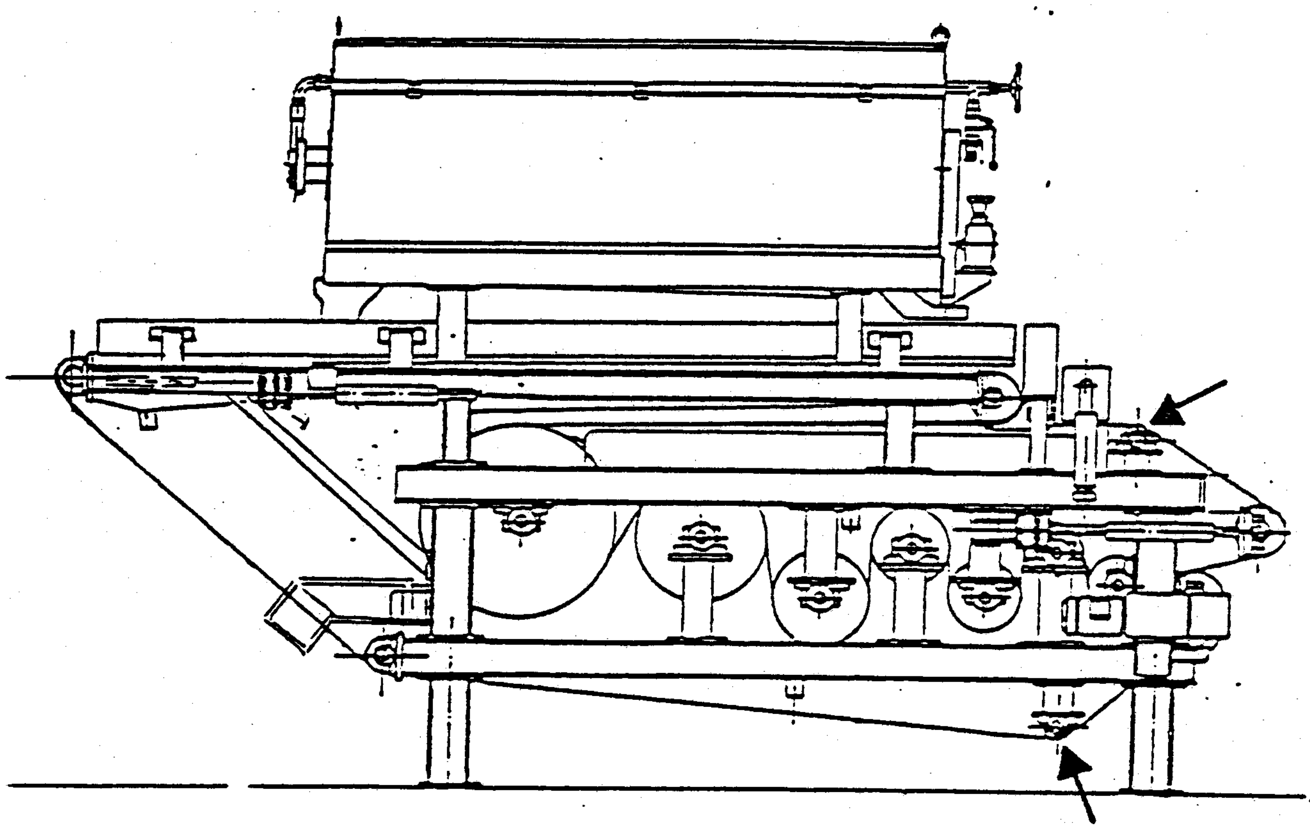
A belt cleaning shower is located both on the upper and lower belts. They will clean any particles that may adhere to the belt while in operation. The hand-wheel located at one end of the spray pipe is connected to a S/S brush. When turned, the brush cleans the nozzles and water back- flushes all particles within the shower itself. The hand-wheel must be turned to the fullest opening to get proper cleaning.

The optional Rotary Screen Thickner (RST) also is supplied with a belt cleaning shower that operates identically to the SMX. The belt cleañing device is described in detail in Items 6.0



2.7 BELT TRACKING DEVICE

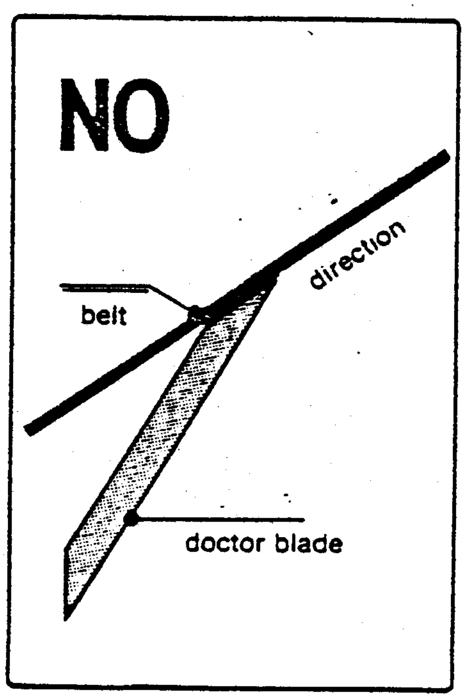
The belt tracking device is of pneumatic design. Both the upper and lower belt have tracking system. This tracking system will keep the belt centered on the rolls at all times. Tracking is done by a rubber coated roll which is activated by two (2) air cylinder. A scanning finger monitors the location of the belt at all times and keeps the tracking roll in the needed position. For complete instructions on the maintenance and operation of this system, please refer to the operating instructions.

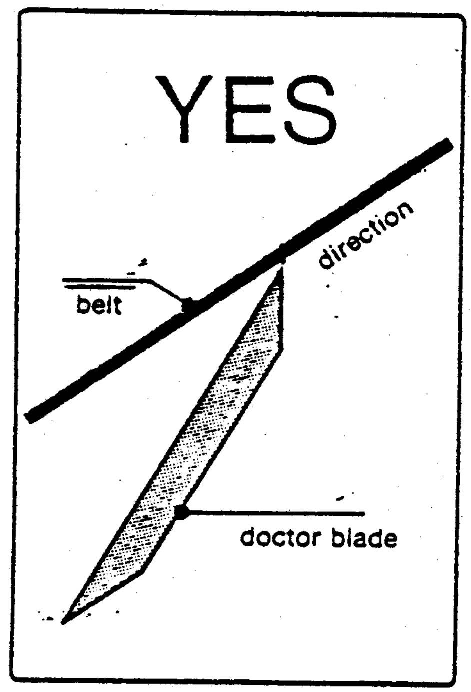


2.8 DOCTOR BLADES

Doctor blades for SMX are used to remove the cake for the wire belt. The doctor blades should be adjusted to ride easily on the wire so that no material can pass under the blade and be washed into the filtrate by the belt cleaning system. Doctor blades should be checked for wear periodically. Replacement of these blades will vary, depending on the nature of the application. To adjust the pressure of the doctor blades against the belt, use the counter weights provides. Two (2) each weights are provided for each doctor blade assembly.

WARNING: Doctor blades should be inspected to insure good service. A worn or damaged blade may result in short wire life.





2.9 MACHINE DRIVE

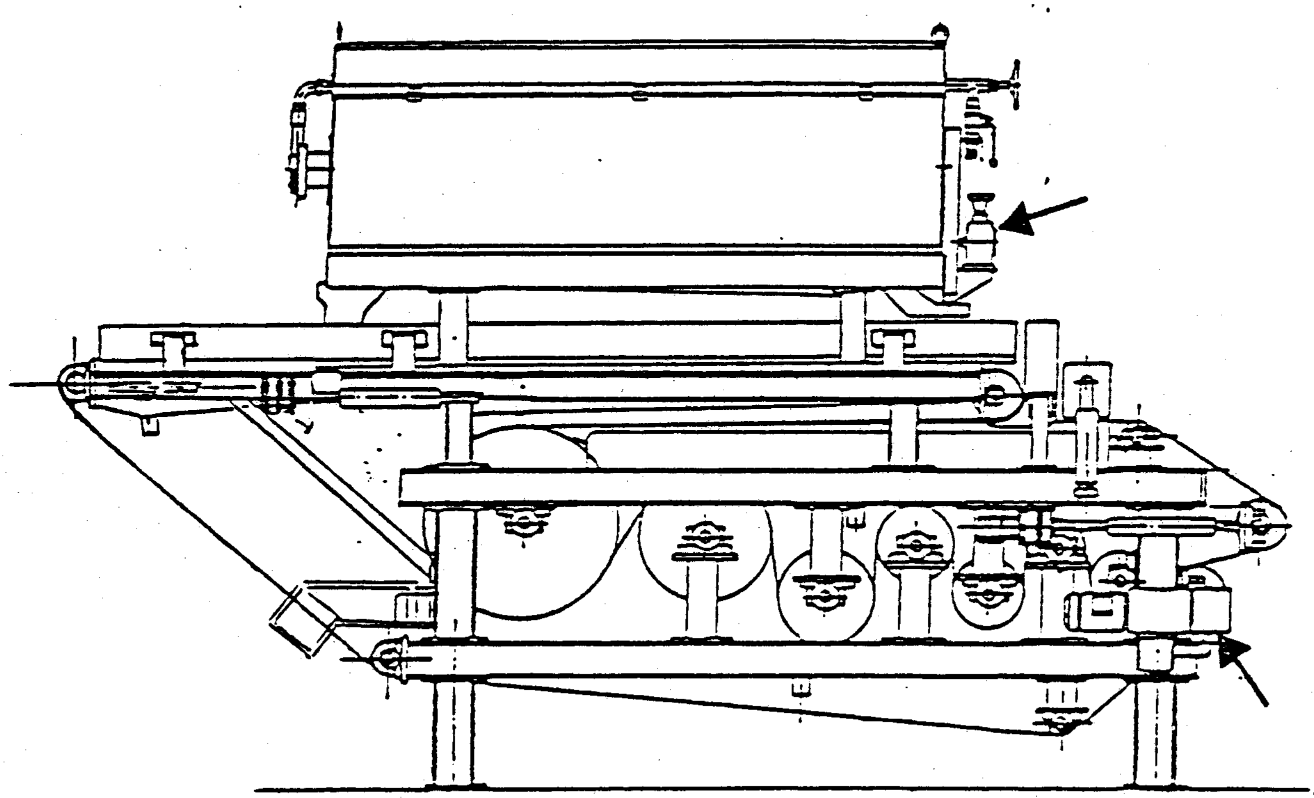
The drive system supplied for your Arus Andritz SMX is a 5.5 HP "AC" mechanical vari- speed. The dirve specifications, as well as the operating and maintenance instructions, for your particular drive system are included in the latter section of this manual.

IMPORTANT: When changing speed of the drive motor, the drive motor must be running. Damage to the belt and gears may occur.

