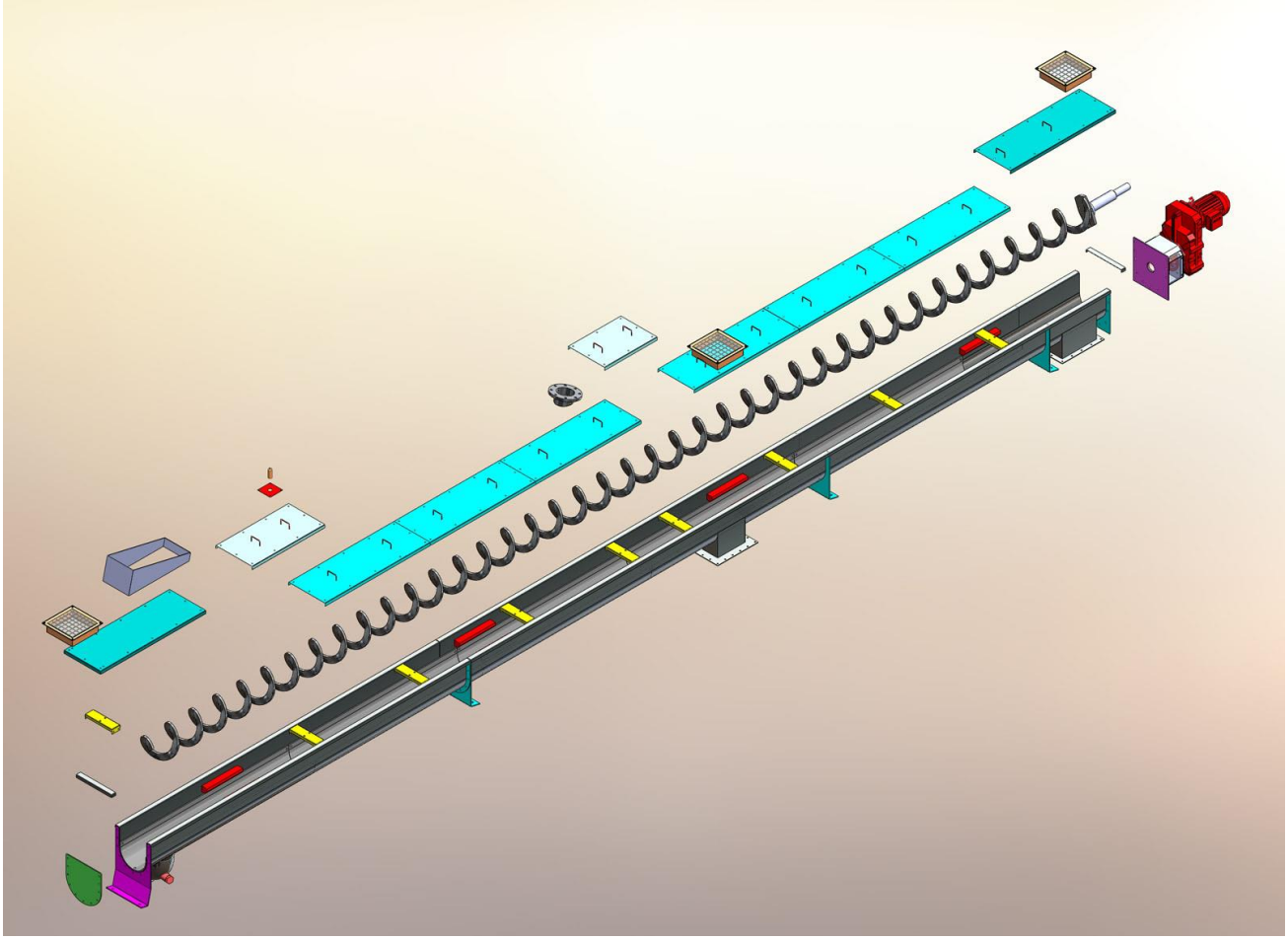
Installation and Maintenance Manual

for

serpecon Shaftless Screw Conveyors

Models: S300, S350, S400, S500 & S600

Edition 8.4 June 2020



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1. Introduction

This manual detail's the normal functions and operations associated with serpecon models, S300, S350, S400, S500 & S600 Shaftless Screw Conveyors and is intended to be used by qualified mechanical and electrical personnel.

Please note reference should be made to the specific order, as built drawings, specifications and appendices issued with this manual as it is unlikely your purchased conveyor includes all the various combinations of options detailed.

It is not the intention of this manual to describe how the overall scheme should be operated; such information will be found in the client's standard operating procedures and ultimately their FDS.

The operation and maintenance manual forms a vital role in the operation of the mechanical and associated electrical components installed and it is important that the equipment is used in conjunction with this manual. This manual should be kept for the complete life of the equipment, and therefore all amendments must be documented carefully by the client, to ensure that the manual describes the actual operation of the equipment at all times. Failure to do so will result in this manual being obsolete.

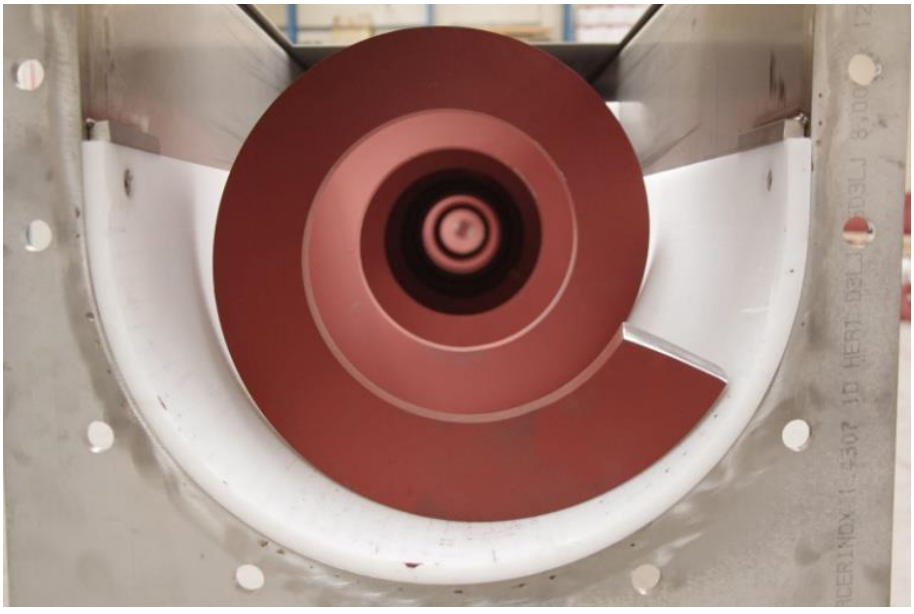
Failure by the purchaser to operate and maintain the equipment in accordance with this operating and maintenance manual may result in the warranty and any/ or contractual obligations being null and void.

1.1 The serpecon Screw Conveyor

The serpecon screw conveyor is used efficiently for the collection and transport of uncompressed screenings from the inlet works of a sewage treatment plant, simple but effective equipment for transporting them efficiently by a shaftless spiral screw conveyor.

1.2 Design

The screw conveyor is manufactured from stainless steel formed into a U-trough to house a plastic liner and internal rotating spiral which runs on the plastic liner for transportation of a wide variety of materials.



1.3 Design Features

- Free standing units for ease of installation and system arrangement
- Fully enclosed for odour control and safety
- No lubrication required, (except for external drive unit)
- Complete system to be included as a package
- No tail or intermediate bearings – thus minimising maintenance
- Can be delivered as a complete unit with standard supports
- All metal parts are manufactured from 304L stainless steel, (316, galvanised or painted is also available as an option)
- Spirals manufactured from special high tensile carbon steels increasing its wear and durability characteristics, (316 spirals available as an option)

1.4 Shaftless Spiral

Our standard spiral screw is manufactured from high-tensile steel having an ultimate breaking stress above 500 N/mm². The high tensile steel is cold-rolled, giving a substantial hardness increase and thereby an increased wearing resistance. Absence of screw centre tube means that the spiral is flexible and can be placed directly into the U-trough without support bearings. The shaftless screw also has a good dewatering effect, because there is no centre tube preventing water draining. This is an idealistic solution when handling abrasive material. The screw spiral is directly

attached to a geared motor drive. The speed is adjusted for the most suitable dewatering and capacity.

