

Erection Work, Operating and Maintenance Instructions

Machine:	AhlCleaner SC 133 VC
Manufacturing no.:	D-14-815751-010-3260
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Order code:	Dong Tien Paper,Vietnam
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1 INTRODUCTION

This manual is part of the technical documentation of Andritz TC. It is intended as a supplement to the training provided, to supply the basic knowledge required for proper, safe and economical use of the equipment delivered by Andritz TC. Observing these instructions helps avoid hazards and reduce repair and downtime costs, as well as increasing the reliability and useful life of machines.

1.1 Use

Target group	<p>This operating manual is intended for users with a knowledge of mechanical engineering and is for the exclusive use of the operator of the mill and his personnel.</p> <p>Personnel entrusted with work on the machine must have read and understood these operating instructions and comply with them. This refers in particular to the following tasks:</p> <ul style="list-style-type: none">• Handling, starting and stopping• Troubleshooting• Maintenance and upkeep• Haulage• Handling process materials, cleaning of machine and area around the machine
	<p>The following sections are especially important:</p> <ul style="list-style-type: none">• the chapter on SAFETY• the safety instructions contained in various other chapters
Supplementary instructions	<p>The mill operator shall complete this manual by adding national regulations on safety at work, health protection and environmental protection.</p> <p>Instructions on any special operational conditions concerning work organization, sequence of work/operations and the personnel assigned to the job shall also be added. This also includes instructions on supervising and reporting obligations.</p>
Safe keeping	<p>Keep the entire operating manual near the place where the machine is installed and within easy reach.</p>

1.2 Standards and guidelines

The machine/plant has been built in accordance with state-of-the-art standards and the recognized safety rules. The equipment conforms with the equivalent appropriate standards.

1.3 How to use the manual

Pictograms

The following pictograms are used in the manual:



Warning signs

Warning signs are shown with an explanation of the type of the hazard.

The meaning of the different graduations of hazards are described in the chapter on SAFETY.



Marks an instruction on handling of the machine or system.



Marks a useful information.



Marks a cross-reference to other sections, figures and tables in brackets.

Examples:

(▶ Sec. 6.4, Start-up on page 6-3)

(▶ Fig. 9-2/**123.1**) with reference to an item after the slash (/)

(▶ Tab. 3-1, Construction weights on page 3-2)

Work steps (operations)

Work steps are presented in tables. Work steps are numbered and must be carried out in the order specified.

Listings

Lists without numbering do not require operations to be carried out in a certain order.

Numbering of pages, tables and figures

Pages	Consecutive numbering of chapters	2-1
Tables	Tab. + Consecutive numbering of chapters	Tab. 2-1
Figures	Fig. + Consecutive numbering of chapters	Fig. 2-1

Abbreviations

Dwg.	Drawing
Fig.	Figure
Sec.	Section
Tab.	Table

Illustrations and graphic charts

The illustrations and graphic charts show the basic design of the machine. This may not necessarily correspond exactly to the design supplied.

1.4 Warranty and guarantee

Andritz TC's general terms of delivery and sale shall apply.

Guarantee and liability claims on Andritz TC shall become void if personal injury or material damage is caused by one or several of the following:

- Use of the machine/system for any purpose other than its designated use
- Non-conformity of erection work, start-up and handling of the machine/system
- Non-observance of the safety instructions in the manual
- Non-authorized structural changes to the machine/system
- Non-observance of the maintenance and upkeep instructions

In the event of a claim for repair under guarantee, Andritz TC reserves the right to assess the damage to the machine/system.

1.5 Copyright

The operating manual is protected by copyright. All usual rights reserved. It must not be wholly or partly reproduced without authorization by Andritz TC. Contraventions shall entail damage claims and may have penal consequences. All rights shall also be reserved for any patents granted, registration of trade marks and technical modifications without prior notification.

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2 SAFETY

2.1 General safety regulations

The chapter on safety contains general safety regulations which must be observed when working on the machine/plant.

In addition, the chapters in the operating manual contain further safety regulations. These are marked by warning signs.

Safety instructions on components not supplied by Andritz Oy are contained in the descriptions of the components provided by sub-suppliers. The safety instructions supplement Andritz Oy's operating instructions.

All safety instructions must be observed. Disregarding the safety instructions may cause a risk to life and limb, environmental pollution hazards and damage to property.

2.2 Danger and warning signs

The entire SAFETY chapter is of extreme importance and relevant to safety. The information in this chapter, therefore, is not marked with special danger symbols.

In the following chapters of this manual, warnings are marked by a pictogram. The following warning signs are used:



This symbol indicates there may be a risk to life and limb.

Non-compliance with the warning signs may lead to serious health problems or even fatal injuries, and can cause extensive damage to property.



This symbol points to an imminent health risk, as well as a risk of environmental pollution and of damage to property.

Non-compliance with the warning signs may cause moderate health problems and/or extensive environmental pollution and damage to property.



This symbol points to a dangerous situation.

Non-observance of these signs may cause environmental pollution and damage to property.

Further symbols and pictograms used are described in the chapter INTRODUCTION.

2.3 Designated use

The equipment should only be used according to the specifications forming part of the purchase order.

Using the machine/plant for other purposes is considered contrary to its designated use.

Any modifications to the scope of supply made without the agreement of Andritz Oy are considered contrary to the designated use.

The term designated use shall also include adherence to the operating instructions, observance of the operating, inspection and maintenance conditions and of the regulations on cleaning and upkeep.