MIXER DRIVE

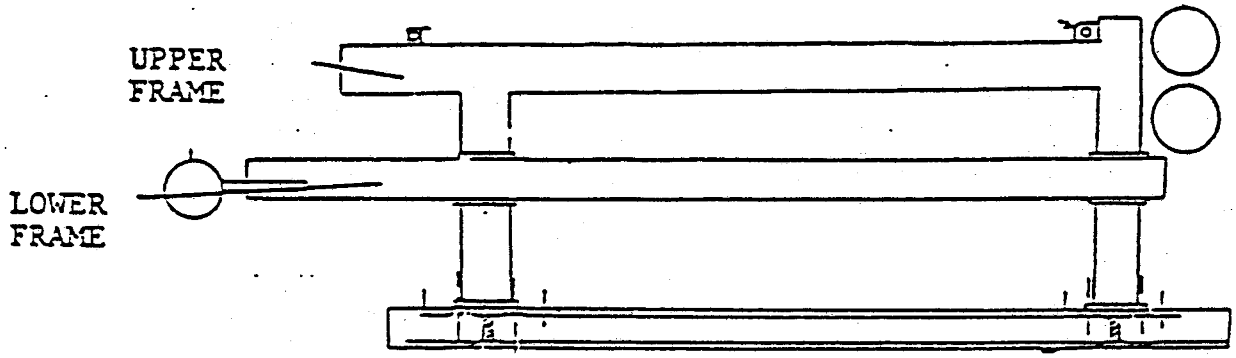
The drive system supplied for your vertical tank mixer is 2 HP "AC" mechanical vari-speed. The drive specifications, as well as the operating and maintenance instructions, for your particular drive system are included in the latter section of this manual.

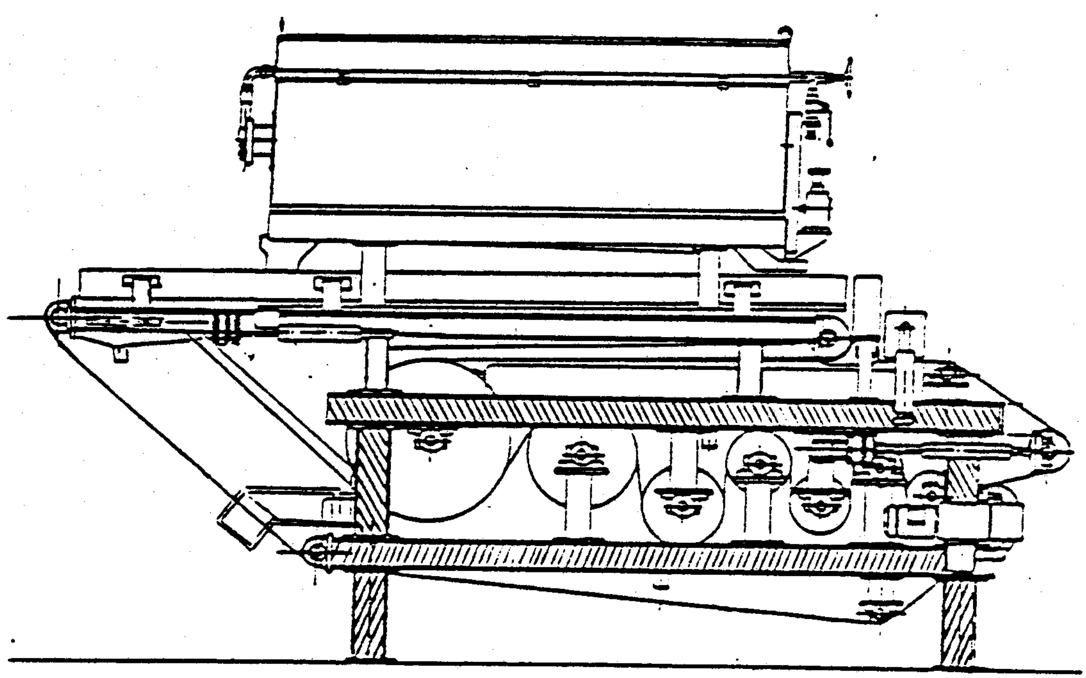
IMPORTANT: When changing speed of the drive motor, the drive motor must be running. Damage to the gears may occur.



2.10 MACHINE FRAME

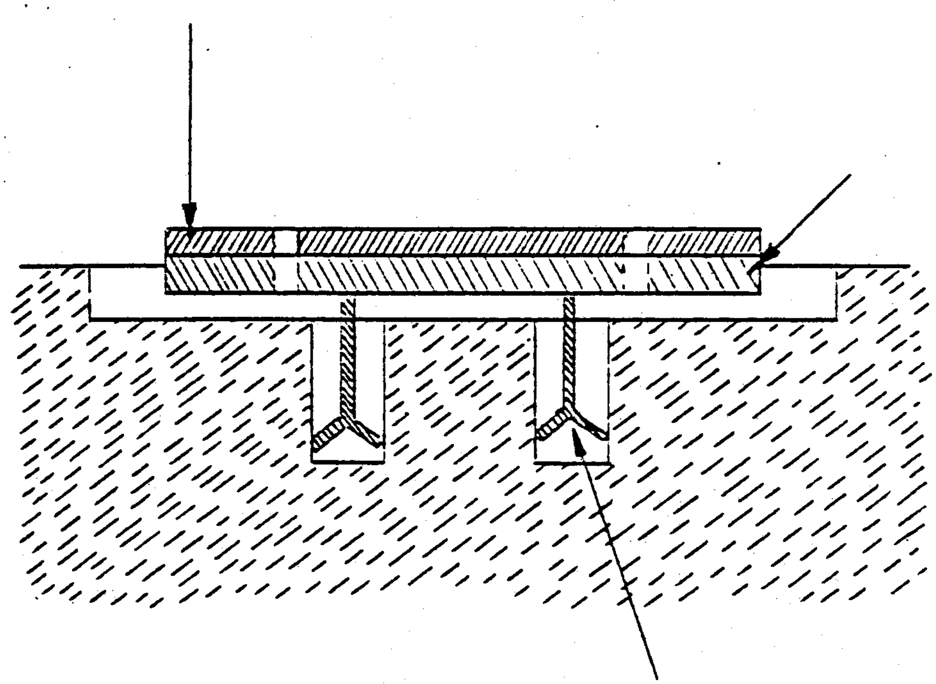
The machine frame serves as the main carriage for the roller assemblies. The frame is constructed from wide flange I-beam and painted with a two (2) part polyurethane paint and primer system to provide a high level of corrosive resistance. The frame consists of two (2) main structures, upper and lower.





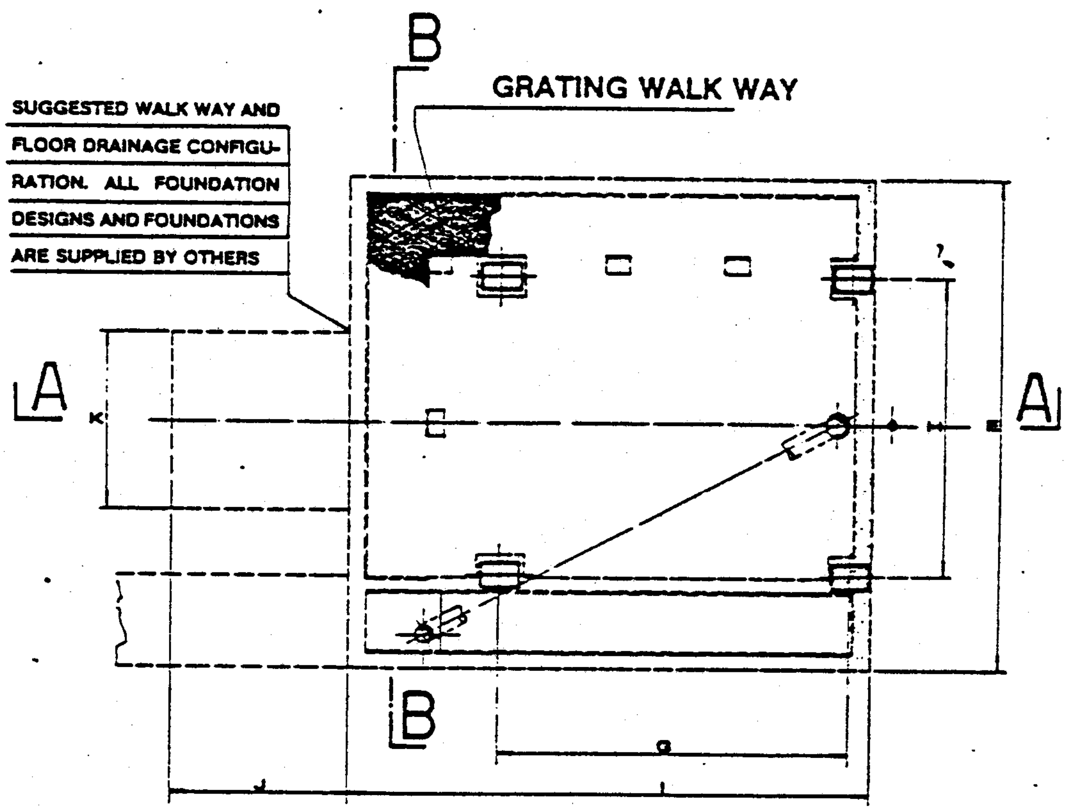
2.11 FOUNDATION PLATES

The SMX comes with four (4) foundation plates. Use of these plates, as later described in the manual, will insure proper leveling of the machine. This is critical in achieving optimum dewatering and equal distribution of the slurry on the belt.

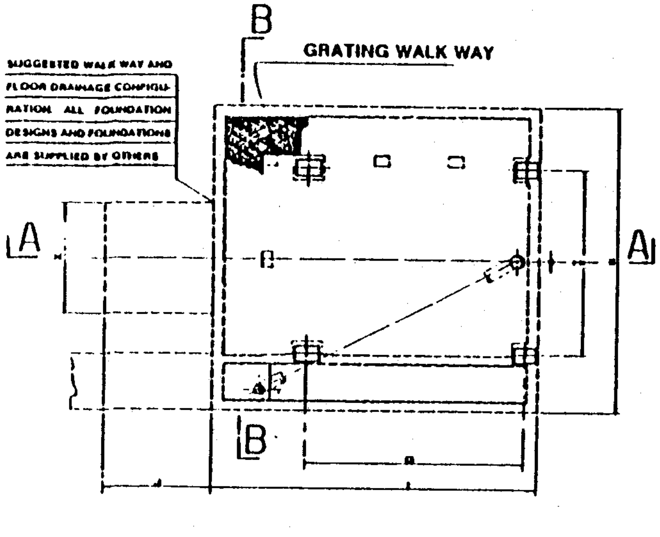


2.12 CONCRETE FOUNDATION

The concrete foundation should be designed to allow central draining of the filtrate and the wire belt cleaning water. Arus Andritz will issue foundation drawings, but please note that these drawings are only suggested for the typical machine work area. Other foundations may be substituted to fit the owners specific needs.



