NETAFIM
SCHOOL OF IRRIGATION

FILTRATION MODULE

SECTION 3

SCREEN FILTERS – MANUAL & AUTOMATIC

Table of Contents

1 Introduction

Screen filters have been available for agricultural use for many, many years and have proven to be popular due their simplicity, user friendliness and affordable cost. Advances in materials, design and experience gained have opened up further the applications where screen filtration can be used.

2 Objectives

The objectives of this Section are

- Summarize the different screen filters and filtration systems commonly used
- To provide a working knowledge of screen filtration in Agricultural applications
- To present an overview on the types of filter applications and selection of the same
- To ensure a good understanding of the above subjects

3 Definitions and Materials

3.1 Definitions

Total Suspended Solids (TSS) A term which expresses the mass, in mg/L, of particles, larger than 0.45 micron, in the water.

Mesh size the degree of filtration is usually expressed in mesh size, which relates to the number of openings per inch. The higher the Mesh number the smaller the particle that should be trapped or filtered out

Micron (μ) unit of measurement for particle sizes. 1000 micron = 1 mm.

General filtering area the area consists of the length multiplied by the circumference of the filter element. The active filtering area is the total area of perforations and the inactive area comprises the filter elements reinforced parts.

Filtering ratio this is the relationship between the cross section area of the filter and the active filtering area. If a 10” (250mm) filter has a cross section area of 500cm² and the active filtering area is 4500cm² - the filtering ratio is 1:9. The minimum should be 1:8, and anything higher is a positive feature

Flow capacity the flow capacity of a filter depends on its diameter, the filtering system and water quality. Although diameter is a decisive factor for flow, its effect may be offset by the filtering system. For example a 2” disc filter may have a higher flow capacity then a 16” gravel filter. Manual filters have lower flow capacities then automatic units.

Flow Velocity this is determined by the flow rate and the diameter of the filter. High flow velocity may cause frequent clogging of the filter. A 2” screen filter with a diameter of 200mm may cope with a 20m³/hr flow at 18 cm/sec velocity while a gravel filter with a 500mm diameter filters a 12 m^3/hr flow at a velocity of only 1.7 cm/sec. High velocities may cause filter elements to collapse during filtration or gravel media to be lost during the back wash process.

Head loss usually split into two categories which are

- Loss at maximum flow when the filter is in a clean state. A 2m to 3m head loss in this state is considered acceptable.
- Pressure Differential Loss at maximum flow when the filter is "dirty". Also known as ""PD" or "DP" (Delta P). A 5m to 7m PD is considered normal before cleaning or back washing is necessary.

Filter cake – a build up of material on the filter element (screen or disc) or on the top of the gravel bed in a media/sand filter

3.2 Materials

Filter bodies and covers Reinforced polyamide, reinforced polyester and polyester coated steel. The steel bodies and steel parts usually are coated with 100 microns of electrostatically applied polyester oven cured on a zinc-phosphate layer for maximal anti-corrosion protection (in the case of Odis products)

Screens Stainless steel mesh, PVC casings

"O" Rings and Seals Nitrile rubber and EPDM

Springs, clamps and bolts/screws Stainless steel

Valves are usually metallic made of bronze, but plastic is becoming more widely accepted and used.

Usually the manufacturer's specifications will detail the materials used in the construction.

4 Screen Filtration – The Concept

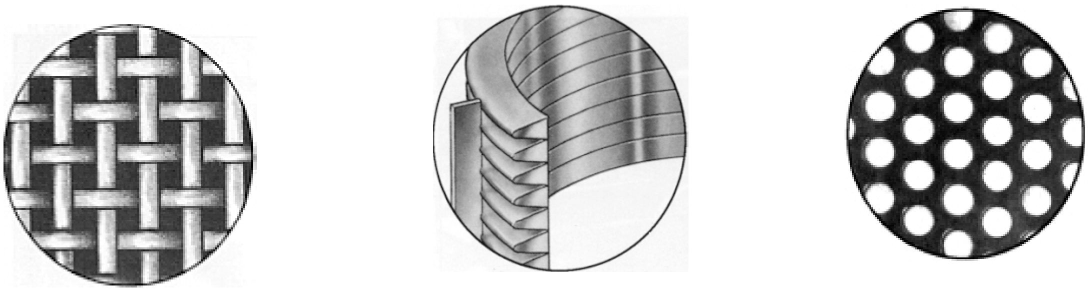
Screen filters were developed early on and are still widely used today. An improvement with design and materials has widened their use. The benefits of screen filters are

- Simple construction and easily understood
- One filter usually used instead of a battery in many cases
- Uses small amount of water to backwash, similar to disc filters.