2.4 General remarks on machine/plant safety

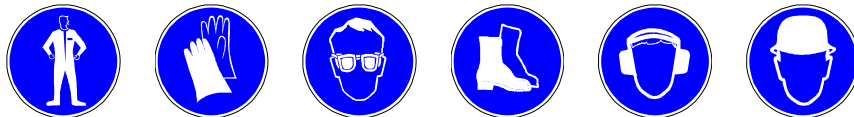
The machine/plant has been built in accordance with state-of-the-art standards and the recognized safety rules. Nevertheless, its use may constitute a risk to life and limb of the user or of third parties, or cause damage to the machine/plant and to other material property.

The machine/plant may only be operated when in perfect condition and with due consideration to safety and the risks involved. All protective devices and the emergency cut-out devices must be in place and fully functional.

Malfunctions and unforeseen changes to the machine/plant must be remedied immediately.

2.5 Personal protective apparel

General protective apparel



The following must always be worn when performing work on the machine/plant:

- Protective clothing to prevent the fiber pulp from coming into contact with the skin
- Gloves to prevent hand injuries
- Goggles to prevent eye injuries
- Safety shoes as protection against foot injuries
- The required personal ear protection to avoid hearing defects
- Standard hard hat as protection against head injuries

2.6 Safety at the machine installation site

- Adequate lighting must be provided (industrial lighting).
- The foundations must be sized to withstand the loads caused by the machine. Customer will be provided with a load plan.
- Area around machine and marked escapes to be kept free. Area around machine must be marked as danger zone.
- Make sure machine and surrounding area are kept clean. In particular, oil and grease on the floor and on machine elements may cause slipping. This is therefore a considerable source of injuries, as are tools.
- The floor around the machine must be provided with a non-slip finish.
- In order to prevent any falls from or damage to the machine, it is forbidden to climb onto machine elements or on the machine (except for the treading areas provided). Use ladders or similar equipment in accordance with recognised standards.
- Ramps, platforms and lifts must be used to avoid injury or excessive physical effort.
- Prior to lifting, check the weight of each bank from the documents provided.

2.7 Safety during start-up

Prior to start-up make sure that:

- The equipment has been correctly assembled and the connections have been tightened.
- The discharge side valve of the feed pump for the cleaner bank is closed, i.e. the pump will start against a closed valve, and that the valve will open gradually to the set value within 30 to 60 seconds.
- The cleaner bank has been correctly aligned. Do not start the unit if the accept valve is closed.
- The deaeration valves are closed and those pressure gauge connections which not in use are equipped with a plug.

2.8 Safety during operation

Do not use the cleaner at a temperature above 90°C. When the operating temperature exceeds 65°C (EN563), short-term surface contact may cause skin burn. Long-term contact may cause skin burn at temperatures below 65°C.

The cleaners must not be opened during operation, nor must parts be detached during operation for replacement.

The pressure sensors must not be detached during operation.

When closing an AhiCleaner bank while other equipment is operating, remember that the accept valve must not be closed before the feed valve is closed.

2.9 Safety during maintenance

Prior to any maintenance work on the cleaners, make sure that the cleaner bank is not pressurized.

Make sure that the feed pump for the cleaner bank cannot be started during maintenance work. Locking the safety switch of the pump ensures this.

The cleaner must not be opened if the stock inside has been hot, i.e. above 50°C.

Do not take tools or lamps that operate with an electric voltage higher than 24 V into the equipment.

3 DELIVERY

3.1 Mode of delivery

The AhI Cleaner centrifugal cleaner bank is usually delivered from the manufacturing plant completely assembled, with the cleaners already mounted. When the cleaners are delivered separately in different packages, the cleaner bank is assembled at the customer's premises (► Sec. 4, ERECTION on page 4-1). Prior to the delivery, all connections of the AhI Cleaner have been protected with cover plates or plugs.



Do not remove the cover plates or plugs until the piping installation requires it.

3.2 Packaging

The AhI Cleaner bank has for longer transportation and shipment been packed and supported securely to avoid damage. The shipping crate is marked with lifting points, and the shipping documents show the weight and dimensions of the crate.

3.3 Removing from the crate

The crate for the AhI Cleaner bank is marked with lifting points.



The cleaner bank must be lifted by the lifting eyes only. Do not attach lifting equipment to any other points other than the lifting eyes. Prior to lifting, check the weight of the cleaner bank from the documents provided and make sure that the lifting equipment used, is appropriate for the weight.

3.4 Receiving inspection

Upon arrival, immediately inspect the AhI Cleaner bank and any separate parts delivered with it for any potential transport damage. Also make sure that the delivery conforms to the data on the shipping documents.



Immediately inform your contact person at Andritz Oy about possible damages or missing parts so as to agree on further procedures and to determine possible compensation claims.

4 ERECTION

The following instructions and drawings are needed when installing the AhICleaner bank:

- Construction and layout drawings for the site, showing the location of the cleaner bank
- Piping drawings showing the direction and location of feed, accept and reject pipes
- Assembly drawings of the cleaner banks
- Foundation drawing
- Machine manual

Lifting eyes are provided on top of the AhICleaner bank for lifting the bank.



Do not attach lifting equipment to any other points other than the lifting eyes.



Install the cleaner bank by securing it with the foundation screws included in the delivery (see foundation/dimensional drawing).

Each AhICleaner bank is provided with:

1. Machine plate

The machine plate for an AhICleaner bank shows:

- Name and address of manufacturer
- Type marking
- Manufacturing job number of the AhICleaner bank
- Manufacturing year

2. Andritz nameplate

When the AhICleaner bank is delivered as separate piece, assemble the bank in accordance with the assembly instructions (► Sec. 4.1, Installing cleaners into the feed/accept manifold on page 4-2 and Sec. 4.2, Assembly of the cleaner body on page 4-3).