FOUNDATION PLAN



FOUNDATION PLAN

TYPE	UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1000	inch	122.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	142.98	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	116.06	[illegible]	[illegible]
2000	inch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	142.98	[illegible]	[illegible]	[illegible]	19.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DRY WEIGHT (lbs)
[illegible]
2450

MATERIAL SPECS AND UTILITIES

1 FRAME
- Fe 42 B SHEET METAL, POLYURETHANE PAINTED

2 DRIVE AND CENTERING ROLLS
- PIPE ST 52 RUBBER CONVERED (92 SH)

3 PRESSURE AND TENSION ROLLS
- PIPE ST 52 RUBBER CONVERED (92 SH)

4 BELT CLEANING HOUSING
- 304 SS SHEET METAL WITH RUBBER SEALS

5 HEAD BOX
- 304 SS SHEET METAL WITH RUBBER SEALS

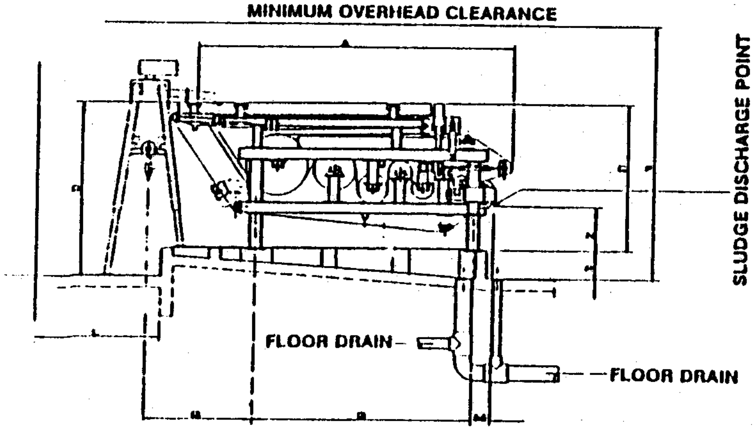
6 FILTRATE TRAY
- 304 SS SHEET METAL

7 FASTENERS
- 304 SS MATERIAL

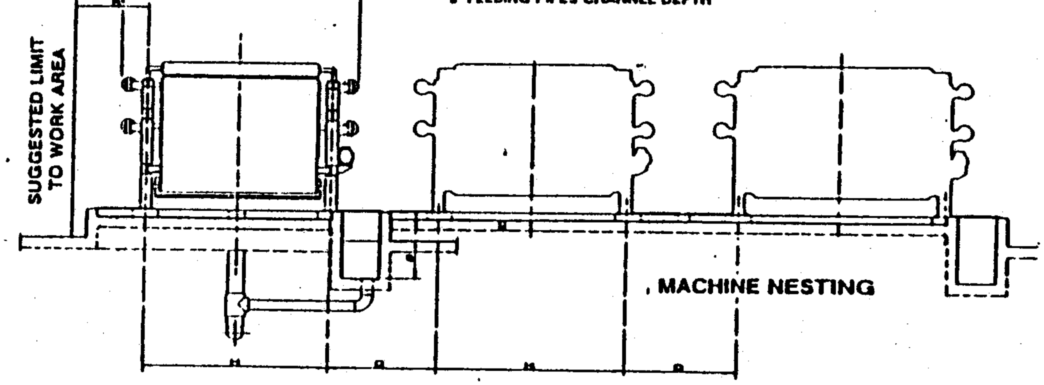
8 UTILITIES
- AIR: type 1000 = 5 mc/h OF 6 bar - type 2000 = 7 mc/h OF 6 bar
- WASH WATER: type 1000 = 130 l/min OF 6 bar - type 2000 = 246 l/min OF 6 bar
- INSTALLED POWER: type 1000 = 2.2 kW - type 2000 = 4 kW

LEGEND

A LENGHT
B WIDTH - OVERALL
C HEIGHT - OVERALL
D SLUDGE FEEDING PIPE HEIGHT
E GRANDING FOUNDATION WIDTH CLEARANCE - SUGGESTED
F SUGGESTED MINIMUM OVERHEAD CLEARANCE
G LEG TO LEG CENTER LINE SIDE ELEVATION
H LEG TO LEG CENTER LINE END ELEVATION
I GRADING FOUNDATION LENGHT - CENTER LINE CLEARANCE - SUGGESTED
J MIXING DRUM GRADING LENGHT (OPTIONAL)
K MIXING DRUM WIDTH (OPTIONAL)
L SUGGESTED LIMIT TO WORK FOR MIXER INSTALLATION (OPTIONAL)
M CENTER LINE LEG TO POINT OF DISCHARGE
N FEET TO POINT OF DISCHARGE
O CENTER LINE MACHINE LEG TO MACHINE LEG - MINIMUM
P FLOOR TO FEET HEIGHT
Q CENTER LINE LEG TO CENTER LINE OF MIXER FEEDING PIPE
R SUGGESTED LIMIT TO WORK AREA
S FEEDING PIPES CHANNEL DEPTH



SECTION A - A



SECTION B - B

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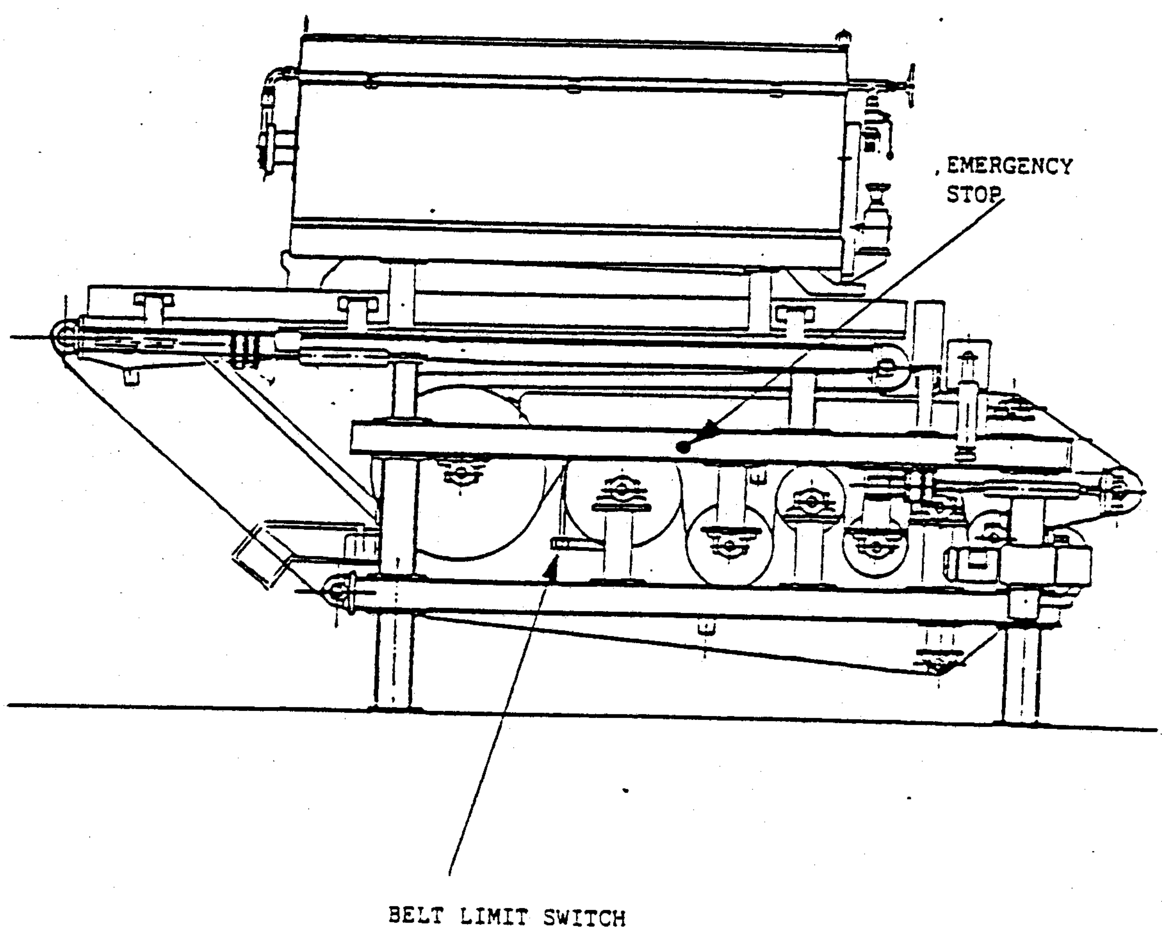
ELIMINATOR
Sales Reference

2.13 BELT LIMIT SWITCH

Should a failure of the pneumatic tracking device occur, (belt tracking) the belt limit switch would then instantly shut-down the machine and the auxiliary equipment, which might cause potential harm if the machine is not running.

2.14 EMERGENCY STOPS

Two and one-fourth (2 1/4) inch red emergency stop switches are located on each side of the machine for complete system shut-down should a hazardous situation occur.



3.0 ARRANGEMENT AND ERECTION OF THE SMX

3.0 ARRANGEMENT AND ERECTION OF THE SMX

The Andritz SMX is delivered to the jobsite with four foundation plates and mounting bolts. The customer will be exspected to prepare the proper foundation for the SMX. Please follow closely the erection instructions on the following pages. If a question should arise during the erection of an SMX that cannot be answered in the manual, please contact Andritz Arlington or your local representative.

3.1 Machine Foundation

The quality of the concrete in regards to strength must be matched to the foundation loads. You may refer to the foundation detail sent in our drawing package.

Depending on the application, the concrete must be resistant to any chemicals which might appear in the filtrate.

IMPORTANT: Exact leveling of the machine is necessary in order to achieve maximum dewatering. The recess for the foundation plates should be exactly as shown on certified foundation plans. Example: setting of foundation plates.

3.2 SETTING OF FOUNDATION PLATES

Foundation plate dimensions (typical) are shown at page 37

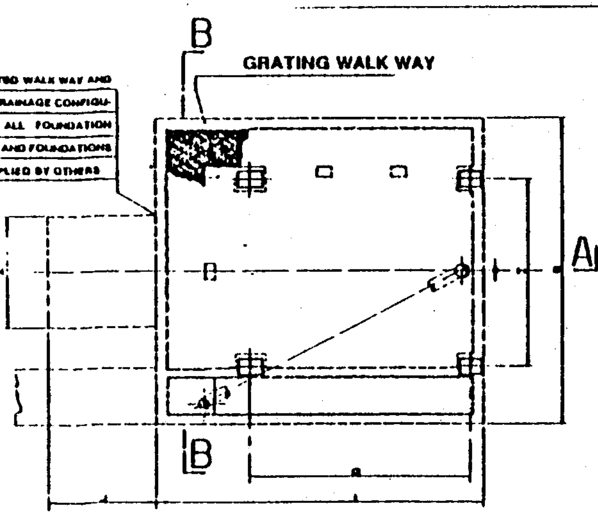
a. Make sure that the recess in which the foundation plates are located are approximately 2" wider on all sides than the foundation plate itself, so as to facilitate the grouting of the plates.

b. Place steel shims in the recess for the foundation plates to rest on. This will allow the grout to pass under the plate. Next, place the foundation plate into the recess with each of the welded-on anchor plates going correctly into their pocket.

c. Set foundation plates with the aid of a builders level and/or surveyors transit, keeping all of the plates exact as possible (1/32" allowable plate-to-plate).

d. Make any fine adjustements necessary, with the aid of metal shims.

e. Grout the plates after exact level between all plates has been achieved. After the grout hardens, the machine may then be placed on the plates.