2. Conveyor Specifications

Description	S250	S300	S350
Capacity (m3/ hour)	0.5 to 3	1 to 6	2 to 10
Incline (degrees)	0 to 12	0 to 18	0 to 20
Geared motor type	Flange mounted – direct shaft coupled		
Power (kw)	0.75 to 4.0	1.1 to 5.5	1.5 to 5.5
Rpm @ 50hz	up to 45	up to 40	up to 36
Length (metres)	2 to 10	2 to 12	2 to 15
Casing construction	304L stainless 316 stainless	304L stainless 316 stainless	304L stainless 316 stainless
Casing thickness (mm)	3	3	3
Cover thickness (mm)	1.5	1.5	1.5
Drive end plate thickness (mm)	6	6	8
Tail end plate thickness (mm)	5	5	5
Spiral construction	SB400D HT 304 Stainless 316 Stainless	SB400D HT 304 Stainless 316 Stainless	SB400D HT 304 Stainless 316 Stainless
Spiral diameter (mm)	210	285	315
Spiral pitch range (mm)	210 to 245	140 to 340	190 to 315
Spiral thickness (mm)	20 to 25	20 to 25	20 to 30
Spiral bar size range (mm)	50 to 60	60 to 80	60 to 80
Spiral rotation monitor	Leutz 40	Leutz 40	Leutz 40
Plastic liner construction	PE1000	PE1000	PE1000
Plastic liner hold blocks	PE500	PE500	PE500
Liner wear indicator	Leutz 20	Leutz 20	Leutz 20

Note:- All specifications and/ or data given above may be subject to change without notice or written warning. Refer to manufacturer direct with any specific queries.

Description	S400	S500	S600
Capacity (m3/ hour)	2 to 15	4 to 30	6 to 50
Incline (degrees)	0 to 22	0 to 30	0 to 30
Geared motor type	Flange mounted – direct shaft coupled		
Power (kw)	2.2 to 11	5.5 to 22	11 to 30
Rpm @ 50hz	up to 36	up to 32	up to 30
Length (metres)	2 to 20	3 to 30	3 to 40
Casing construction	304L Stainless 316 Stainless	304L Stainless 316 Stainless	304LStainless 316 Stainless
Casing thickness (mm)	4	4	4
Cover thickness (mm)	1.5	2.0	2.0
Drive end plate thickness (mm)	8	10	10
Tail end plate thickness (mm)	6	6	6
Spiral construction	SB400D HT 304 Stainless 316 Stainless	SB400D HT 304 Stainless 316 Stainless	SB400D HT 304 Stainless 316 Stainless
Spiral diameter (mm)	380	480	580
Spiral pitch range (mm)	240 to 410	320 to 535	385 to 480
Spiral thickness (mm)	20 to 30	25 to 35	25 to 35
Spiral bar size range (mm)	60 to 80	60 to 80	60 to 80
Spiral rotation monitor	Leutz 40	Leutz 40	Leutz 40
Plastic liner construction	PE1000	PE1000	PE1000
Plastic liner hold blocks	PE500	PE500	PE500
Liner wear indicator	Leutz 20	Leutz 20	Leutz 20

Note all specifications and/ or data given above is general and may be subject to change without notice or written warning. Refer to manufacturer direct with any specific queries.

3. Health and Safety

Health and Safety

All Health and safety matters are contained within the Client's Project Technical File.

3.1 Compliance & Regulations

The operation & maintenance manual is produced to ensure that all equipment is operated and maintained in a safe manner to prevent danger to both the operator and user of the equipment. The Purchaser shall comply with the instructions and information given in the manual, and all personnel associated with the equipment supplied under the contract to which this manual refers, shall be made familiar with the information contained herein. As such, the equipment and its operation and maintenance are subject to the following Acts and Regulations including updates where they apply:

Health and Safety at work Act (HSAWA) 1974

Electricity at work Regulations (EAW) 1989

Management of Health and Safety at work (MHSW) 1999

The Construction, (Design and Management) Regulations 2015

Machinery Directive 2006/42/EC

(To include any amendments or as superseded or replaced by any subsequent and current Statutory Instruments).

3.2 Overview of the Regulations

The following extracts give a brief overview of the Acts and Regulations, as detailed above, and are intended to assist the user in implementing Health and Safety requirements for the safe operation and maintenance of the equipment supplied.

3.3 Operation, Installation and Maintenance

The purchaser is advised to ensure that the equipment supplied to the purchaser's order and contract is correctly installed in a suitable location and the work is undertaken by technically qualified and competent personnel experienced in the type and class of work involved. The requirements for ensuring the safety of personnel working on the equipment are summarised below.

3.4 Normal Operating Use

Ensure that equipment operators:-

- are fully conversant with all controls, particularly those used for emergency shutdown,
- comply fully with all safety warning notices and keep all enclosures closed and safety covers bolted in position, and
- are trained to recognise indications of incorrect operation or malfunction and are aware of the actions to take in the event of such occurrences.

3.5 Maintenance, Testing & Electrical Competence

Suitably qualified mechanical and electrical maintenance engineers only to maintain this equipment.

Ensure that they:-

- isolate the equipment completely prior to opening enclosures, removing covers or beginning work,
- comply with all safe working practises,
- are fully conversant with all information on measures related to personnel safety, and
- are able to recognise the hazards which might arise when working on energised equipment and take all necessary precautions

3.6 Operating With Voltages

The user shall ensure that all apparatus operating with voltage present is completely isolated and made safe prior to any work being undertaken. The user shall also ensure the apparatus cannot be energised while any work is being undertaken.

A safe permit to work system must be employed to control all work activities which could result in danger.

3.7 Code Of Practice For Electrical Maintenance

The recommendations in the British Standards publications detailed below should be considered in relation to all maintenance procedures, safety and in the upkeep of records.

This is:-

- BS6626: 2010 – British Standard Code of Practice for the Maintenance of Electrical Switchgear and Control Gear for voltages above 1kV and up to and including 36kV.
- The Electricity at Work Regulations 1989

4. Installation of Machinery

4. Installation of Machinery

Upon delivery to site, all machinery must be checked for damage.

Under no circumstances should any attempt be made to install any item, which shows sign of damage without first notifying Serpecon.

All component parts have been extensively and rigorously inspected prior to assembly, for correctness. This close attention has continued throughout the manufacturing and assembly process to ensure correct and true alignment of the screw and of the shafts through the bearing arrangements.

The complete assembly of each machine has been test run, with checks made during running for bearing performances, geared motor unit performances etc.

However, after a protracted period in storage and/ or transit, misalignment may occur. This is specific regarded to the stresses to which the equipment will have been subjected during the shipment/storage stage. If by sea or airfreight it is recommended that all machines should be closely inspected, prior to power being applied to the drive motor and that the casing be checked for debris.

When offloading, care must be exercised to ensure no damage occurs to the conveyor casing, lids, drive units and paintwork.

Whilst every care has been taken in delivering the goods, visual inspection must be carried out for possible damage in transit and irregular findings reported to SERPECON LTD immediately.

Failure to report damage immediately could result in the loss of your warranty.

Once the machine has been securely bolted in its location, the following checks should be made:-

- check alignment of machine,
- check assembly and mounting bolts and tighten if necessary,
- when bolting to other items of process machinery, proof check prior to tightening bolts to avoid unnecessary stresses to the machinery bodies which could cause deflection, and possible internal spiral to casing interference,

- check that spiral shaft is free to turn by hand, by rotating the geared motor fan,
- inlet and discharge ports shall be securely connected to other equipment to completely enclose the conveyor, and
- prior to connecting power to the drive a pre-start check should be performed to ensure that the equipment and surrounding area is safe for operation and that all safety guards are secured.

Please note that a full set of approved RAMS should be produced prior to considering and installation.

5. Commissioning & Operation Guidance

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5.1 Introduction / Getting Started

As both pre-commissioning and commissioning of the equipment should only be undertaken by qualified electrical & mechanical engineers, experienced in commissioning and putting in to service of electrical control panels and medium/ low voltage switchgear along with any associated plant or equipment is also required.