4.1 Installing cleaners into the feed/accept manifold



To facilitate the installation of the cleaner body, place a piece of deal onto the feed head fasteners. By hammering lightly on the deal with a plastic or rubber hammer, the feed and accept connections of the feed head, and the O-rings, sink into the bank connections.



When hammering, always use an intermediate piece (a piece of deal) otherwise the feed head may break.

Step	Action
1	Make sure that the O-rings and locking rings have been inserted in the feed head feed and accept connections. The locking ring ends must be at the claw clutches.
2	Slide the fasteners to the stud bolts of the bank under the classifier pipes.
3	Lubricate the inner surfaces of the feed and accept connections of the bank with soap, grease or any other mould lubricant.
4	Install the cleaner body by pushing the feed head feed and accept connections into the bank feed and accept connections so far only, that the ends of the bank connections meet the feed head feed and accept connection stoppers.
5	Ensure that the O-rings remain in their grooves.
6	During installation of the cleaner body, ensure that it is turned the right way. Direction arrows have been marked on the feed head connections: Feed head accept connection = direction arrow outwards. Feed connection of feed head = direction arrow inwards.
7	Install another cleaner body in the same manner under the same fastening element.
8	Slip the fasteners on the head side of the classifier pipe, then put the stud bolts through the fasteners and tighten the wing nut to hand tightness.
9	Install the cleaner fastening element in its place and tighten the wing nut to hand tightness. In the feed and accept connections, the stopper should barely touch the bank connection ends.
10	Check that the O-rings are in their places in the classifier pipe groove.
11	Slip the joint nut on the cone.
12	Fasten the cone to the classifier pipe with a joint nut and tighten the nut with a key.
13	Tighten the clamps of the sight glasses.

Tab. 4-1 Installing cleaners into the feed/accept manifold


CAUTION

In plastic cones, the classifier pipe stopper must slide into the groove of the cone flange. If the cones are ceramic, remove the stopper studs on the classifier pipes. The easiest way to remove the stud is to grab it with a pair of small tongs and bend it off in the direction of the classifier pipe radius. Then even the plane of fracture to the same level as the classifier pipe end.


WARNING

Install the ceramic cone with special care, as it does not tolerate blow stress.

4.2 Assembly of the cleaner body

Step	Action
1	Install the O-rings (► Fig. 4-2/412.1) into the seal grooves of the feed and accept connections of the cleaner feed head (► Fig. 4-2/5252), behind the clutch claws.
2	Install the locking rings (► Fig. 4-2/517) in front of the O-rings behind the clutch claws so that the locking ring heads are at the clutch claws.
3	Push the accept pipes (► Fig. 4-2/5253.2; det. B) into the feed head of the "O"-side marked with an "O" and the "V"-side marked with a "V" so that the guide bars on the inner surface of the feed head meet the grooves of the outer sleeves of the accept pipes. The marks "O" and "V" are found at the outer surface of the feed head and at the accept pipe sides between the outer sleeve and the inner pipe.
4	Install the O-ring (► Fig. 4-2/412.2; det. B) in the classifier pipe (► Fig. 4-2/5254) sealing groove, against the sealing flange.
5	Push the classifier pipe on the feed head so the guide bar of the feed head meets the groove of the classifier pipe sealing groove.
6	Tighten the joint nut (► Fig. 4-2/5255.1, det. B) with a key.
7	Install the O-ring (► Fig. 4-2/412.2; det. C) onto the feed head cover's (► Fig. 4-2/5282, det. C) sealing groove, against the sealing flange.
8	Push the feed head cover on the feed head so that the guide bar of the feed head meets the groove of the feed head cover's sealing groove and tighten the joint nut (► Fig. 4-2/5255.1, det. C).