FOUNDATION PLAN

TYPE	UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1000	inch	210.41	[illegible]	[illegible]	[illegible]	[illegible]	137.70	115.10	[illegible]	192.91	[illegible]	[illegible]	[illegible]	19.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2000	inch	131.34	[illegible]	[illegible]	[illegible]	[illegible]	137.70	115.10	[illegible]	192.91	[illegible]	[illegible]	[illegible]	19.68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

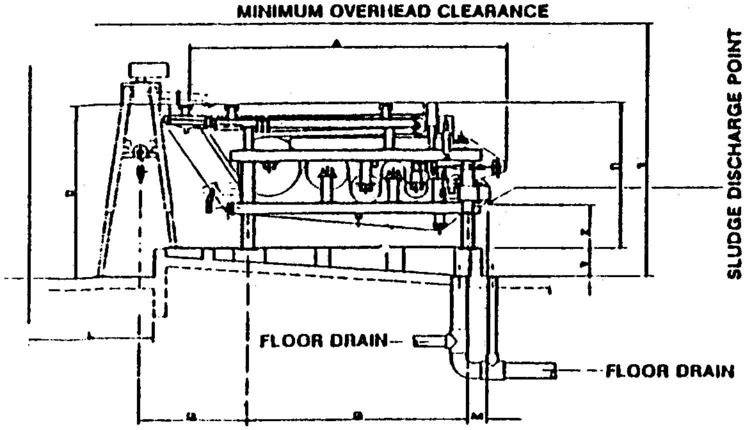
DRY WEIGHT (lbs)
[illegible]
3450

MATERIAL SPECS AND UTILITIES

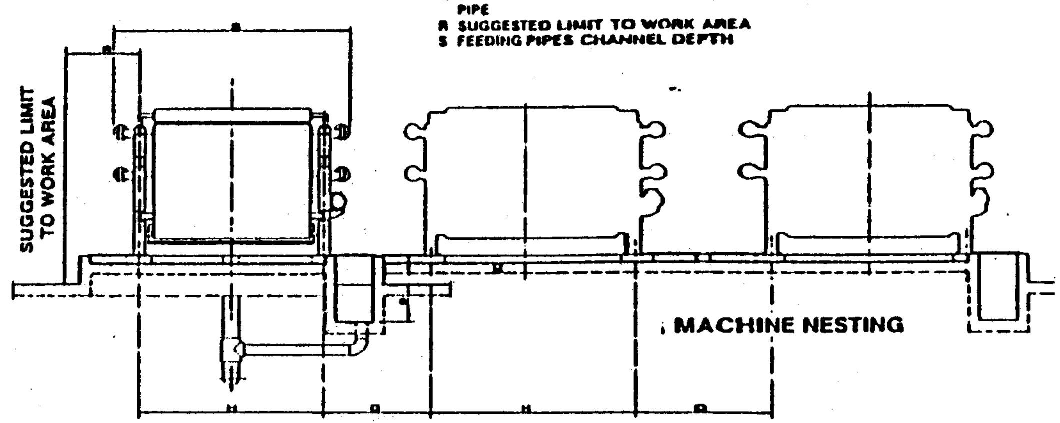
1 FRAME
- Fe 42 B SHEET METAL, POLYURETHANE PAINTED
2 DRIVE AND CENTERING ROLLS
- PIPE ST 52 RUBBER CONVERED (92 SH)
3 PRESSURE AND TENSION ROLLS
- PIPE ST 52 RUBBER CONVERED (92 SH)
4 BELT CLEANING HOUSING
- 304 SS SHEET METAL WITH RUBBER SEALS
5 HEAD BOX
- 304 SS SHEET METAL WITH RUBBER SEALS
6 FILTRATE TRAY
- 304 SS SHEET METAL
7 FASTENERS
- 304 SS MATERIAL
8 UTILITIES
- AIR: type 1000 = 5 mc/h OF 6 bar - type 2000 = 7 mc/h OF 6 bar
- WASH WATER: type 1000 = 130 l/min OF 6 bar - type 2000 = 240 l/min OF 6 bar
- INSTALLED POWER: type 1000 = 2.2 kW - type 2000 = 4 kW

LEGEND

A LENGHT
B WIDTH - OVERALL
C HEIGHT - OVERALL
D SLUDGE FEEDING PIPE HEIGHT
E GRANDING FOUNDATION WIDTH CLEARANCE - SUGGESTED
F SUGGESTED MINIMUM OVERHEAD CLEARANCE
G LEG TO LEG CENTER LINE SIDE ELEVATION
H LEG TO LEG CENTER LINE END ELEVATION
I GRADING FOUNDATION LENGHT - CENTER LINE CLEARANCE - SUGGESTED
J MIXING DRUM GRADING LENGHT (OPTIONAL)
K MIXING DRUM WIDTH (OPTIONAL)
L SUGGESTED LIMIT TO WORK FOR MIXER INSTALLATION (OPTIONAL)
M CENTER LINE LEG TO POINT OF DISCHARGE
N FEET TO POINT OF DISCHARGE
O CENTER LINE MACHINE LEG TO MACHINE LEG - MINIMUM
P FLOOR TO FEET HEIGHT
Q CENTER LINE LEG TO CENTER LINE OF MIXER FEEDING PIPE
R SUGGESTED LIMIT TO WORK AREA
S FEEDING PIPES CHANNEL DEPTH



SECTION A - A



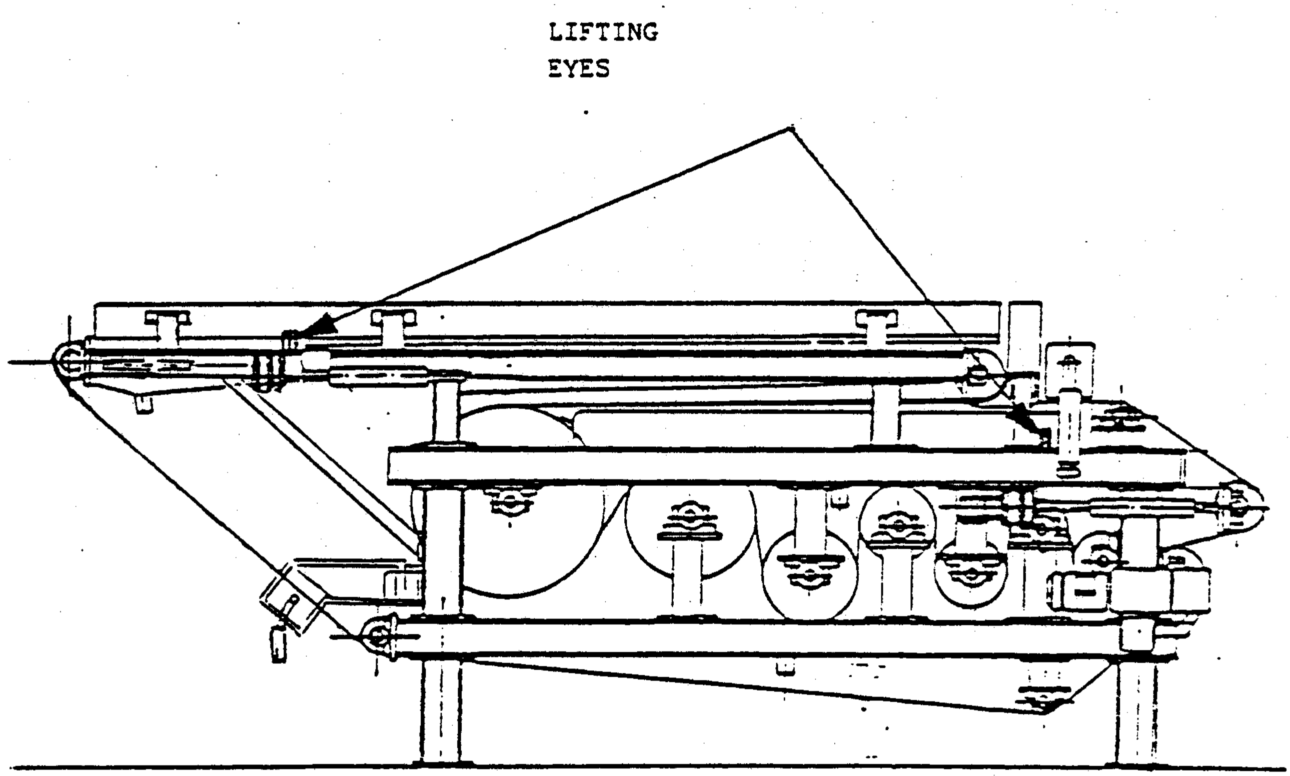
SECTION B - B

ELIMINATOR
Sales Reference

3.3 Erection of the assembled machine

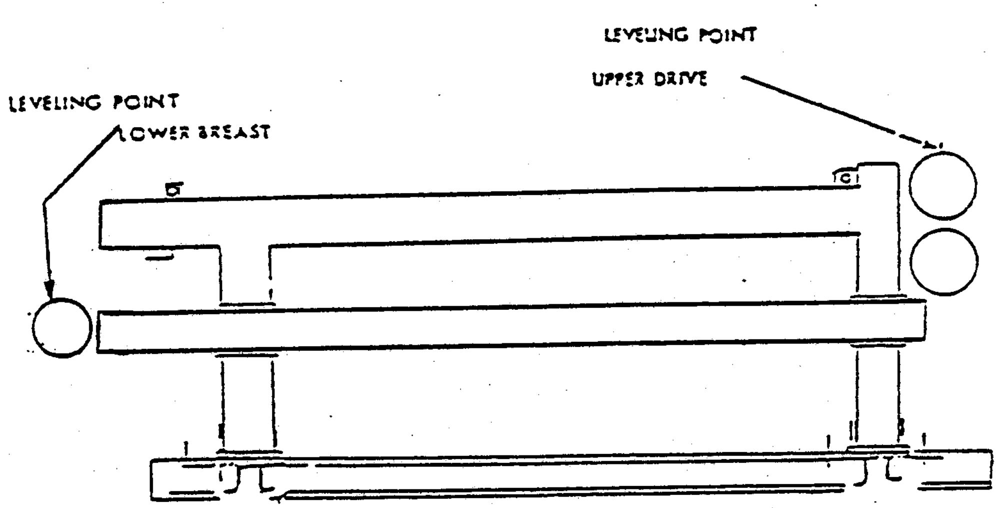
In setting the machine on the foundation, either a fixed or mobile crane may be used. For sizing the capacity of the crane, please refer to figure below, which lists the overall weights and dimensions. Without the use of a crane, the SMX may be moved on a horizontal plane by the use of jacks and transport rollers. When mounting the machine in this manner, one must not apply uneven pressures to any of the legs. When lifting the machine, use only the special lifting eyes as shown in Figure.

CAUTION: In order to keep from damaging the frame coating during lifting operations, place wooden blocks between the frame and lifting cable.



IMPORTANT

After setting the machine on the foundation pads, make sure that the machine is perfectly level. This may be done by placing steel shims between the leg of the machine and the foundation pads. For leveling check points on the machine, refer to Figure. By checking these points, exact leveling of the machine can be insured.