Commissioning must be carried out according to the client's overall commissioning plan.

5.2 Pre-Commissioning Checks

It is important that all personnel engaged in the commissioning of this equipment read the safety warnings, study the operation and maintenance manual along with drawings, to familiarise themselves with the equipment and overall scheme, along with gaining an understanding and appreciation of any other equipment and plant that is connected to and/or associated with and/or likely to be affected by the equipment being commissioned by reading the respective Manual and Drawings.

It is inevitable that during commissioning, switching off the mains supply(s) will be necessary, which will also cause disruption to any connected loads and possibly supplies to other equipment that is being commissioned.

It is essential that all parties concerned with, but not necessarily involved directly with the commissioning of this equipment, are aware of these possibilities at the commencement of the commissioning, and are in full agreement about its timing and the manner in which supply may be affected.

5.3 Precautions

The client should:-

- maintain a safety training and safety equipment operating and maintenance programme for all employees,
- ensure an emergency stop switch is fitted to the system as an absolute minimum requirement, this should be fitted so it is easily reachable,
- conveyor shall not be operated unless all moving elements are completely enclosed at all times and that power transmission guards are in place,

- practice good housekeeping at all times, provide and maintain good lighting around all machines,
- keep all operating personnel advised of the location and operation of all emergency controls and devices. Clear access to these controls and devices must be maintained,
- frequent inspections of these controls and devices, also covers, guards and equipment to ensure proper working order and correct positioning must be performed,
- do not walk on conveyor parts, guards or motors, unless safe to do so such as using a harness.
- do not poke or prod material in to any part of the grit classifier,
- do not place hands, feet or allow any item of loose clothing i.e. tie, into the wash press opening,
- do not overload or attempt to use it for other than the intended purpose,
- prior to connecting power to the drive a pre-start check should be performed to ensure the equipment and area are safe for operation and all guards are in place and made secure.

If the conveyor is to be opened for inspection, cleaning or observation, the geared motor drive unit and any peripheral equipment which could affect the grit classifier, should be locked out electrically in such a manner as it cannot be re-started by anyone. The client should have a safe lock off procedure of which all personal, employed or subcontract operating on their site should have been trained.

5.4 Start Up; No Material

We recommend the attendance of Serpecon Limited personnel during the initial start-up. Client must ensure the following:-

- all Gear Mounted Units and drives are in correct position and secured,
- all applicable covers and guards are in correct position and securely bolted down so that all moving elements are completely enclosed,
- gearboxes have the correct quantity of lubricant in accordance with manufacturer instructions, (to fill level),
- check electrical supplies to the drive unit comply with current legislation,

- peripheral safety devices are active and checked,
- ensure that no foreign bodies are in the machine, (Such as tools, screws etc),
- briefly energise drive motor and check for correct rotation.

When starting the conveyor for the first time, do so intermittently, (inching), to ensure no damage is caused if any problems occur. Serpecon always recommend soft starts and inverter drives.

Allow the conveyor to run for no more than 10 mins maximum when running dry and/ or with no material.

Regular checks should be made to observe for the following:-

- unusual noises emanating from the machine,
- drive misalignment, and
- gearbox over-heating

If any of the above points are observed, check the following and take necessary corrective action:-

- check alignment of machine and mounting of supports and interface joints with other items of plant machinery,
- check assembly and mounting bolts and tighten if necessary,
- contact Serpecon for guidance and/ or assistance, and
- check the rotation sensor is operating properly to ensure that if a breakdown occurs the safety cut out is triggered.

5.5 Start Up; With Material

Client must ensure the following:-

- check all outlets and skips are free of any restrictions, before feeding material into the grit classifier,
- gradually increase the feed rate until the rated capacity is reached,
- allow the conveyor to run for several hours starting and stopping at frequent intervals,
- check for excessive grinding or scraping noise,
- ensure slide gates are in the relevant position if applicable, and

- check and examine bearings, speed reducer and gear mounted units for overheating.

It is important that the conveyor is not overloaded by changing the feed condition. All motor powers, gearbox size and output speeds, shaft & bearing sizes etc, have been assessed and selected against the capacities, material densities and flow rates provided in the order specifications. In an overload situation damage may occur to some if not all of the constituent components of these items.

5.6 Operating Instructions

After installation of the machine in its operational location, (and connection of the electrical supplies to the drive unit), the following checks should be made:

- Check gearbox for correct level of oil, (refer to gearbox section for lubrication details),
- Check that all moving elements are completely enclosed and that all guards/covers are in place and secure, and
- Check GMU securing bolts.
- Check for leaks
- Ensure that the conveyor is only run periodically when grit is pumped into the classifier tank. This machine should not be run continuously. If it is run continuously then the wear rates of the internal spiral and liner will be very excessive and may invalidate your warranty and/ or any life time guarantees given.

6. General Fault Finding Check List

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Symptom	Check
Motor fails to start	Control circuits Overloads and reset switches All isolators and switches Electrical supply is available Conveyor is not jammed through overfeeding/ foreign object Blockage indicators/ rotation sensor are not jammed Outlets are not blocked Refer to manufacturers operating and maintenance instructions
Motor functions but no material is being fed into the skip	Material is not being fed in to the conveyor Screw is rotating in the correct direction Blockages are occurring inside Shaft is rotating (indicates a broken coupling joint etc.) Material consistency is to specification
Conveyor emits excessive noise	Foreign bodies present in conveyor Correct alignment of drive unit and transmission components Drive gearbox worn or breaking down Flights rubbing on casing (screw misalignment, liners worn)
Conveyor produces excessive vibration	Alignment of drive unit and transmission components and screws Loose or faulty components Conveyor mounting or support framework insecurely fitted
Low material throughput by conveyor	Low feed from feeding equipment Bridging of material inside the inlet hopper Internal spiral is worn
Slide valve does not open	Throat outlet blocked with material Rack and pinion mechanism seized Actuator faulty Drive shaft snapped Gears broken

7. Warranty

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Failure to carry out basic and routine maintenance as described in this manual will invalidate your warranty.

If in doubt the services of skilled Serpecon engineers are available at a fraction of downtime cost to assist in any maintenance mentioned in this manual.

Please note that due to the bespoke nature of the equipment offered, the varying materials it is expected to handle and the differing site conditions, it is impossible to for this manual to cover every item required to fulfil the warranty. The end user has obligations to ensure that only trained and competent staff maintains the equipment. There should be an in-house inspection and maintenance documented and signed schedule developed based upon the nature of the site otherwise warranty will be void.

Failure by the purchaser to operate and maintain the equipment in accordance with this operating and maintenance manual may result in the warranty and any/ or contractual obligations being null and void.

8. Maintenance

8. Maintenance

All maintenance must be carried out in compliance with the relevant Health & Safety regulations and end users own safe systems of work.

Regular checking of all lubrication points is essential – over lubricating is as detrimental as under lubricating.

Encourage staff to report any unusual sounds or smells immediately for investigation.

8.1 General Schedule of Minimum Maintenance

We recommend the following minimum maintenance schedules are carried out:-

8.2 Screw Conveyors operating with typical dewatered sludge cake

1.	Check all covers are fully bolted & bolts not missing.	weekly
2.	Remove sludge build up from internal instrumentation.	as required
3.	Remove sludge build up from internal spiral drive coupling.	as required
4.	Ensure slide valves are working correctly & not blocked.	weekly
5.	Remove sludge build up from the internal casing.	3 monthly
6.	Remove rotation, blocked chute & liner wear sensors	3 monthly
7.	Check Rotorks in accordance with the Rotork manual.	
8.	Check GMUs in accordance with the GMU manual.	
9.	Check drive shaft seal.	3 monthly
10.	Check condition of liners visually. (see section 8.9)	3 monthly
11.	Grease the rack and pinion drives on the slide valves	3 monthly
12.	Check Internal spiral for reduction in diameter & thickness.	3 monthly
13.	Check hold down blocks for condition & securely fastened.	6 monthly

8.3 Screw Conveyors operating with radial undercarriages

1.	Check all components are fully bolted & bolts not missing.	weekly
2.	Check GMU in accordance with the GMU manual.	
3.	Remove sludge build up from external components.	as required
4.	Remove sludge build up from the wheels & tyres	as required
5.	Check outer exposed bearings are clean.	as required
6.	Check radial pivot bearing is operating smoothly.	as required
7.	Remove sludge build up from safety light sensor.	as required

8.4 Screw Conveyors operating with bifurcated chutes

1.	Check all covers are fully bolted & bolts not missing.	weekly
2.	Remove rag, fats, & sludge from blocked chute sensors.	weekly
3.	Remove rag, fats & sludge from internal blade & shaft.	weekly
4.	Check outer exposed bearings are clean.	weekly
5.	Check Rotorks in accordance with the Rotork manual.	