Tab. 4-2 Assembly of the cleaner body

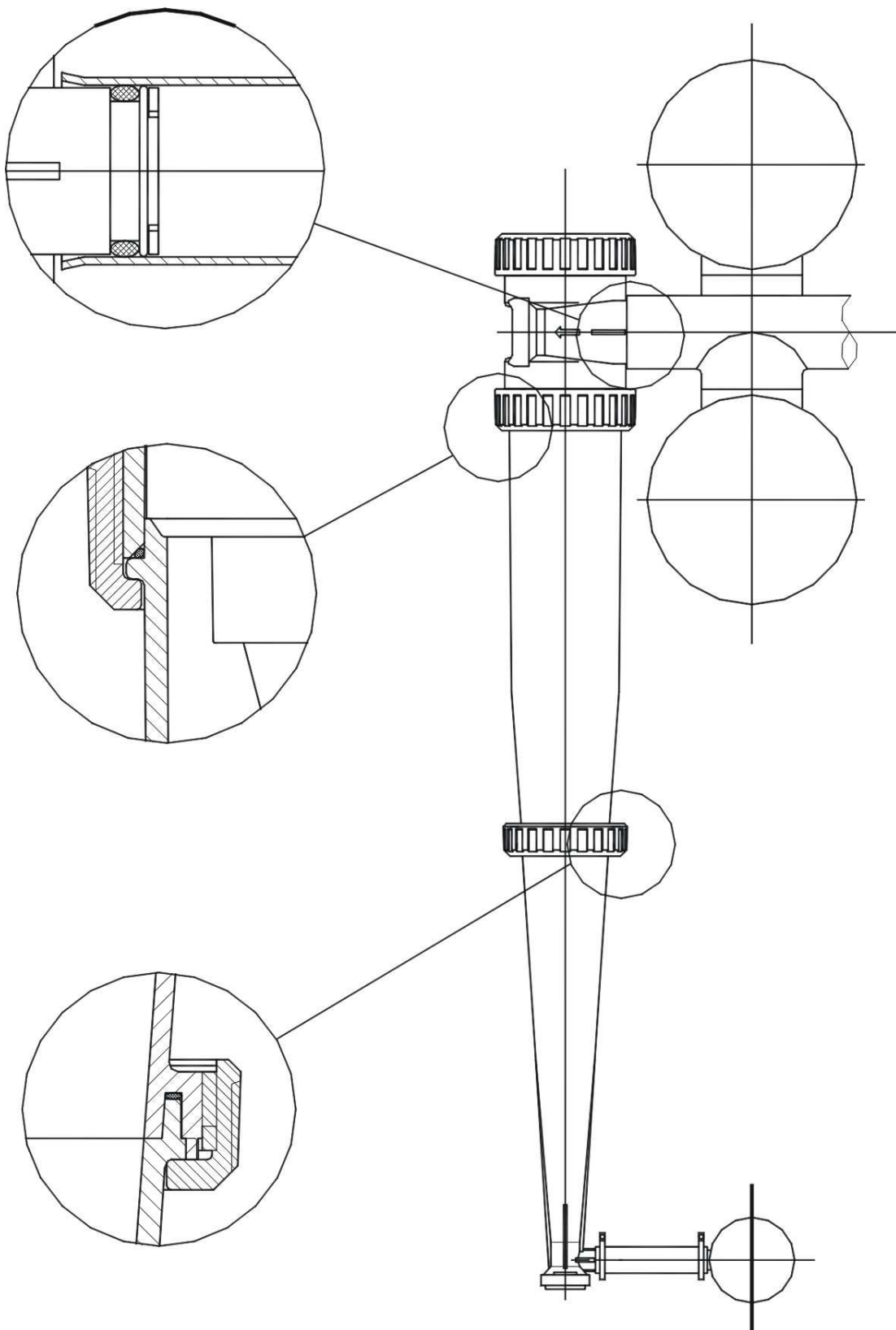


Fig. 4-1 Cleaner assembly, connections

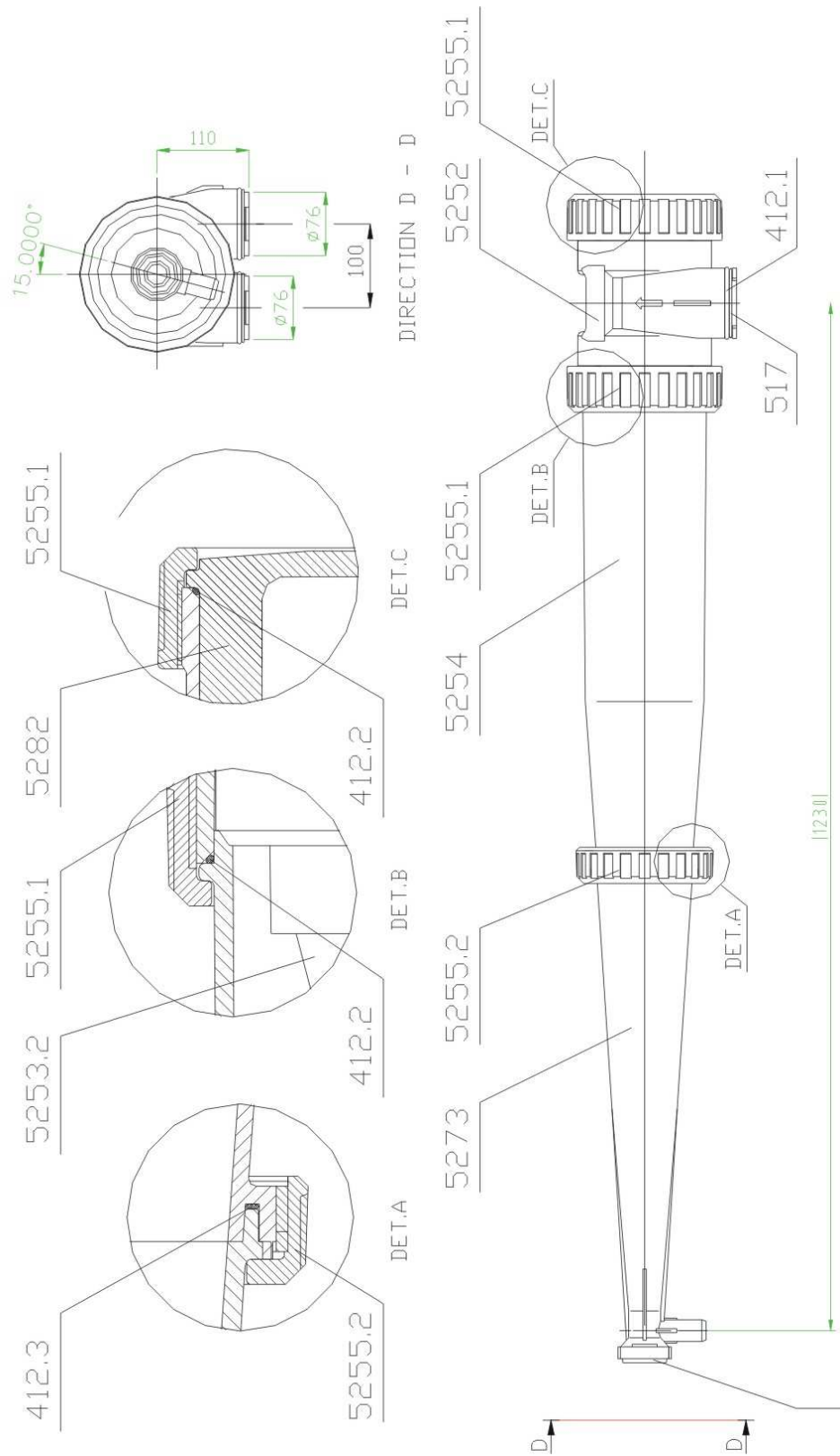


Fig. 4-2 Cleaner body assembly

5 OPERATION

The Ah!Cleaner centrifugal cleaner bank is usually part of a plant consisting of several centrifugal cleaner banks. There is a separate instruction for each Ah!Cleaner centrifugal cleaner type.