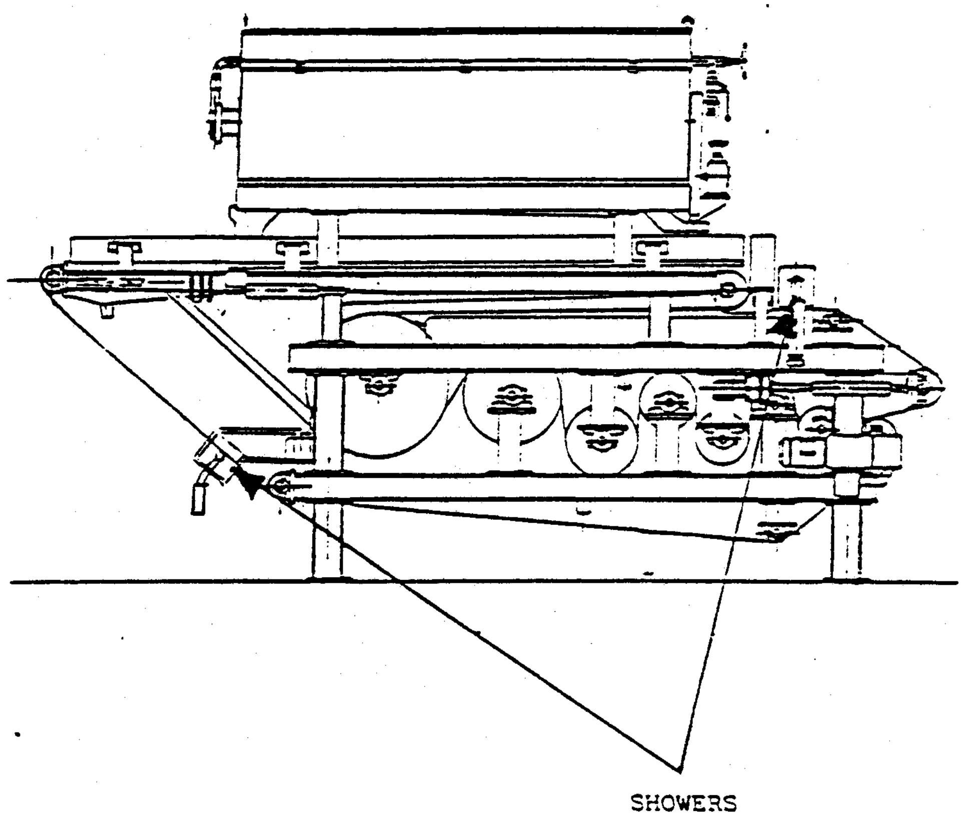


--Leveling Points – SMX

3.5

Pipe Connection and Hook-up Detailing. Refer to Figure below for the location of all connection involved. Table *1 below contains the working dimensions of all connections to be accomplished in the field.

UNIT TYPE	SLUDGE CONNECTION	POLYMER CONNECTION	SHOWERS	AIR
1.0	3.0" 150 lb Ansi Flange	1" NPT	1 1/2"	1/4"NPT
1.2	3" 150 lb Ansi Flange	1" NPT	1 1/2"	1/4"NPT
2.0	6" 150 lb Ansi Flange	1" NPT	2 "	1/4"NPT
2.2	6" 150 lb Ansi Flange	1" NPT	1 1/2"	1/4"NPT

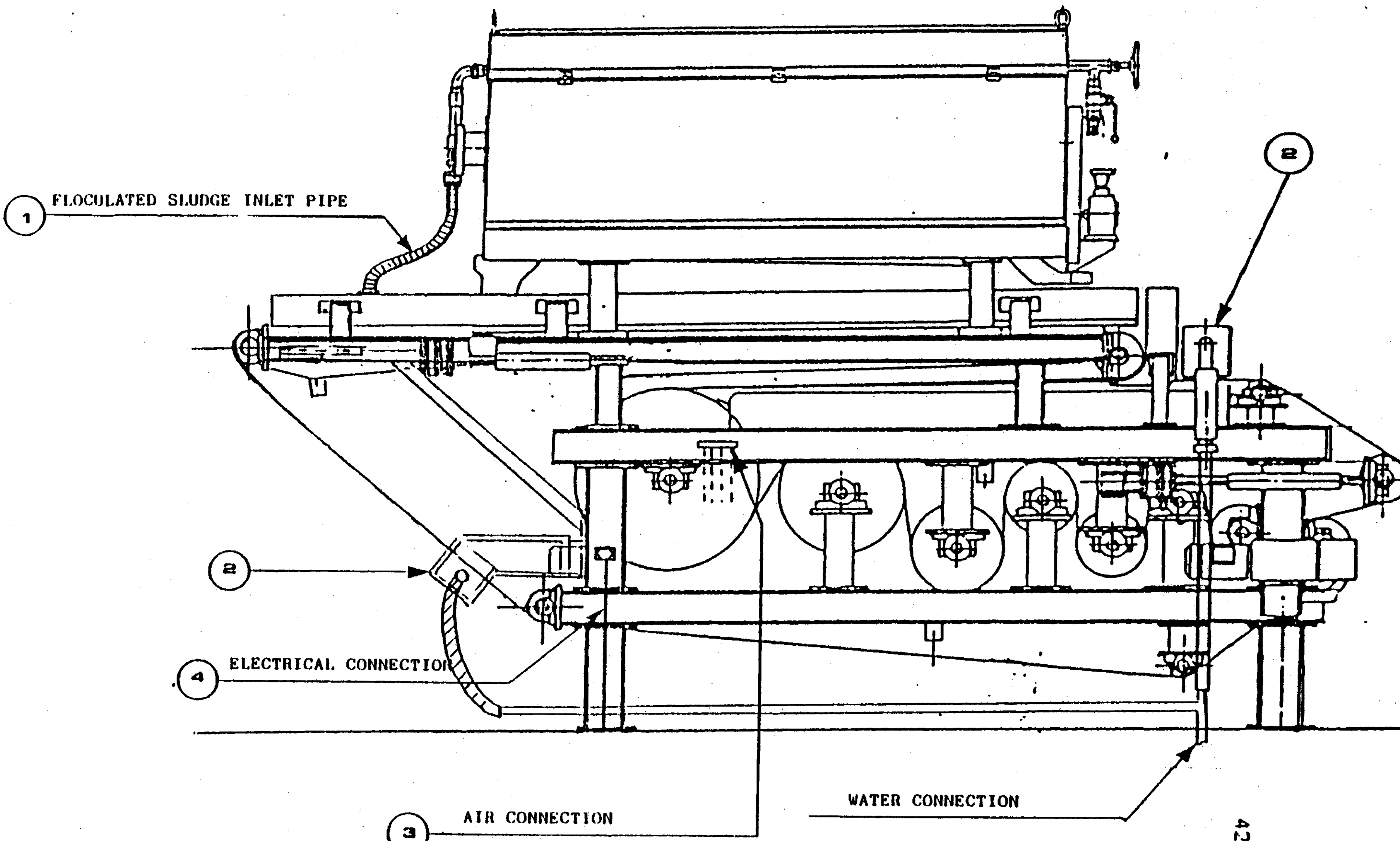


3.6 Sludge Feed

All the piping coming into the sludge feed system should have a slope of at least 2°, with a clean-out valve at the lowest point. This will allow the operator to throughly clean the sludge piping system after a shut-down. If this is not done, slduge will remain in the lines and harden over a period of time. A bypass line, located at the machine, is recommended in case of the machine needs to be shut-down quickly. (Do not place a valve in the main sludge line if a pump such as a Moynois being used.) It is also recommended that the last two feet of a connection between the sludge pipe and the machine be of flexible rubber hosing. This will absorb any vibration between the piping system and the machine.

3.7 Polymer Feed

One connection for polymer feed is located at the machine. It is recommended, however, that additional polymer injection points be incorporated elsewhere in the sludge feed system. The reason for this is that different sludges have different reaction times with the polymers. Single polymer or dual polymer injection is used with the tornado mixer to provide optimum mixing of the polymer with the sludge. The dual systems may be handled in various manners. One way would be to inject polymer both on top and bottom of the slduge feed line. This would aid greatly in making maximum use of the full polymer charge. Another system found very succesfull with high consistency sludges (4% and up) is to inject polymer at a very low feed rate, very low consistency (0.1% or less) about 25 to 35 feet from the machine. The second injection point (which should be the bulk of the injection) should be placed at the unit itself. Other means of mixing to acquire proper flocculation are possible. In-line mixers (kinetic mixers) are very helpful on certain applications. Actual placement of spirals in the piping system is helpful. Please note that the last two suggestions should only be used after lab tests show that sludge flocculation will not break down the direct agitation. Polymer dosing pumps should be of the metering types (Moyno or Viking). This is mainly the preference of the customer.



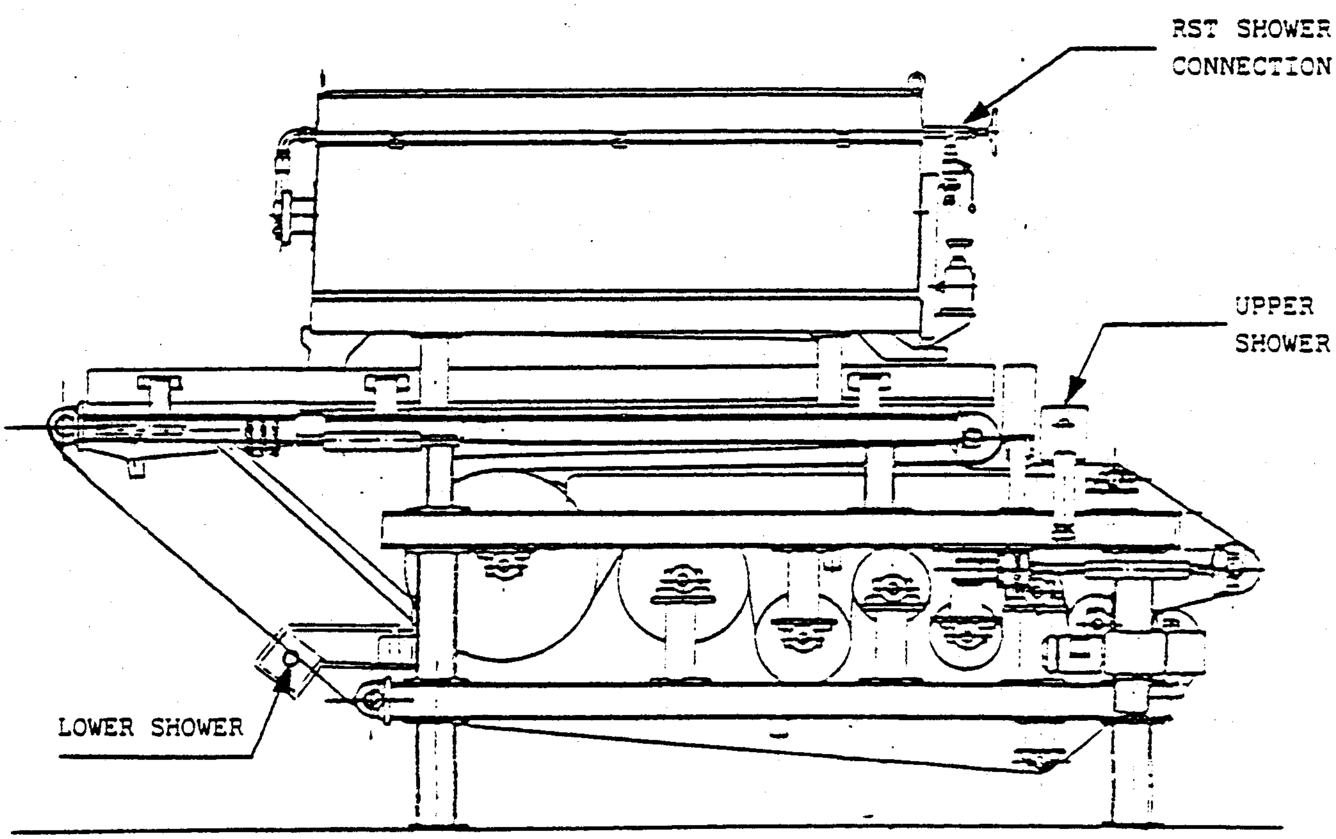
TYPICAL CUSTOMER SERVICE CONNECTIONS

3.8 Belt showers SMX

Two belt showers are on the Arus-Andritz SMX (upper and lower). A simple "T" connection coming from the main water supply, may be placed in the line ot feed both showers. It is recommended that this "T" connect be located near the machine, with a valve assembly for quick shut-down. Flexible hose should be used between the "T" and the shower connection.Dimensioning is shown on the foundation drawing. The design operating pressure for the showers is 85 P.S.I.G. On certain applications, continuos belt cleaning is not necessary.