8.5 Screw Conveyors operating with typical inlet screenings

1.	Visually check all covers are fully bolted & bolts not missing.	weekly
2.	Visually ensure slide valves are working correctly.	weekly
3.	Remove grit, rag and fats build up from head end casing.	weekly
4.	Remove rag & fats from blocked chute sensor	weekly
5.	Remove rag & fats from internal spiral drive coupling.	weekly
6.	Remove all grit, rag & fats from the drain decks.	monthly
7.	Check spiral brushes are in good working order if fitted.	3 monthly
8.	Check drive shaft seal.	3 monthly
9.	Check condition of liners visually at the tail end.	3 monthly
10.	Grease the rack and pinion drives on the slide valves	3 monthly
11.	Check Internal spiral for reduction in diameter & thickness.	6 monthly
12.	Check hold down blocks for condition & securely fastened.	6 monthly
13.	Check the internal plastic runner bars & knife plate of the vertical type slide valves. Check Rotorks in accordance with the Rotork manual. Check GMUs in accordance with the geared motor manual.	12 monthly

Special note re item 5. This should be a weekly check if a spray nozzle is fitted which reduces build up. If the spray nozzle is not fitted it will be a site specific/ as required task.

8.6 General Housekeeping/ Cleaning Inlet Works Conveyors

In addition to the above the end user should ensure that all components are kept clean at all times. Due to the nature of inlet screenings internal components will be required to be thoroughly de-ragged and fat build up removed on a regular basis, particularly in winter months after heavy rainfall & with flat sewer systems.

A good housekeeping practice should be set up. If the equipment is to be left for the weekend the end user should ensure that all internal components such as spirals, instrumentation, drive shafts, spiral couplings, drain decks are thoroughly clean. Also this should be done in anticipation of a storm, (peak flows), and immediately afterwards. This is essential if the system is to be kept reliable.

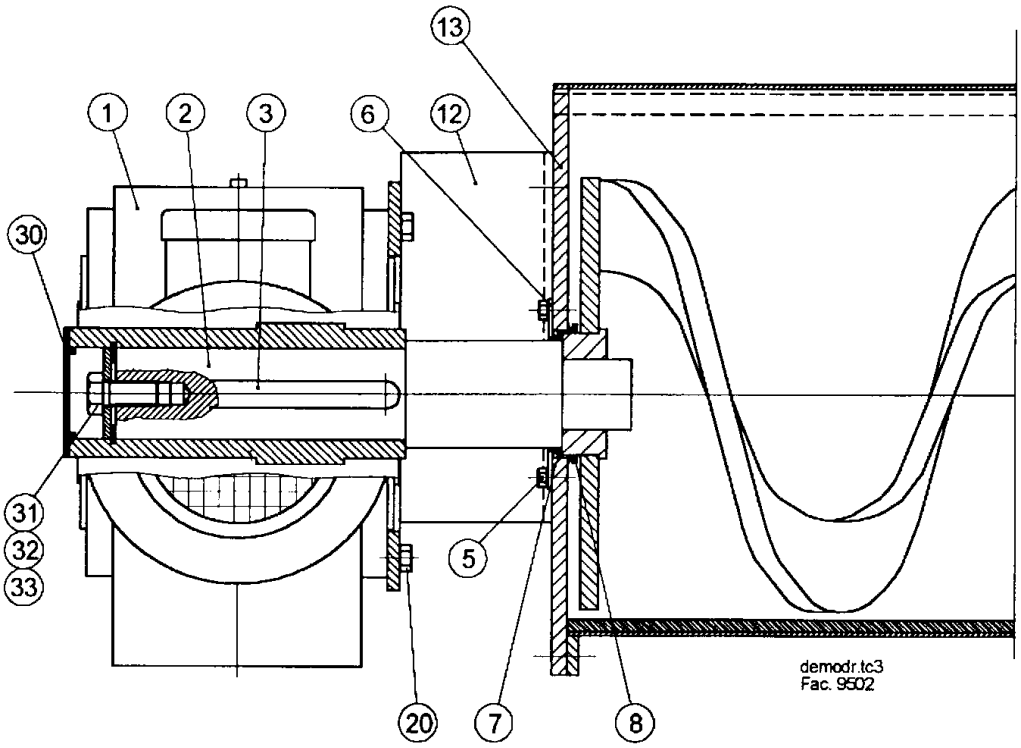
The system will not be reliable if this is not carried out on a daily/ weekly basis. A documented system must be adhered to and tailored to suit the history of the

site, (which only the end user can fully know). Please note Serpecon expect the client to produce a written log of the task schedule carried out. Failure to produce evidence of the above will result in the withdrawal of the warranty.

8.7 Removing The Geared Motor Unit

The power units have a circular flange bolted directly to the trough end plate. The dismantling procedure and re-assembly procedure is the same in reverse.

1. If the trough is inclined, secure the spiral screw in position with a sling or chain.
2. Remove the screws connecting the flange of the power unit to end plate.
3. Remove the cover (30) and dismantle the bolt and washers (31, 32, 33) keeping the power unit (I) in position on the shaft end (2).
4. Push the shaft (2) out from the power unit centre using a suitable putter.



Assemble in reverse order. Clean, inspect and lubricate the components before assembly.

8.8 Dismantling The Shaft Seals

Between the trough and the drive unit there are two standard V-seals to decrease the risk of leakage or damage to the gear's seal. Remove the drive unit as above and the seal rings are then completely free and can easily be removed.

1. Remove the screw (5) holding the seal's washer (6) and remove washer.

2. Remove the outer V-ring seal (7). Note the direction of the sealing lip.

3. Push the screw into the trough until the step with the inner V-ring seal (8) is exposed, and lock it in this position. (For any inclined clarifier, slacken somewhat on the positioning sling or chain holding the screw.)

4. Assemble in reverse order. Clean, inspect and lubricate the sealing parts before reassemble. Be careful not to damage the new seals when mounting them. Finally, replace the power unit.

8.9 Joining Spiral Screw Sections

Before you start, check that the spiral is axially straight and undamaged.

1. Place the sections one after the other in a U-beam or directly in the trough. This makes it easier to get the screw straight.

2. Check that the spliced edges are cut at 90°angle towards the spirals tangent line for optimum strength in the splice. The edges are prepared for X or K joints and placed towards each other with 2mm columns.

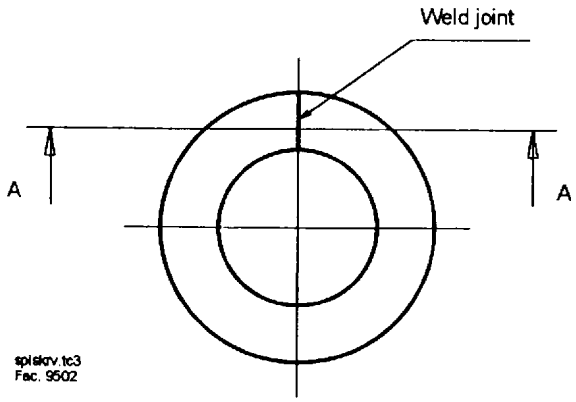
3. The sections are now carefully welded together with continuous checking of the spiral's straightness as follows:

4. Alternates tack weld both sides of the screw joint along its edges.

5. Then continue with a weld run along one side and follow one on the opposite side.

6. Repeat this until the welding joint is completely filled.

A minimum of three welded runs at each side are recommended to obtain good strength. The maximum allowed curvature for spiral weld straightness is 5mm per 1000mm in length.



End view of spiral

8.10 Changing Internal Spiral

If a large part or the spiral becomes out of true or worn, the entire spiral is normally changed.