5.1 Inspection before operation

Prior to start-up, make sure that:

- The cleaners are correctly assembled
- The feed, accept and reject pipes are connected to the pipelines and are properly tightened and supported
- The foundation screws of the cleaner bank are tightened and that grouting is made
- The pipes and supports are correctly mounted
- The pipes do not stress the cleaner bank

5.2 Checking the instrumentation

Calibrate the instrumentation during a water run.

5.3 Start-up

The Ah!Cleaner bank is usually part of an entire plant. The cleaner bank is often started together with other related equipment.

Prior to the start-up, make sure that:

Preconditions

- The Ah!Cleaner cleaners are correctly assembled and the connections are tightened
- The pipes connected to the Ah!Cleaner bank are correctly installed and supported
- Any impurities generated during installation, such as welding remains, slag, building mortar etc., are flushed away
- The accept and reject valves for each Ah!Cleaner bank as well as the accept and reject valves in the pipeline are completely open
- The discharge side valve of the feed pump for the Ah!Cleaner bank is closed, i.e. the pump will start against a closed valve
- The valves on the suction side of feed pumps are opened
- The dilution water tank for the Ah!Cleaners is full of water
- The deaeration valves are closed and the instrumentation is correctly installed

In addition, pay attention to the following factors during the start-up:

- Always start the AhICleaner pump with white water
- Adjust the feed pressure with the discharge side valve of the pump, which will open gradually to its set value within 30 to 60 seconds
- Once stable conditions have been achieved with water and the air has been removed from the cleaner bank (which can be hastened by opening the R 1/2" deaeration valves in the top part of accept and feed pipe), thick stock can be led into the circulation. Once stock has entered the circulation, make sure that the pressures are correctly adjusted, and make any necessary changes
- Make sure that all cleaners reject. This is done by looking through the sight glasses, where a reject flow can be seen as a steady turbulent movement. In connection with a misadjustment, the reject flow may cease. Should this happen, increase accept pressure while keeping the pressure loss unchanged. Then readjust the reject pressure
- Tune the AhICleaner centrifugal cleaning plant by taking consistency samples at every stage

Start-up

Start the AhICleaner bank as follows:

Step	Action
1	Start the feed pump against a closed valve. The feed valve will open gradually to its set value within 30 to 60 seconds.
2	Adjust the feed pressure with the pressure side valve to 160 - 180 kPa.
3	Adjust the accept and reject valves so that the desired pressure loss of approx. 130 kPa for AhICleaner TC/SC 133 is achieved. Adjust the accept pressure to 30 - 50 kPa and the reject pressure to 20 - 40 kPa.
4	Lead stock into the circulation.
5	Check the pressure difference.

Tab. 5-1 Start-up the AhICleaner bank

5.4 Adjusting the AhICleaner

The AhICleaner is usually part of a plant consisting of several centrifugal cleaner stages. There is a separate instruction for each AhICleaner centrifugal cleaner type.

The AhICleaner should be adjusted once continuous operation has been achieved in order to maintain effective operation.

Pressure loss, feed consistency and the reject rate affect the operation of the cleaner.

The total amount of reject in centrifugal cleaning depends on the amount of impurities in the stock fed into the cleaner. A sufficient amount of the reject must be removed continuously.

The reject quantity and pressure difference are altered during optimization.

The reject rate per weight can be calculated using the following formula:

Formula:	
$\text{Reject rate [\%]} = \frac{C_r (C_i - C_a)}{C_i (C_r - C_a)} \times 100$	
Variables:	
	C_r = reject consistency [%]
	C_i = feed consistency [%]
	C_a =accept consistency [%]

Tab. 5-2 Reject rate formula

The following figures visualize the cleaner's capacities when running water at a temperature of 50°C. Approximate capacities when running stock can be calculated by deducting the given values of water by 5%. The x-axis indicates the **pressure drop** $P_{\text{feed-accept}}$ at the AhlCleaner.