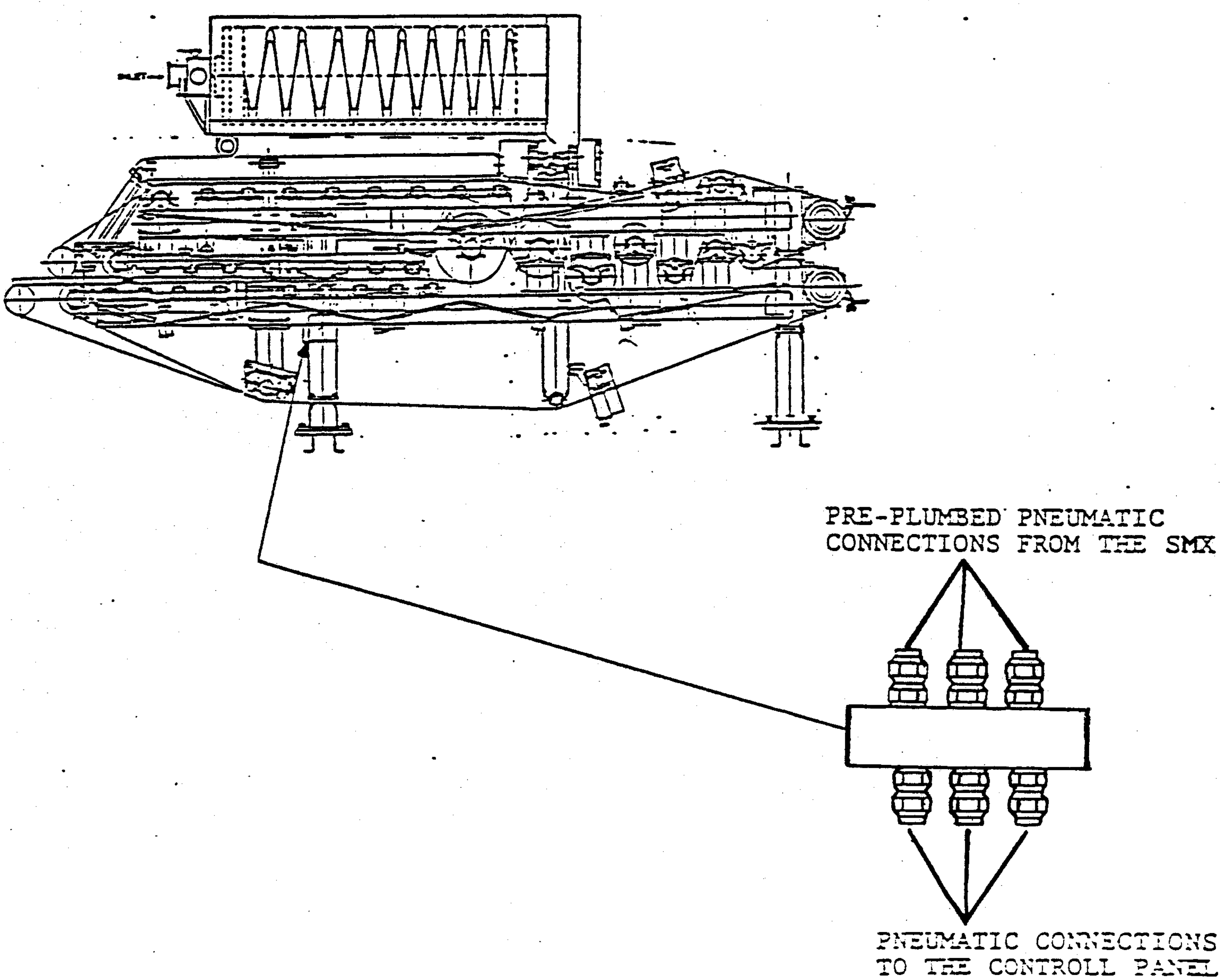
3.9 Belt Shower RST

One belt shower is supplied on the RST. The water supply hook-up should be similar to the SMX shower hook-up.



3.10
Air Connection

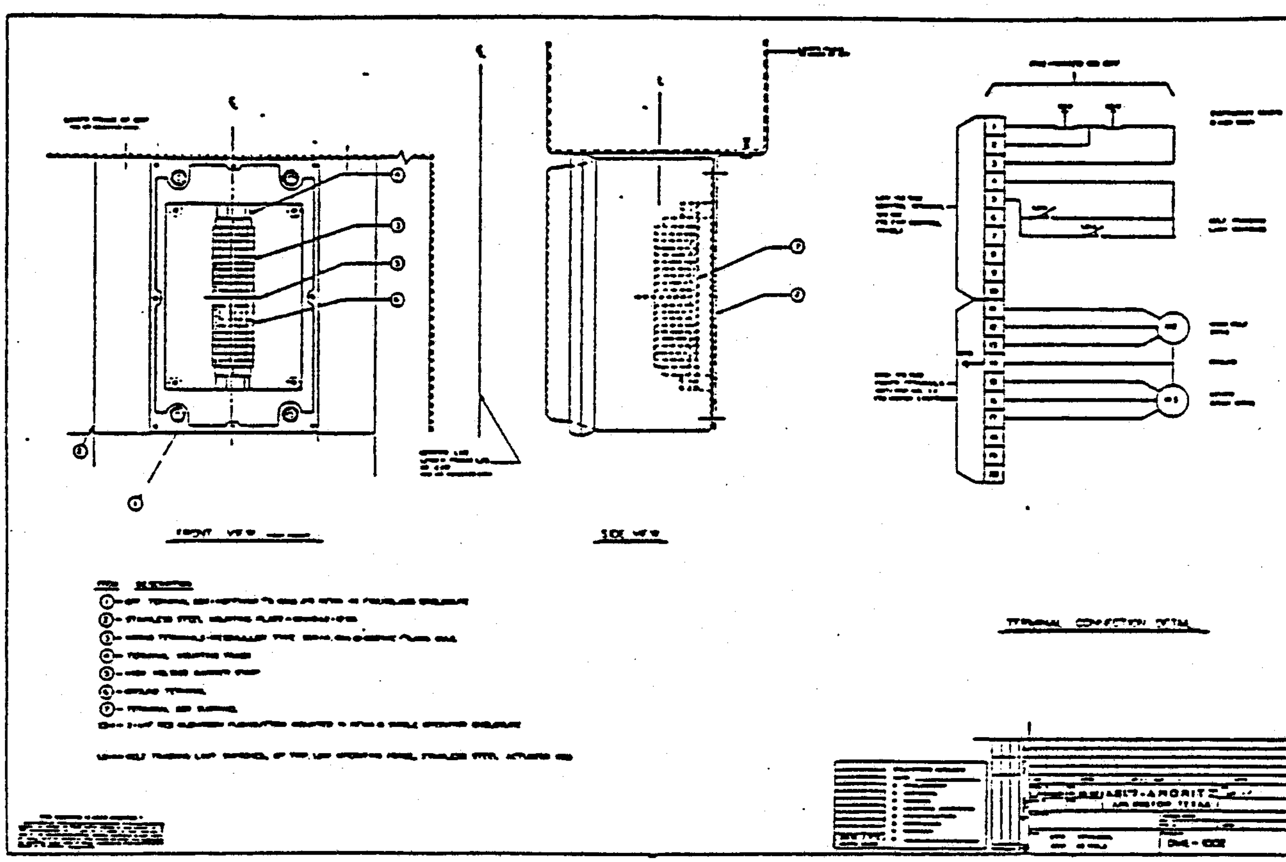
All pneumatics on the machine are completed upon leaving the factory. The only connection which the customer must make is 1/4" female connections located as shown in the connection drawings. A filter and oiler, with a pressure regulator comes mounted in the pneumatic panel. The operating pressures required is 120 PSI.



3.11

Electrical Connection (Typical)

All electrical functions on the machine are brought down to two enclosed terminal strips (Nema 4 construction). These terminal strips are located as shown in the connection drawings. One terminal strip contains all high voltage lines for motors (main drive, mixer drive, distribution screw drive or RST drive. While the second terminal strip carries all low voltage functions (two belt limit switches: air press limits, emergency stops.) Electrical connections from the machine to Arus-Andritz control panel are the responsibility of the owner.



Control Panel

Panel will be covered in more detail in the operation section of the SMX.

4.0 OPERATION OF THE SMX

4.1 ADJUSTEMENT PRIOR TO START-UP

IMPORTANT: We feel it is necessary to mention at this point that the start up should be not attempted unless under the supervision of an Arus-Andritz start-up technician.

PLACEMENT OF THE BELTS ON THE MACHINE

Installation of the belts on the SMX-I type machinè is a simple operation that requires little time. The following operations must be performed:

1. check that both upper and lower drive roll doctor blades are positioned away from the belt.