1. The spiral guiders in the trough are removed if they are fitted. The lock bolt at the end of the shaft is removed and the gearbox mounting bolts loosened to allow the spiral shaft to be drawn out of the gearbox and the spiral lifted out the trough.

2. The assembly of the new spiral is now performed in reversed order.

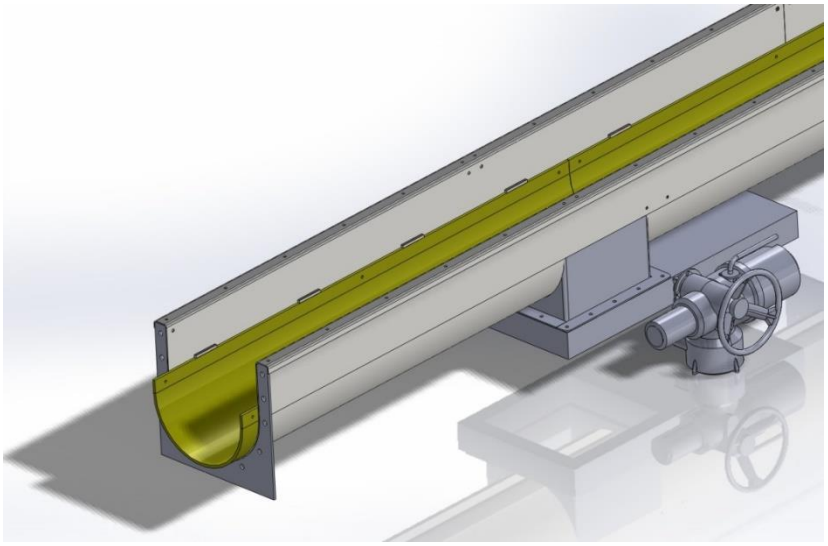
Sometimes it can be impractical to dismantle the spiral drive end. In such cases, the end of the spiral is cut from its end plate. If the necessary space is available over the conveyor the new spiral is placed in the trough, (straightness is obtained automatically), using spacers between spiral lining to ensure alignment of shaft trough endplate into gearbox. Afterwards the spiral is welded to its endplate.

With longer conveyors or when a short section only becomes damaged, only the defective section is replaced. This is done by cutting out sections of the spiral, the replacing with the correct length, placed in the trough and welded together, (see section 8.4).

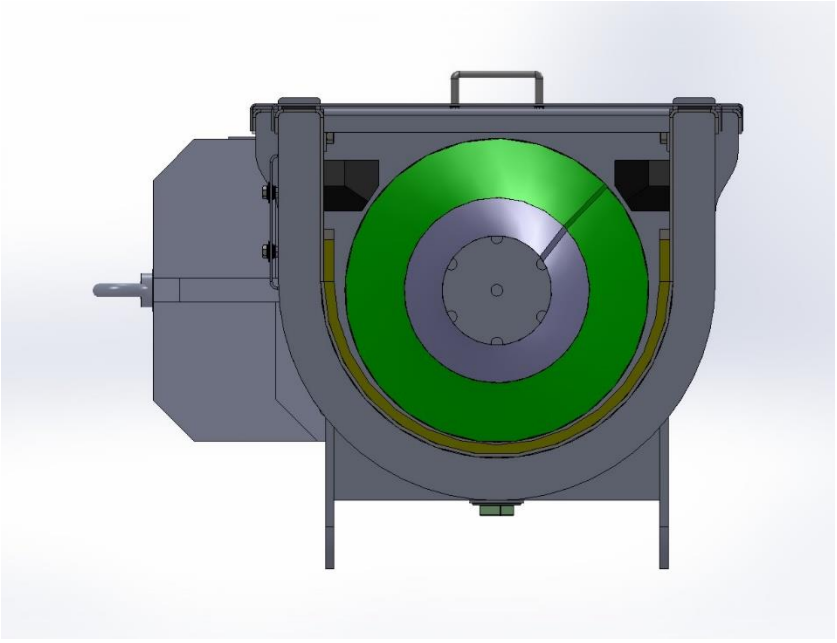
The diameter of the spiral should be checked and the spiral replaced when it goes below 330mm in diameter.

8.11 Changing Internal Liners

The conveyors are fitted with 10mm plastic white colour liners at the bottom of the screw trough.

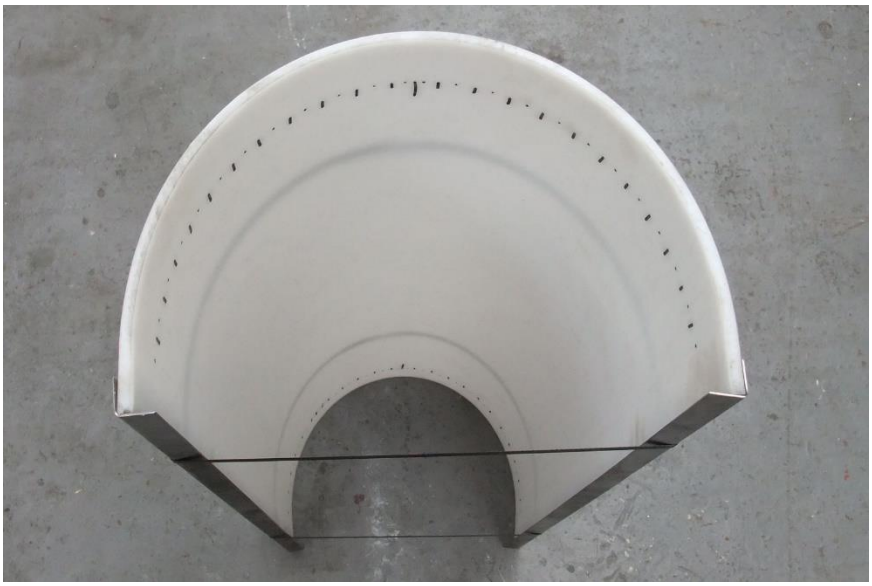


The liners are sacrificial/ wear items; therefore they will wear over time. Regular visual checks on an advised time interval of three months is required and a log should be kept. The liners should be replaced when the stainless steel trough starts to show in the bottom of the trough through the line.



To replace the liners ensure the conveyor is isolated and locked off.

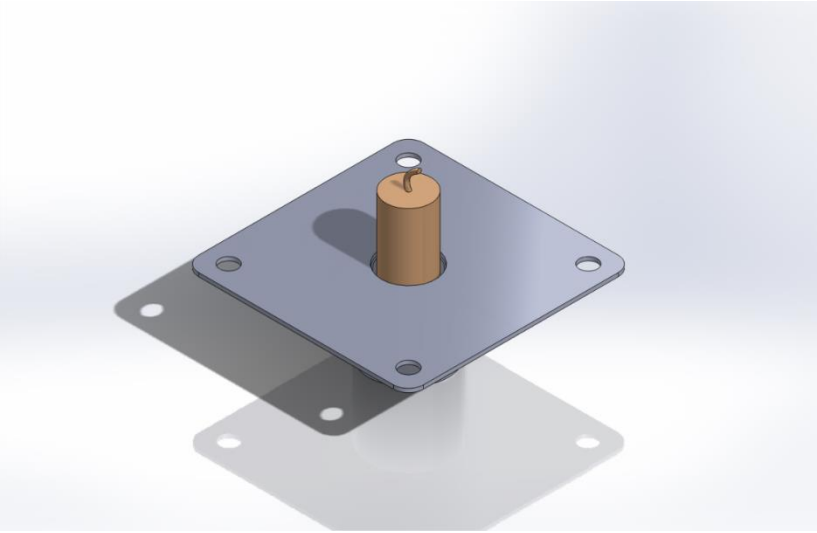
Expose the liners and unbolt, prise out and replace with new ones.



Please note that the internal spiral should be raised off of the liner if the liners are to be changed with the spiral in-situ, (not always possible because of site layout and feed restrictions. Serpecon offer a tested spiral jacking lifting beam which can be supplied by request and at extra cost.

8.12 Rotation & Liner Wear Sensors

The conveyor should be fitted, (not always specified), with a rotation sensor at the opposite end of the drive. This is fitted either into the top cover on an adjustable thread or located on the underside on a specific bracket. The rotation sensor picks up the movement of the internal spiral to ensure the conveyor is working properly.