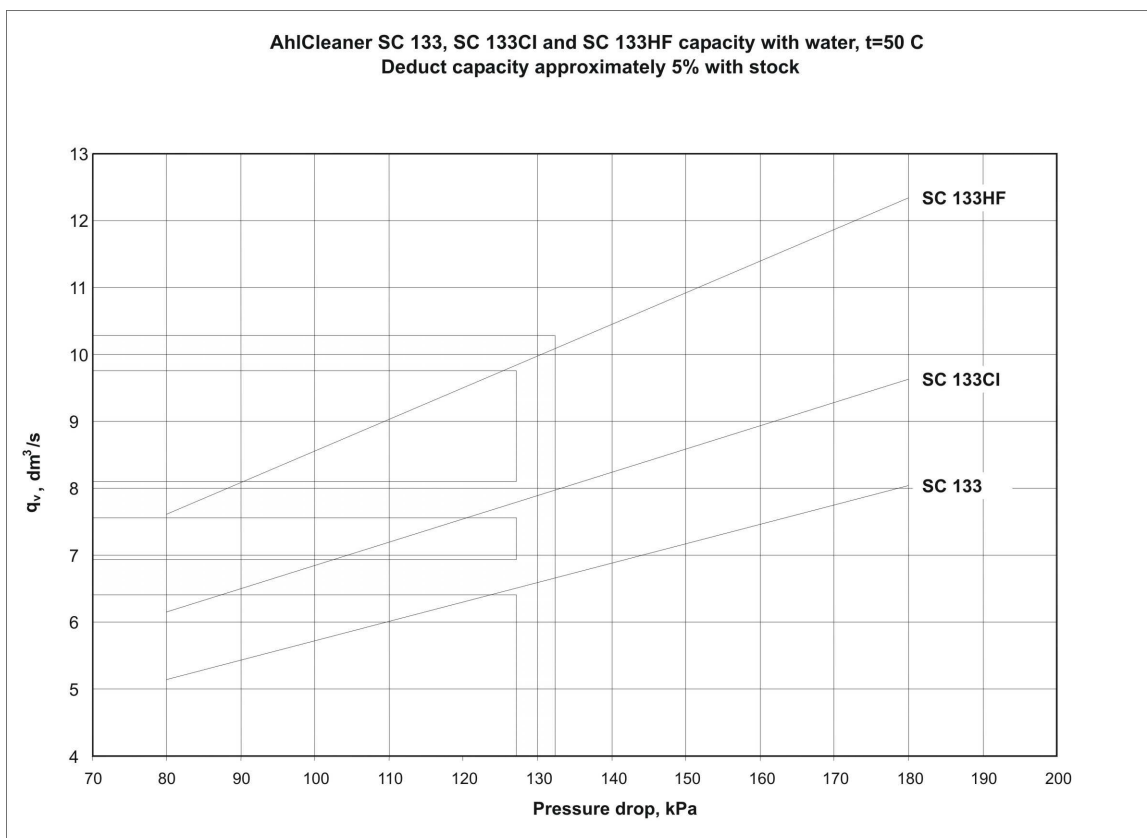


Fig. 5-1 Capacity curve, SI units

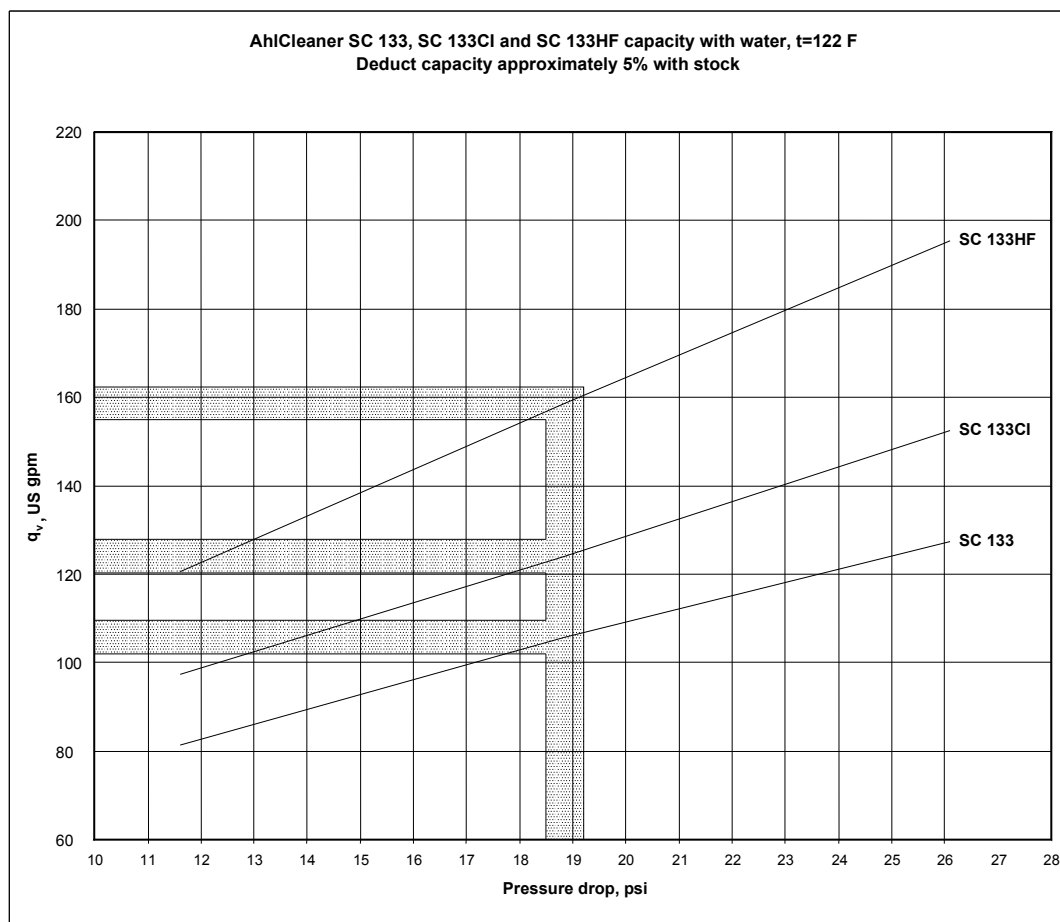


Fig. 5-2 Capacity curve, US units

5.5 Monitoring during operation

The operation of the cleaner bank can be monitored by means of pressure gauges and the sight glasses. Pressure variations are a sign of air circulating in the process.

Pay attention to the following factors:

- Check the feed, accept and reject pressures
- Check that each AhiCleaner operates properly. Reject flow will be slow or even cease if the tip in the cone of the cleaner becomes plugged. This can be observed through the sight glass. If several cleaners become plugged and the cleaner bank is still operating, the impurities begin to circulate in the cleaners, causing wear and giving an impaired cleaning result
- Check the consistencies
- Measure the reject amount
- Check the cleaner for leaks

- Monitor the cleaners for any vibration, which is a sign of plugged cleaners

5.6 Shutdown

The AhlCleaner bank is stopped in stages as deemed necessary by the operation of the plant.