2. remove the wedge peices

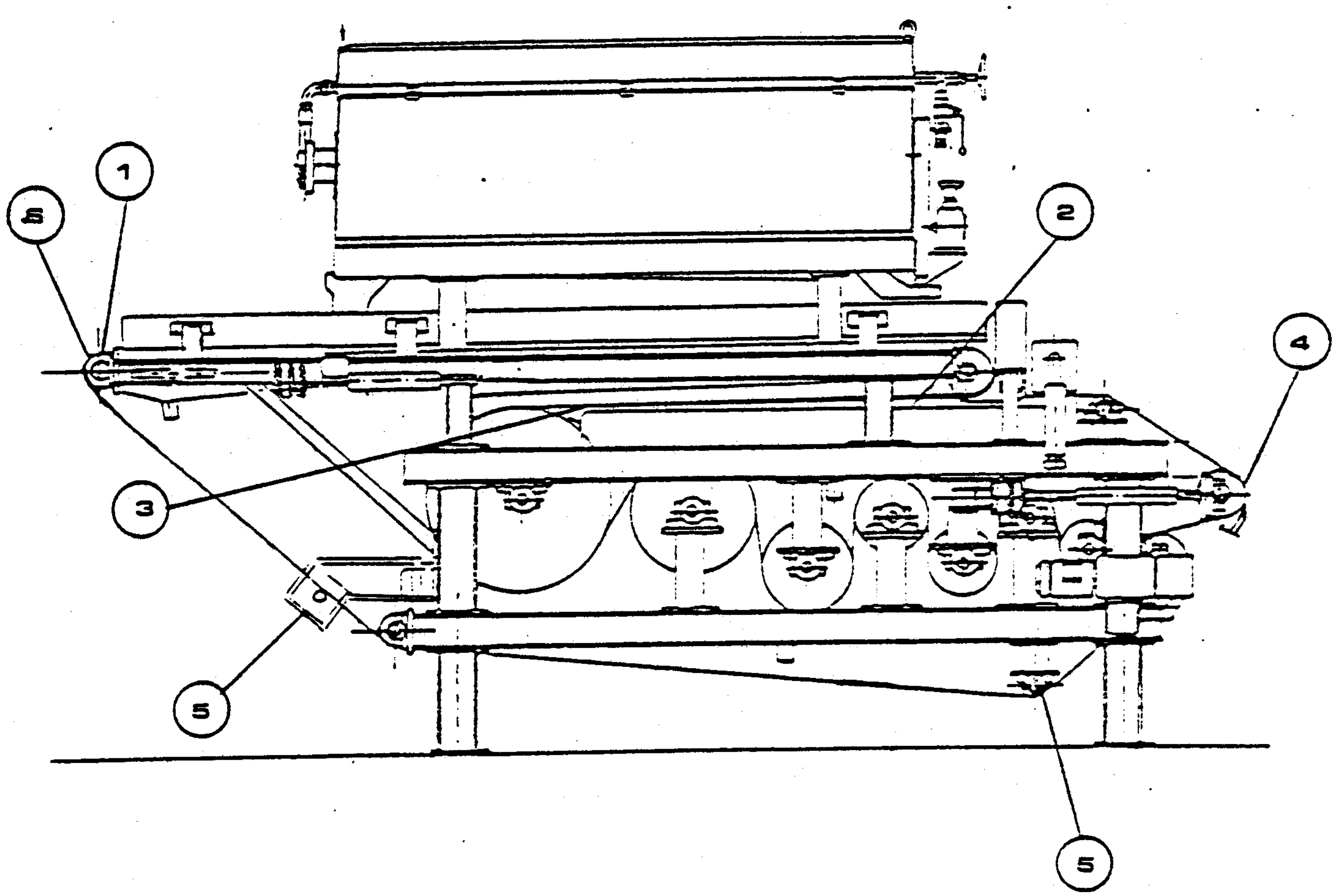
3. remove the upper shower cover (upper half) and lower shower cover (lower half) to facilitate easy belt passage through the shower area.

4. crank the wire tension assembly towards the drive roll. The longest of the two belts will be as the top belt of the SMX machine. The rolled up belt should be layed on the floor below the breast roll.

NOTE: Determination of the sludge side vs roller side of the belt must be made before installation begins. This will be explained by the start up technician.

5. Pick-up end of te clipper seam belt and.

1. slide it over the breast roll
2. through the wedge section
3. through the S-roll section
4. between the drive roll and doctor blade
5. under the tracking roll and shower box
6. back to the breast roll where the two seams are joined



6. The top belt should be placed on the machine in the similar manner.

7. Reassemble the machine after both belts are installed

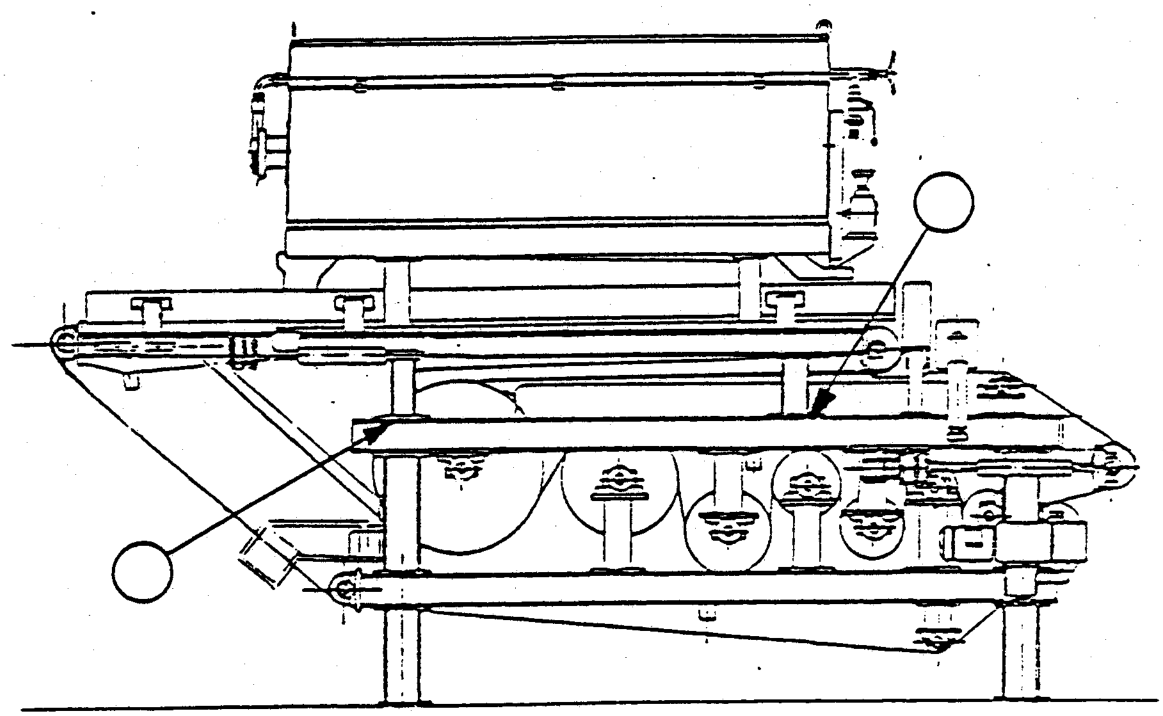
Note: accurate records should be kept on belts such as:

1. When installed ?
2. How many hours run ?
3. Why failed: age,debris in sludge,mechanical failure,etc.?
4. Was a new belt ordered to replace the old belt ?
5. Was the belt tagged with all necessary information ?

4.1.3 Adjustement of Wedge Zone

To prevent extrusion of sludge from wedge zone, corréct distances must be mantained between the belt and the wedge. This adjustment is critical in the operation of the machine. If this sdjustment is not properly set, either too close or too far, belt damage may occur. Hold distances are as follows:
Fiber type slduges - 0.7 - 1 mm
Biological type sludges - 0.2 - 0.3 mm

This adjustment has been preset at the factory, however, stainless steel shim plates have been provided, should adjustment be required. To install the shim plates, remove bolts of the upper frame assembly; raise slightly and add shim plates until the desired height has been reached, reinstall the bolts.

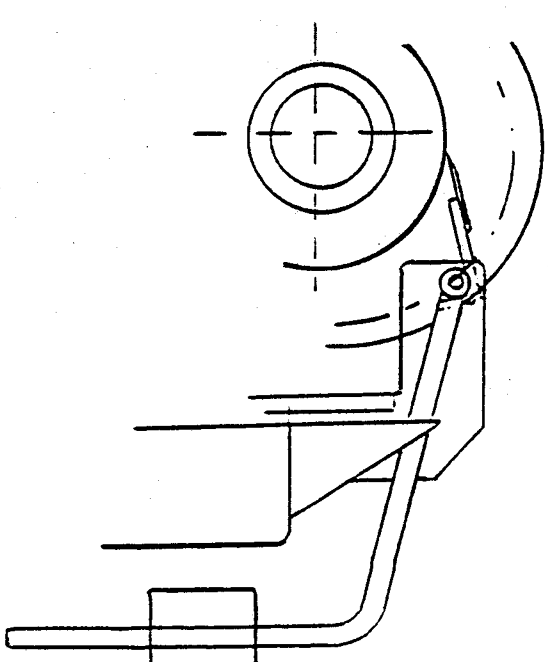


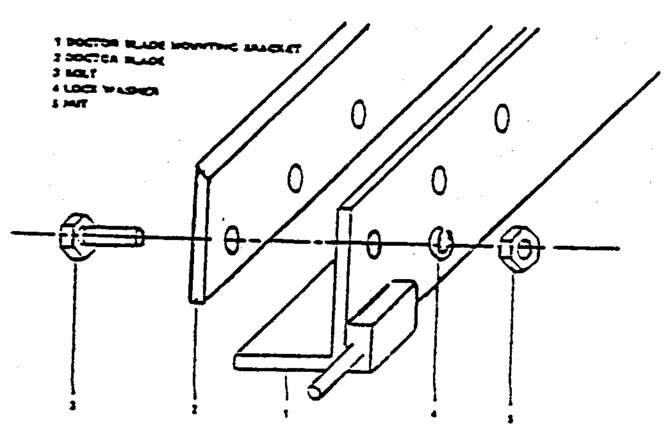
4.1.4 Doctor Blade Adjustment

Before initial start-up, all the doctor blades must be checked. The most critical adjustment on the doctor blade is making sure that the blade is exactly parallel with the roll on which it is mounted. If this is not checked, the belt cleaning will not be as effective or possible belt damage may occur. There are several ways to re-align the blade with the roll. One way would be to loosen the bolts as shown in the figure below, item 3, and square the blade within the blade mounting assembly. After this is done, to whole assembly may then be squared to the roll. This can be done on the lower doctor blade by loosening the mounting bracket and moving along the slotted holes until the blade is parallel to the roll. The upper doctor blade is adjusted in the same fashion. Simply loosen the mounting brackets and square the blade with the roll. When running without sludge, it is advisable to move away the blades from the roll. This is accomplished by removing the counter weight and pushing the bar away from the roll.

Doctor Blade Adjustment

Move the counterweight up or down the rod until the desired tension has been achieved, thighten holding bolt.





DOCTOR BLADE ASSEMBLY

4.1.5 Adjustment of belt tracking regulator

a. The Servo regulator has been installed so that the tracking roll runs parallel to the other rolls on the machine when the machine is in a "neutral" position. In cases where the bearing sliding block on the regulator is not centered, this indicates that the belts are not travelling in their correct position, so that the tracking roll has changed its paralleled alignment in order to retrack the belts.

b. When adjusting the regulator, place the belts into the desired running position. When this is done, push the scanning finger until it touches the wire. Make sure that the regulator is in a neutral position. This is done by loosening the scanning finger and aligning the finger at approximately a 16° angle, then tighten the finger.

c. The response time of the automatic control unit may be changed by adjusting the scanning finger's vertical position. If the belt runs along the upper range of the scanning finger, the regulator will respond faster. If the belt runs along the lower range, the regulator response will be slower. The adjusting speed of the wire will depend on the air pressure on which the system is being run. Always be sure that the scanning finger rides evenly along the entire length of the wire. If the unusual wear of the wires edge occurs, the tracking may not be consistent.

d. When the Servo regulator is performing well, the bearing sliding block for the most part should remain centered. If the tracking roll runs continually out of the center, a problem could be indicated. If this occurs, all of the adjustements should be checked. It is always advisable to check the tracking system after installation of a new belt.

e. Be sure to keep the bearing sliding block clean and occasionally lubricate.