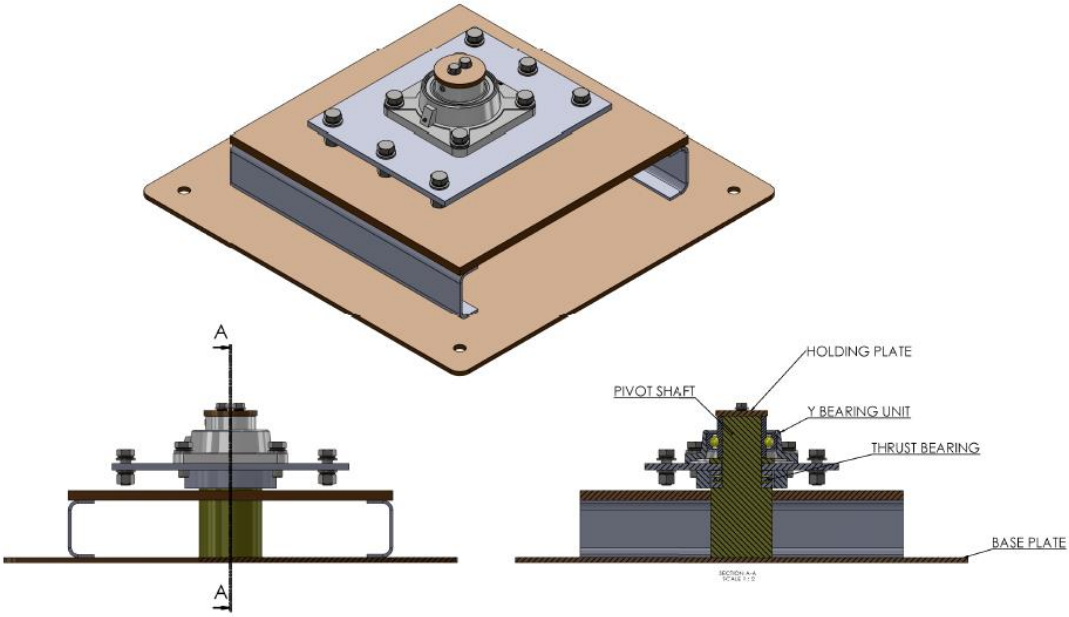
If the screw breaks or the drive shaft breaks and the drive continues to run then the rotation sensor detect that the spiral is not moving and shuts the whole line down in sequence to ensure that further damage to the conveyor is prevented.

Always ensure that the rotation sensor is working correctly otherwise your warranty will be null and void.

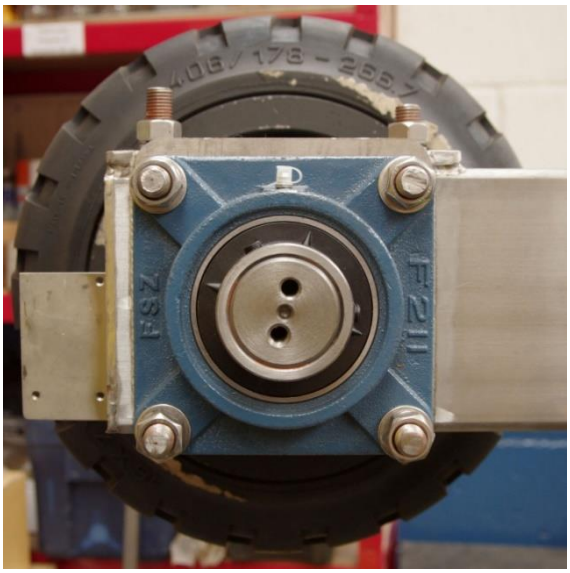
Additionally, the conveyor can be fitted with an external proximity sensor to monitor the wear of the internal liner in difficult to reach locations, (ie no permanent access). This is an additional safeguard to protect the trough but should not be used as the only method of monitoring liner wear. Visual inspections of the internal liners should still be carried out.

8.13 Radial Undercarriage Maintenance

The radial undercarriage pivot assembly above consists of a solid shaft with a step to locate a thrust bearing arrangement. The complete unit is “sealed for life” but a grease nipple has been included in case of a sludge spillage or emergency.



The wheel and tyre arrangement consists of pressed tyres onto a solid machined wheel. This is connected to flanged bearings via a drive shaft.



It is important that all linch pins are inspected to ensure they are correctly positioned and the safety retaining pins are secure. Pneumatic tyres should be inspected regularly for damage, wear and that they are inflated with sufficient pressure as indicated on the tyre wall. Inspect hydraulics as per Section 1.24.

Ensure the conveyor is operating correctly in its radial action and that the radial track line is clear and free from debris etc. It is important that all linch pins are inspected to ensure they are correctly positioned and the safety retaining pins are secure. Remove wheel covers and inspect wheel mounting shafts and bearings for any damage and wear.

Drive shaft bearings should be greased. The manufacturer's recommended lubricant is a high-quality lithium based grease of 2-3 consistency. Ensure motor mounting bracket is secure and replace covers and secure fixings.

Radial slewing anchor bearings will also need to be greased when required. Ensure ground fixing anchors are still secure and tight. Visually inspect electrical wiring and connections for any signs of damage. Any electrical maintenance work required should be carried out by a qualified electrician.

Visually check that there are no leakages or damage at hose connections, along the hose length and the ram. Check safety linch pins are correctly inserted and retained. Try and elevate the conveyor to its maximum position. If the conveyor will not reach this position, it is an indication that there is insufficient hydraulic oil in the system. Next lower the conveyor to its lowest position, ensuring that the hydraulic ram is in its closed position. Proceed to add oil to the hydraulic pump as necessary.

8.14 Maintaining Slide Valves (Rack & Pinion Type)

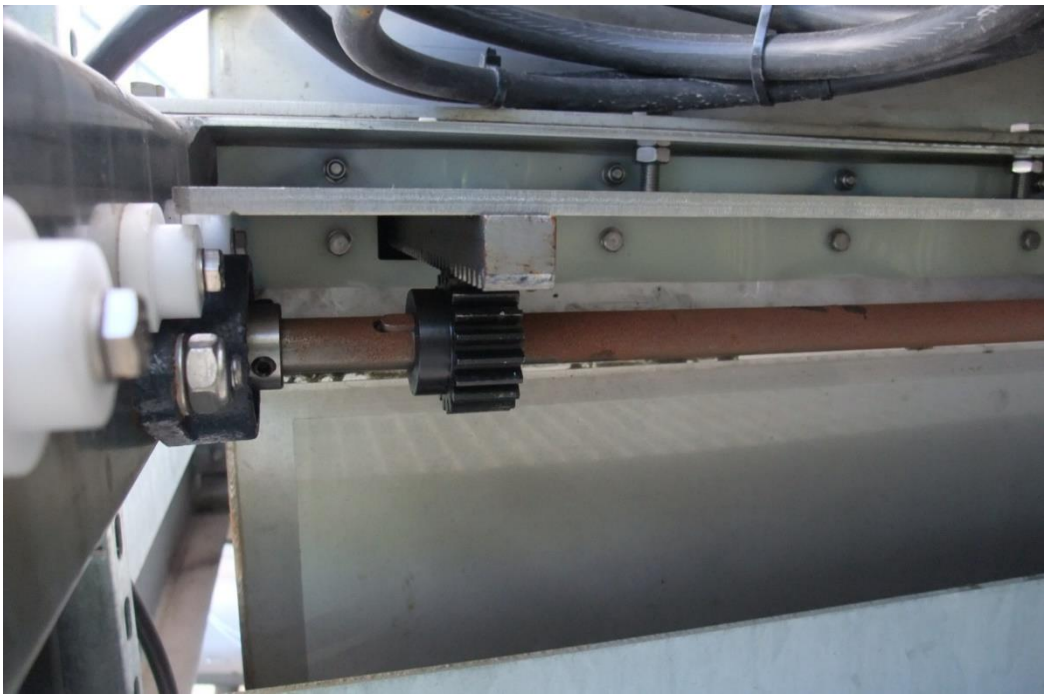
Slide valves are actuated by Rotork actuators, (usually IQ10's). The slide valves are a very simple design and require little maintenance.