CAUTION

After each shutdown, flush the centrifugal cleaner process with circulating water until all stock has been removed from circulation. If flushing is not performed, the stock remaining in the centrifugal cleaners will become thick and plug the cleaners when restarted.

Stop the AhlCleaner bank as follows:

Step	Action
1	Close the stock feed.
2	Run the cleaner bank with circulating water.
3	Stop the feed pump.

Tab. 5-3 Stopping the AhlCleaner



CAUTION

If the plant has several stages, stop the first stage and then the proceeding stages following the sequence.

5.7 AhlCleaner TC133 and SC133 units with Vortex Control – nozzles

5.7.1 General

Vortex Control –nozzles can be used in final stage / latter stages to increase cleaning efficiency, reduce fiber loss and to improve operation reliability (ie. minimize cone plugging).

The main idea is to be able to control the length of vortex flow in the center of cleaner. In conventional cleaners the vortex flow extends all the way down to the reject end sight glass and in the worst case sucking impurities to accept flow. As a consequence of this the accept pulp cleanliness is reduced. The working principle is shown in (► Fig. 5-3, Conventional cleaner vs. Vortex Control -nozzle on page 5-7)

The vortex flow is stopped with the Vortex Control –nozzle, which is closed on top. The nozzle prevents the vortex flow from reaching the reject end. In addition, there are two narrow slots in the nozzle for feeding flush water/filtrate. Flush water is injected tangentially to the reject flow near the reject end. The flush water dilutes reject flow by washing useable fibers and fillers to accept flow. Flush water lowers the reject thickening resulting reduced mass reject rate (if reject volume flow is kept constant). Therefore the risk of plugging is also lower.

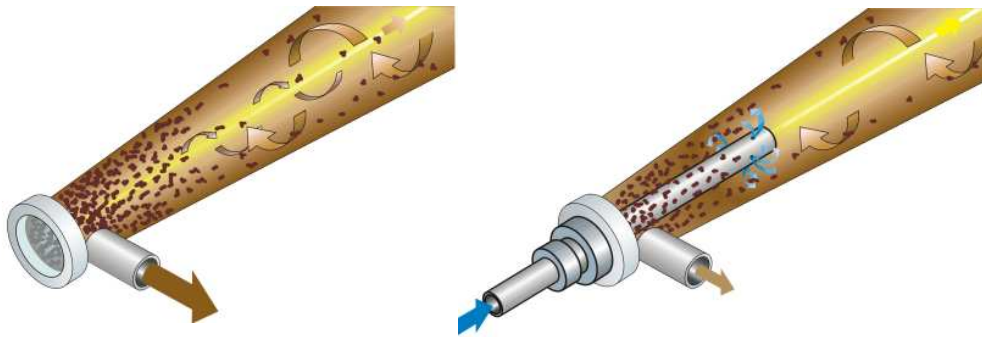


Fig. 5-3 Conventional cleaner vs. Vortex Control -nozzle

5.7.2 Assembly Instructions

The Vortex Control –nozzle is fitted to the reject end of the cone (replacing the sight glass). Before fitting the nozzle, the length of nozzle must be adjusted to desired position. The optimal distance for the nozzle is 95 mm from the upper end of the fastening element. The construction of the nozzle is shown in (► Fig. 5-4, Construction of Vortex Control –nozzle on page 5-7)

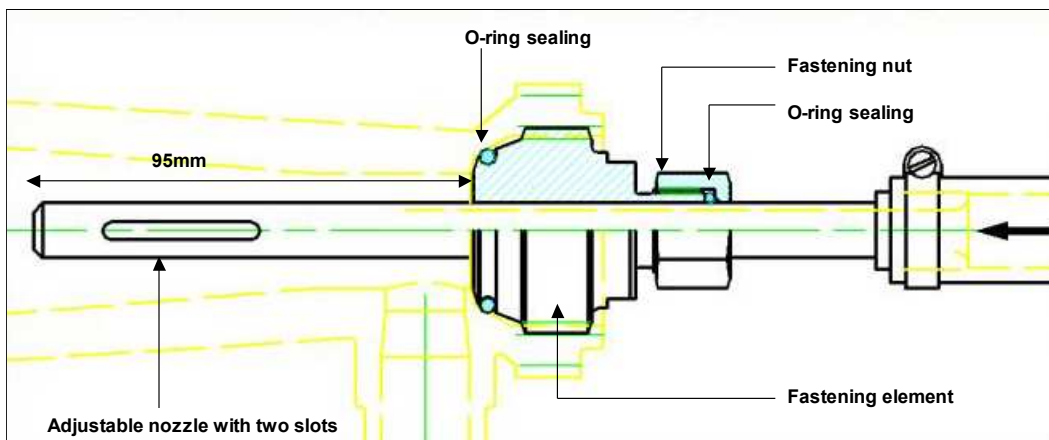


Fig. 5-4 Construction of Vortex Control –nozzle

If the distance is considerably less than 95mm, the reject rate per weight is reduced, but the cleaning efficiency starts to decrease. If the distance is considerably more than 95mm, the reject rate per weight is increased, but the cleaning efficiency remains the same.

- Fit the length of the nozzle to be 95 mm from the top end of the nozzle to the upper end of the fastening element
- Place 2 pcs of O-rings against the lower part of the fastening element
- Tighten the nut
- Remove the cleaner sight glass by using unplugging device for example (special tool)
- Screw the nozzle in and fasten from the fastening element

- In case the nozzle must be detached from the cleaner, remove the nozzle by unscrewing it from the fastening element, not from the fastening nut

5.7.3 Operating instructions

When Vortex Control -nozzles are used, the reject flow is controlled with reject pressure the same way as with other pressurized cones.