BELT TRACKINMG DEVICE

The automatic centering of the upper and lower belt is obtained by two(2) centering rolls pivoting on one side and swinging on the other side. When the belts deviate laterally from their original central position, the swinging movement of the rolls immediately and automatically arranges the deviation. This is obtained by two (2) regulation devices pneumatically operated and made of :

- Regulation device that allows the swinging movement

- Automatic device checking the belts position

According to the belts position, the position of the regulation device causes the variation of the air pressure inside the air chambers and consequently the swinging of the centering roll connected to them. The belts centering device is also equipped with two (2) limit switches situated :

a) on the right side of the machine near the "S" tension rolls.

b) one on the left and one on the right side of the machine at belts height in the "S" zone.

When a belt laterally moves and overruns the security limit, it pushes a rod near the limit switch that stops the electric motor. The reasons that have caused this stop are to be checked. They may be:

a) blocking of the belts centering device flap.

b) air lack in the belts centering air pressure manifold

c) belts not tensioned due to the slider cock left closed

To restart the motor, first move the limit sw. rod away from the limit switch itself, the warning light (led) will come off. Then rotate the selector in the direction of "start".

4.2 ELECTRICAL CONTROL PANEL SYSTEM AND OPERATION

* After Final Installation of Machine, Control Panels and All Wiring and Tubing Connections.

Check all wiring for proper connection. Supply ------------- VAC requiring ------------- KVA and 90 PSI to pneumatic panel. When the system is ready to begin, place the disconnect in the ON position, place system control power selector switch to ON position. If air compressor selector switch is mounted on control panel, place this in the ON position. System can not operate further until air pressure is supplied to pneumatic panel and properly adjusted to the wire tension bellows and belt tracking system. Start sytem control by pressing START PB. For first time operation, check all alarms and emergency stops by depressing any emergency stop on panel or machine. This will extinguish START PB light. Tripping of belt unit switches should extinguish START PB light and give a visual and audible alarm which can be silenced and reset (when alarm condition has returned no normal). Test air loss alarm by disconnecting air supply to panel or by closing filter/reg/lubricator inside of pneumatic panel. All additional alarms should be checked at this time.

4.2.1 SEQUENCE OF OPERATION MACHINE

Belt wash water should be supplied to machine. At this time, turn belt shower solenoid selector switch to ON position. Start discharge conveyor. This will allow the main belt drive to be started. Next start the mixing drum. (For fisrt time operation, check belt tracking and operation of speed adjustement of main drive and mixing drum). After main drive has been started, polymer pump may be started followed by sludge pump.

4.2.2 SHUT DOWN SEQUENCE

Shut down of the machine should be done in reverse order of start up. Beginning with sludge pump and polymer pump. Ample time should be given to allow machine to discharge all sludge and wash belts clean. After this, mixing drum and main belt drive can be de-energized. Discharge conveyor and belt wash solenoid last.

4.2.3 MACHINE INTERLOCKS

Less of discharge conveyor will shut down machine, polymer pump and sludge pump. Less of main drive will shut down sludge and polymer pump.

4.2.4 PNEUMATIC CONTROL PANEL

The pneumatic control panel is used to control pressures to the upper and lower wire tension assemblies, the belt tracking regulators and the press nip, if it is supplied. The supply of air to the pneumatic panel is the responsibility the customer. This 1/4" female connection should be at the bulkhead fitting . 1 on the side of this panel. The other 1/4" female bulkhead fittings are to be connected to the 1/4" to the 1/4" manifold block mounted on the SMX.

4.3 i START UP SEQUENCE

a. Place tension (approximately 50 psig) on both the upper and lower belt (using regulator valve).

b. Check the belt position along with the wedge seals. (Belt outside the wedge) NOTE: improper adjustement of the wedge may lead to belt damage.

c. Pressurize the belt tracking system to 50 psig.

d. Inspect the belt tracking system (most important that scanning finger is making proper contact with the belt).

e. Make sure all doctor blades are engaged. (on belts)

f. Switch power selector switch to "on".

g. Switch on belt showers.

h. Switch on main belt drive.

i. Switch on mixer drive.

j. Switch on polymer pump.(allow polymer to enter the main sludge line).

k. Switch on macerator (if applicable).

l. Switch on sludge pump.

4.3.i 2 SHUT DOWN SEQUENCE

On final shutdown, always allow the machine to run 10-15 minutes without the sludge pump running. This will remove all sludge from the belt, give you a clean belt for the new start up, and provide a longer belt life.

a. Shut off sludge
b. Shut off polymer pump
c. Shut off mixing drum

After the sludge and polymer pumps are off, take this time to take off the machine while the belts are being cleaned. Make sure that any build up on the rolls is cleaned off.

CAUTION: While cleaning machine, stay away from moving parts. Do not place hands inside of wedge section. The machine is moving very slowly, but is still very dangerous. Loose clothing should never be worn.

SHUT DOWN SEQUENCE CONTINUED

d. After machine runs for 10-15 minutes, shut off entire control panel.

e. Relieve pressure from belts and tracking system.

Using the "Blow Off" valve at the coming air supply (oil & filter), clean out any excess water.

4.3.2 3 OPTIMIZING THE DEWATERING PROCESS

a. When applying the belt pressure on "S" execution machines, do not exceed the maximum allowable Pli of 60, nor apply pressure, to the point that sludge begins to extrude to the belt mesh. This will cause very poor capture rates. When applying belt pressure to all models of the SMX-I, always remember that belt tension does not depend solely on the gauge pressure. It also depends on the "bellow height". (Distance between holding flanges). Never exceeded 60 psi gauge pressure since pressures in this range are maximum for the belt. When First starting the polymer and sludge pumps, start polymer pump approximately 20% higher than needed while the sludge feed rate should be about 20% lower. After running a few minutes, begin to move the pump speeds to their necessary position. Starting up in this manner will prevent the possibility of not getting proper flocculation, which could lead to a messy start up that may require shut down of equipment for cleaning. An important factor to remember for proper machine operation is that the most of the water must run off during the first stage of gravity dewatering. This may be done by proper flocculation. If proper flocculation is not achieved, water will be carried into the wedge, extrusions will occur. Another cause of improper draining is poor belt cleaning.

4.3.3 4 GENERAL MACHINE CHECKS

To keep the machine in best operating condition and reduce wear on critical parts, the following procedures are recommended:

a. Check the wedge clearance top and bottom by pushing on the point of the wedge while watching for free movement of the wedge.

GENERAL MACHINE CHECKS CONTINUED

b. Check belts before each start up for holes and tears. If the holes and tears are caught early, they may be patched.

Check for wear on the belt along the wedges. Slurry build up from extrusion between wedge and belt occurs here. Extrusion build up on slurry can harden and cause wear and tearing of the belts.

c. Check all doctor blades for any unusual wear.

d. Check all pneumatic equipment.
(Including lubricator oil level).

e. Check all rolls - especially the roll coating.

f. Check all rubber seals in gravity section, wedge section and shower boxes. Look for wear on rubber or leaks during operation.

g. Visually check belt after it passes through shower boxes. If you see dirty stripes on belt, a shower nozzle is blocked.

To clear nozzle, turn shower cleaning hand wheel to fully open. Then close valve and check belt. If stripe is still there, repeat.

4.4 TROUBLE SHOOTING

PROBLEM	REASON	CORRECTION
A. Belt limit is on	1. No air in tracking system	1. Check air supply and valves to be sure they are open
	2. Slurry extrusion trips limit	2. Reduce feed rate and/or
		2b Increase belt rate NOTE: If limit switch is now OK but extrusion is seen in the high pressure zone - adjust polymer.
		2c Slow down belt rate
B. Air pressure limit is on	1. No air pressure	1. Check air supply system to the machine. Make sure it has no leaks and that compressor is on.
C. Extrusion of slurry in gravity zone	1. Rubber sealing worn	1. Replace rubber in gravity zone
	2. Knots under seals	2. Call factory representative
	3. No polymer	3. Check that polymer system is on and/or reduce feed rate.
D. Drainage bad in gravity zone	1. Poor flocculation	1. Check problem F
	2. Belts plugged	2. Check problem R.
E. Slurry flowing over headbox	1. Slurry feed too high	1a Decrease slurry and polymer
		1b Increase belt speed
	2. Bad drainage	2. Check problem D.
F. Poor flocculation	1. Too little or too much polymer	1. Check and adjust polymer feed rate.
	2. Dilution water feed rate incorrect	2. Adjust feed rate.

PROBLEM	REASON	CORRECTION
G. Extrusion of slurry from wedge section	1. Wedges worn	1. Replace wedges, call maintenance
	2. Poor flocculation	2. See problem F.
	3. Through-put too high	3. Reduce feed rate
	4. Belt speed too slow	4. Increase belt speed
	5. Knots under wedge	5. Call factory representative
H. Roller lock down	1. No lubrication; bearing worn	1. Call maintenance
I. Bulge in wedge zone	1. Too much water still in slurry cake	1. See problem F.
	2. Floc breaking down under pressure	2. See problem F or G-3
	3. Belts plugged	3. See problem R.
J. Block breaking down under pressure	1. Poor flocculation	1. See problem F.
	2. Too much pressure on slurry by belts	2. See problem G-3
K. Extrusion in high pressure zone	1. Poor flocculation	1. See problem F
	2. Too much pressure on slurry by belts	2. Increase belt tension and/or belt speed
L. Bulge in high pressure section	1. Too much water/ slurry in cake	1a See problem F
		1b Reduce belt speed
	2. Belts plugged	2. See problem R
M. Wire slips on drive roll	1. Not enough wire tension	1. Increase wire tension (do not exceed recommended belt tensions)
	2. Overload too much slurry in machine	2. Shut down machine: remove excess slurry and restart machine at a lower feed rate.
N. Cake sticking to belt	1. Poor flocculation	1. See problem F
	2. Doctor blades worn	2. Replace blades call maintenance
	3. Belts not being cleaned	3. See problem R.

PROBLEM	REASON	CORRECTION
O. Doctor baldes wearing haevily	1. Misalignment of blades	1. Call maintenance
	2. Too much doctor blade pressure on belt	2. Call maintenance
P. Drive system gear lock down	1. No oil in system	1. Call maintenance
	2. Pulleys or "V", belt torn or slipping	2. Call maintenance
Q. No speed variation on main drive or mixer drive	1. Faulty wiring in DC or AC panel speed control or mechanical failure in drive	1. Call maintenance
R. Belts plugged	1. Spray nozzle plugged	1. Use shower cleaning wheel located on shower
	2. Poor flocculation	2. See problem F
S. Belts wrinkling or holding	1. Poor distribution	1. See problem V
	2. Lower belt tension	2. Increase belt tension
	3. DC drive system not working correctly	3. Call maintenance
	4. Cake too thick	4. Increase belt speed and/or decrease feed rate
T. Belt tearing along wedge	1. Gravity zone or wedge zone forcing belt to ride forceably between wedege and rollers	1. Call maintenance
U. Knots in wedge	1. Improper wedge adjustment	1. Call factory representative
V. Poor ditribution	1. Screw/paddle at wrong speed	1. Increse/decrease speed as needed
	2. Belt speed incorrect	2. Adjust belt speed as needed
W. Cake coming off machine is ueven	1. Poor distribution	1. See problem V
X. No slurry	1. Check slurry pump	1. Turn on
	2. Valve may be closed	2. Open valve
	3. Pipe clogged	3. Call maintenance
	4. Pipe may leak	4. Call maintenance
Y. Overload relays from drive system are on	1. Drive is being overloaded	1. See problem M
	2. Relay overload	2. Call maintenance