Every three months remove the cover and expose the rack and pinion. Clean out with a hose and re-grease. Always keep the rack and pinion well-greased to avoid seizure. The outer shaft bearings are sealed for life and do not require greasing.

All slide valves run on nylon rollers/ grooved guides for smooth operation and some feature a polyurethane scraper above the slide plate, dependant on application, with a steel backing plate. Care should be exercised if the product contains large solid lumps to ensure these do not interfere with the proper operation of the slide.

Regular maintenance ensures that the slide valves will continue to perform to the optimum level. It is good practice to keep the machine and the area around the machine clean and tidy. This helps in the identification of machine faults and makes for a safer working environment.

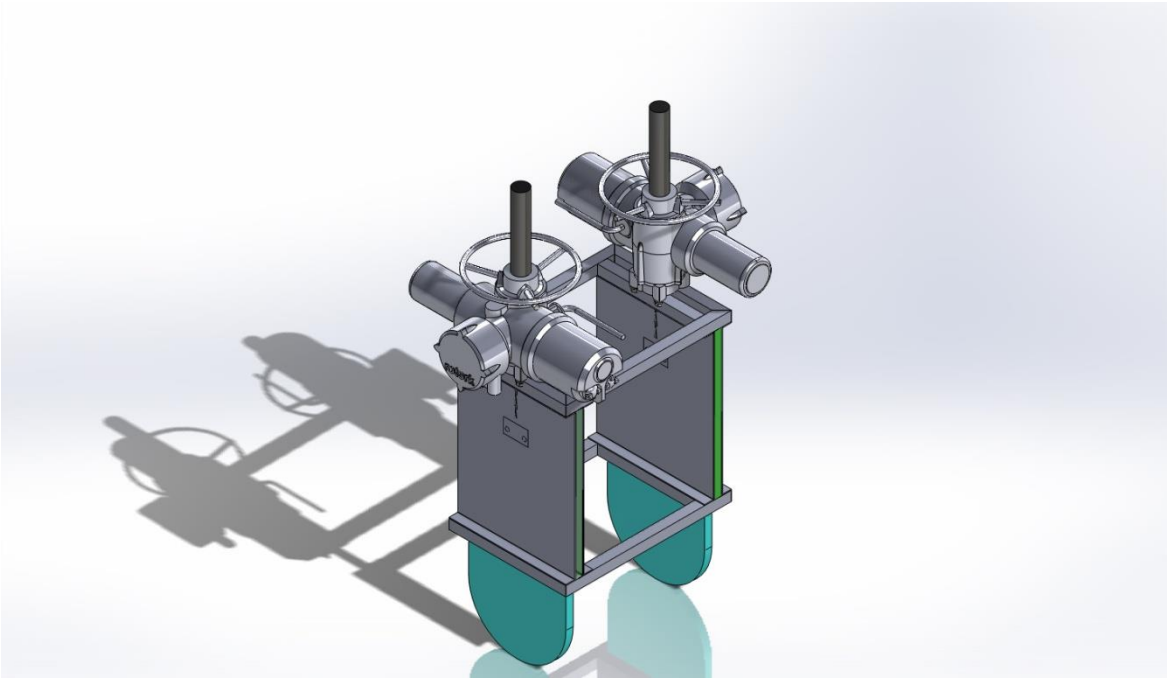
- Remove the bottom cover plate, (held in place by bolts), which screw into the valve body frame which incorporate threaded location holes.
- Periodically check all nylon rollers/ grooved guides are free to operate.
- Bearings are sealed for life and do not normally require greasing.
- Check limit micro switches/ Rotork settings are correct.
- All debris including grit, fat and organics which have built up or are jammed onto the internal surfaces must be cleaned off.
- The rack and pinion must be re-greased.



Frequency of the above will be dependent upon the site operating conditions but it is imperative these items are kept clean otherwise the mechanism will wear prematurely.

8.15 Maintaining Slide Valves (Vertical Slide Type)

Slide valves are actuated by Rotork actuators, (usually IQ10's). The slide valves are a very simple design and require little maintenance.



Remove the Rotork by counter screwing the four Rotork holding bolts.

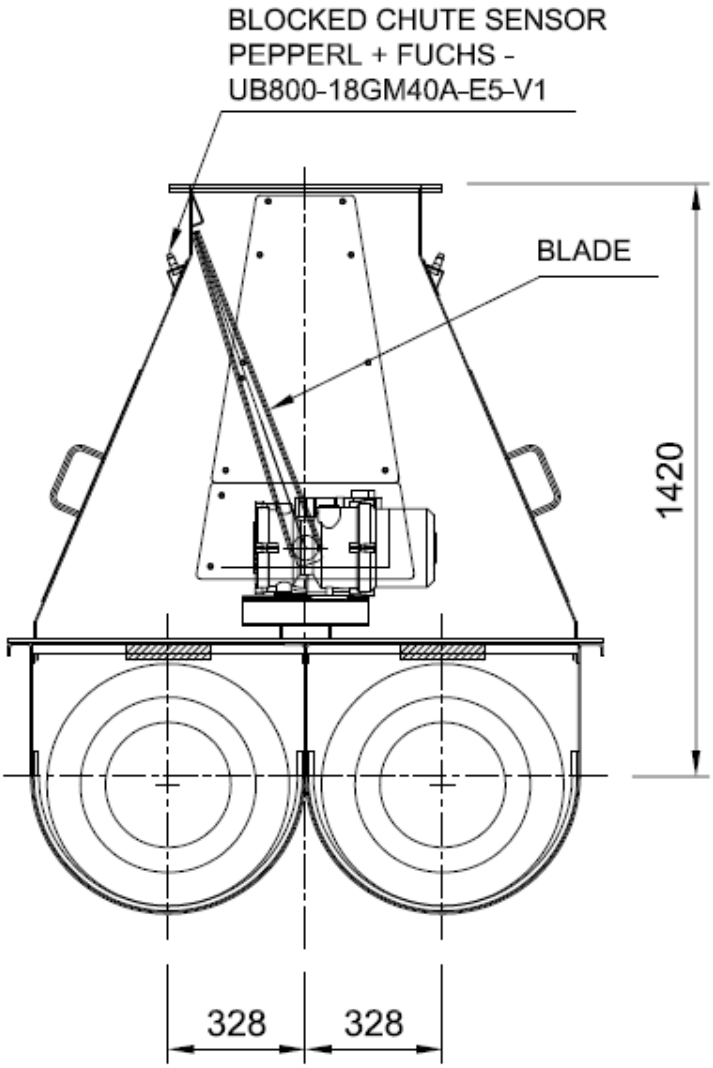
Check the internal Rotork thread for damage.

Pull out the internal knife blade and visually check for damage.

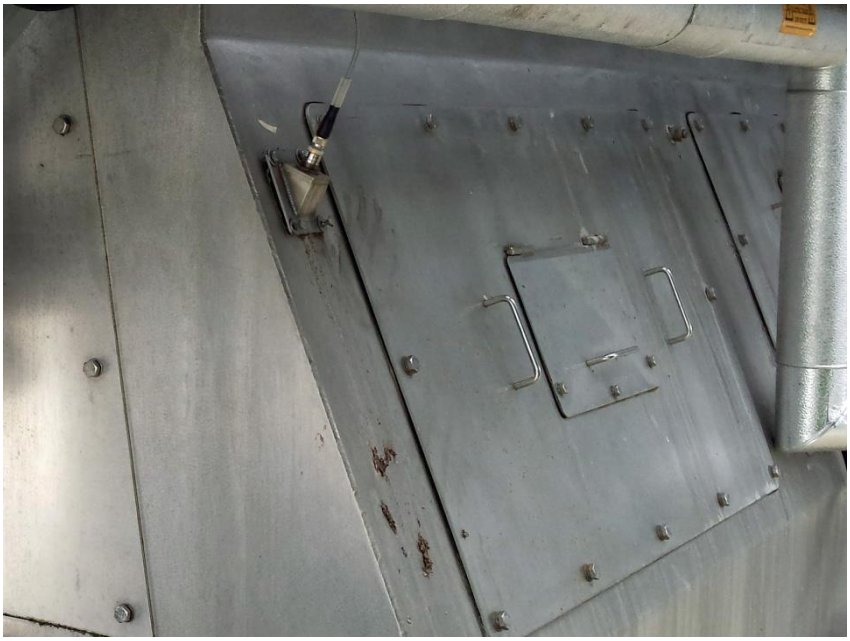
Visually inspect he PTFE the two plastic vertical runners by looking down the internal groves and replace if necessary.