Recommended pressures in the cleaner system are:

Type of Pressure	Value (kPa)
Feed pressure p_{feed} approx.	180
Accept pressure p_{accept} approx.	50
Pressure difference $p_{\text{feed}} - p_{\text{accept}}$	130
Reject pressure p_{reject} approx.	30

Tab. 5-4 Recommended pressures in the cleaner system

The flow and pressure of the flush water/filtrate is adjusted so that the desired reduction in reject thickening is achieved. The average flush water/filtrate flow should be approx. 35-40 l/min (0.6-0.7 l/s) per cone, which corresponds to pressure of 1.5-1.7 bar in the flush water manifold. If the flush water flow exceeds 50 l/min per cone, the cleaning efficiency starts to decrease and the flush water eventually washes all the rejects to cleaner accept. The flush water pressure vs. flow curve is shown on (► Fig. 5-5, The flush water pressure vs. flow on page 5-9).

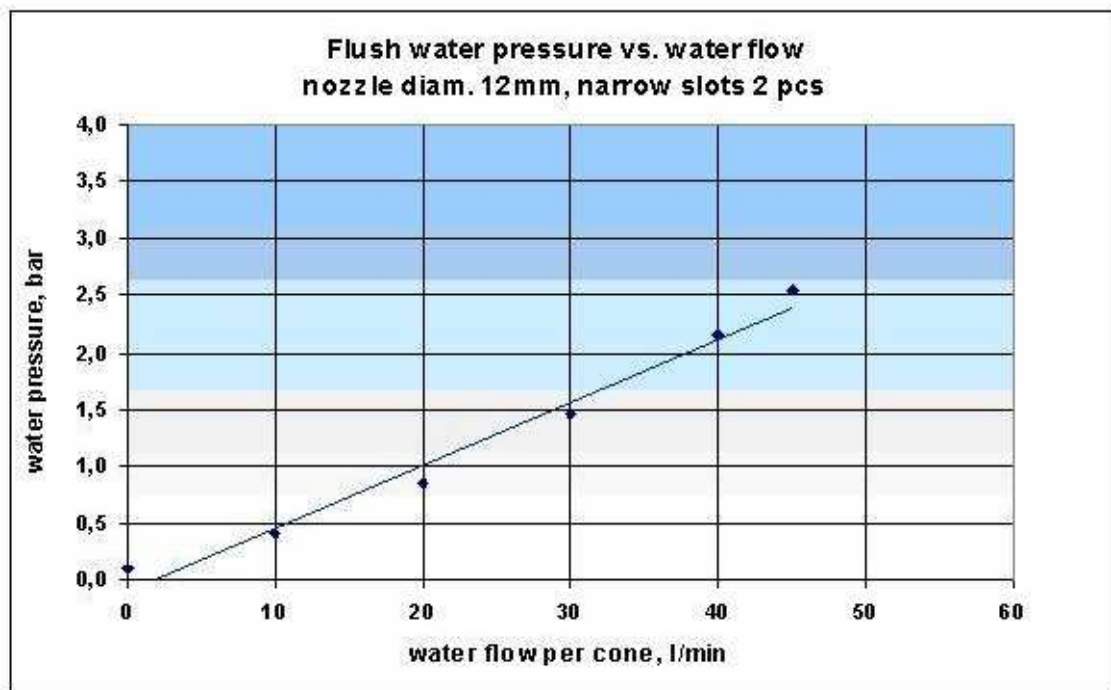


Fig. 5-5 The flush water pressure vs. flow

When Vortex Control -nozzles are used, an additional pressure metering or rotameter/flow meter is needed for adjusting flush water. In addition the flush water must be interlocked in the instrumentation so that the flush water is always in use when the cleaners are operating (ie. flush water starts first and stops last) otherwise the Vortex Control -nozzle and the flush water manifold might get plugged.



For operating the cleaners safely, it is most important to prevent the flush water pressure from pressurizing the cleaners. The flush water must be interlocked so that cleaner accept valve will not close before flush water is shut off.

Basic instructions for adjusting the AhlCleaner TC133 with Vortex Control – nozzles:

Step	Action
1	Open flush water vave so that the water flows to cones.
2	Start feed pump for the AhlCleaner stage which is equipped with Vortex Contro-nozzles (if several stages are equipped with Vortex Control-nozzles, always start from the latter stage.)
3	Adjust the feed and accept pressures.
4	Adjust the reject pressure.
5	Adjust the flush water flow to be approx.35-40 l/min per cone
6	Estimate the quantity of unseable fibers in the reject flow. If lots of useable fibers and fines are rejected, increase the flush water flow. Adjust the reject flow so that the quantity of fibers rejected in the reject flow is acceptable.

Tab. 5-5 Adjusting the AhlCleaner SC133 with Vortex Control-nozzles

6 INSPECTION AND MAINTENANCE

The AhlCleaner bank is usually maintained during shutdowns. Simultaneously, inspect the condition of the cleaners and replace any damaged parts. Perform a general overhaul every six months.

Overhaul

Proceed as follows when performing an overhaul:

Step	Action
1	Open the cleaners.
2	Flush the cleaners.
3	Inspect the cleaners for wear.
4	Replace parts that are severely worn.

Tab. 6-1 Performing an overhaul

Extent of wear

The extent of wear is measured by checking the smoothness of the inner surfaces of the cleaners and the size of the reject opening in the tip.

7 ACCESSORIES

7.1 Pressure gauges

Ready installed pressure gauges for remote control are supplied with the Ah!Cleaner bank on request.

7.2 Deaeration

The feed and accept pipes are provided with deaeration valves R 1/2".

7.3 Stairs

On request, portable stairs are supplied with the Ah!Cleaner bank to facilitate maintenance and installation of the cleaners.