Any maintenance required to the Rotork actuator must be carried out in accordance with the Rotork operating and maintenance manual.

8.16 Maintaining Bifurcated Chutes

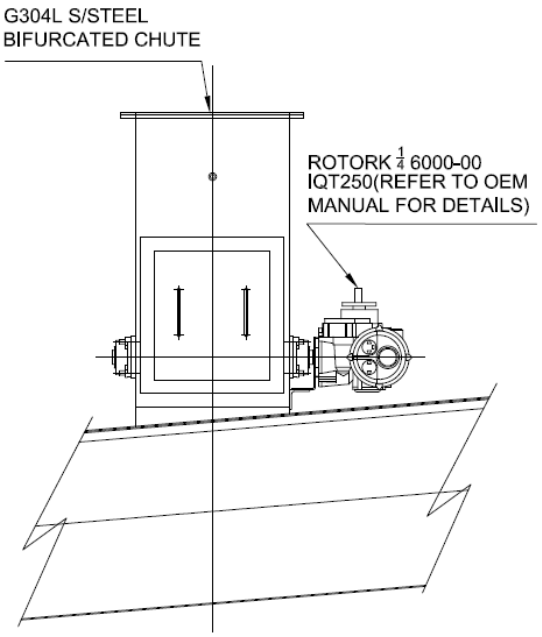


1. Check all covers are fully bolted & bolts not missing.
2. Ensure screen and corresponding conveyor is isolated before attempting 3 to 6.
3. Remove rag & fats from the blocked chute sensors by unscrewing the sensor and cleaning it, alternatively leave the sensor in place and access it by unbolting the adjacent cover plate, see photo on page 38.
4. Remove rag & fats from internal blade & shaft by access via by unbolting the adjacent cover plate.
5. Check outer exposed bearings are clean, (visual inspection).
6. Check Rotork's in accordance with the Rotork manual.



Picture showing the removable blocked chute sensor which should be cleaned regularly so that it does not give false readings.

8.17 Small Bifurcated Chutes Between conveyors



Maintenance routine is the same as item 8.1.

8.18 Blocked Chute Sensors Between Conveyors

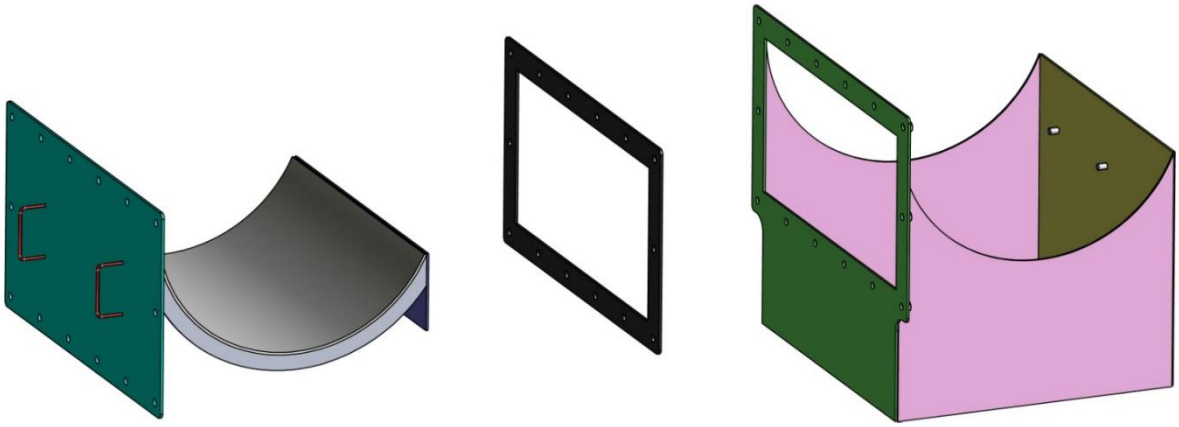
1. Check all covers are fully bolted & bolts not missing.
2. Ensure screen and corresponding conveyor is isolated before attempting 3.
3. Clean off rag & fats from the blocked chute sensors by unscrewing the sensor and cleaning it, alternatively leave the sensor in place and access it by unbolting the adjacent cover plate, see photo on page 38.

8.19 Spray Nozzles for Drain Decks

Under each bifurcated chute corresponding to each screen is a conveyor drain deck with brushes. To help keep the drain deck area clean of fats is a spray bar spraying wash water onto the underside of the screen mesh.

This should be periodically cleaned to avoid excessive build up of fats.

8.20 Conveyor Drain Deck, (drawer & hinged types)



Each bifurcated chute under each Longwood screen has a drawer type removable drain deck. The drain deck is manufactured from 4mm punched and rolled stainless steel plate, please note this is a wear item).

It is important that this drain deck is kept free from fat and grit build up. There is a brush welded to the spiral which keeps the material flowing along the top of the drain deck but this will not prevent grit blocking the holes and fat building upon the underside, see photos below:-

Drain deck above blocked by grit.

Ensure that the drain decks are removed as per the schedule and thoroughly cleaned. The conveyor and corresponding screen will need to be isolated for this procedure. The drawer type drain deck is removed by unbolting the cover plate and pulled out. Please note the drain deck does not need to be completely removed for this procedure. As this is a wear part please ensure that spare drain decks are kept in stock.

Drain deck above blocked by fat

If fat and grit block the drain holes the organics content and volume of feed to the wash presses will be greatly increased. This will result in the wash presses being unable to process the screenings properly. The compacted screenings will therefore have higher organics content and be heavier. The dry solids content will increase dramatically.

A drain deck after cleaning will allow organics to flow through and look like this:-

Cleaned drain deck allowing organics and wash water to flow through.

8.21 Changing Conveyor Brushes

The internal shaft less spiral, which runs the full length of each conveyor, has pre-formed and coiled brushes bolted to the internal spiral where each drain deck sits between the plastic liners. This helps keep the inside of the drain deck free from fats and grit.

These brushes are a ‘wear’ item and depending upon grit content and volume flows, will require replacement.

To replace the brushes, remove the overhead conveyor covers and corresponding drain deck, or bifurcated chute side access panels, unbolt the old ones and replace with new.

9. Spare Parts Quick Ref Availability

9. Spare Parts Quick Ref Availability

No.	item	Typical Lead Time
Conveyors		
1.	Various covers replacement	4 weeks
2.	Replacement sensors, rotation or blocked chute type	4 weeks
3.	Various gaskets	4 weeks
4.	Replacement liners	4 weeks
5.	Replacement internal spiral drive coupling & shaft	4 weeks
6.	Replacement drive shaft seals	4 weeks
7.	Replacement internal spiral	6 weeks
8.	Replacement brushes	6 weeks
9.	Replacement geared motor unit	6 weeks
10.	Replacement Rotork	8 weeks
11.	Replacement slide valve components	8 weeks
12.	Replacement fabrications ex. chutes etc.	8 weeks

10. Commissioning Documentation

Example Form Conveyor No.1 **Serial No.**

Dry Testing

Test date
Rotation Direction of Spirals Correct
Forward Running Amps
Amps Trip Set
Excessive Vibration and/ or Noise
Rotation Speed Correct
Rotation Monitor Set

Wet Testing

Test date
Forward Running Amps
Material Conveyed Correctly
Any Material Leaks

Additional Comments

Commissioning Engineer	Signed	Dated
Project Manager	Signed	Dated

11. Maintenance Service History

MAINTENANCE CARRIED OUT	SERVICE TYPE					
	MONTHLY		3 MONTHLY		ANNUAL	
SIGNATURE:	PRINT:				DATE:	

Next service due: - ____/____/_____

MAINTENANCE CARRIED OUT	SERVICE TYPE					
	MONTHLY		3 MONTHLY		ANNUAL	
SIGNATURE:	PRINT:				DATE:	

Next service due: - ____/____/_____

It is important that the Service History is completed and the manual adhered to in order to validate the manufacturer's warranty.

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SIGNATURE:	PRINT:			DATE:		

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