A screen filter generally has one filtration point with passages of one size – the blockage force is a simple mechanical one and sometimes can be of an adhesive nature.

Screens are made of woven mesh, perforated plates or of a wedge style construction. See Figure 1 below

Figure 1



Different screen elements showing,from Left to Right, Woven screen, Wedge wire and Perforated plate

Screen filters can be built in almost any size and are commercially available in a wide range of flows. They are a single *surface* filter with only one retention point for solids. The range of mesh sizes is also wide, from 30 to 200 mesh. Whilst screen filters can be a main automatic unit they are widely used as secondary filters for gravel systems and check filters in the field. Refer Figure 2 below. Although the effective filtration area can be quite high and the initial “clean” head loss is quite low, the PD can build up quickly. Therefore an effective cleaning schedule is a necessity. Screen filters can be cleaned manually or automatically, like all other types of filter. Manual cleaning usually involves removing the filter element and hosing/brushing it clean. Automatic units utilise a number of methods to clean themselves such as

Motorised brush a brush rotates over the screen element dislodging the “filter cake” and a purge valve will allow the dirt to exit to atmosphere, whilst the system is under pressure.

Through flushing a valve at the end of the filter barrel opens up and the accelerated flow washes the screen

Suction scanner a rotating suction scanner lifts “filter cake” off the screen without actually making physical contact – this system can be quite effective and does not damage the screen as a brush does. This is described in more detail later.
Some screen filters can be useful in handling *light* loads of sand, but are generally not favoured for high organic loads.
The degree of filtration is usually expressed in “mesh size” – refer Figure 2 below

Mesh size = the number of openings per inch

Actual size = one inch divided by the number of wires
Multiplied by the thickness of the wires

Effective opening = 30% to 35% for an 80 mesh filter

Mesh to mm (Micron) conversion Calculations

$$\text{Mesh} = \frac{25.4\text{mm}}{d + W}$$

$$\text{Hole size (W) in microns} = \frac{25.4}{\text{Mesh}} - d \text{ (microns)}$$

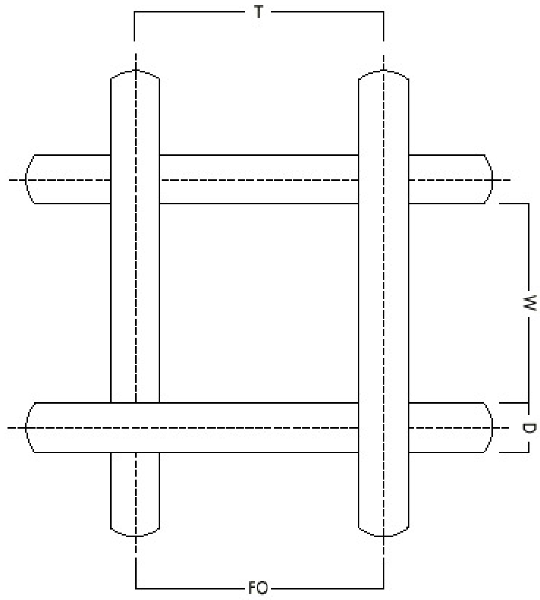


Figure 2

Example

$$\text{Mesh } 200 = \frac{25.4}{200} = 0.127\text{mm} = 127 \text{ microns}$$

d + W = 127 microns if wire = 50 microns, then W = 127 – 50 = 77 microns

$$\text{Fo (open space)} = \frac{w^2}{T^2} \times 100$$

Where	Mesh	= number of holes per inch
	W	= hole size
	D	= wire diameter
	T	= Threshold (W + d)
	Fo	= % of open space

The Effective filtering area of the screen can be found in Table 1 below

Table 1

Mesh Grade	mm	Micron	Effective Filtering Area %
40	0.435	435	47
60	0.225	225	31
80	0.178	178	31
100	0.139	139	30
120	0.122	122	33
140	0.112	112	37
160	0.094	94	35
200	0.072	72	32

5 Manual Screen Filters

The Odis family of manual screen filters consists of

5.1 Odis 1000 Series Filters

This is a water screen filter with two stainless steel screens for added safety. Direction of water flow is "Out – In". The filter has a horizontal inlet and a vertical outlet – Refer Figure 3. Sizes available are 40mm, 50mm and 80mm. Each filter is equipped with a drain valve located at the bottom of the unit, and two pressure check points, in order to check head loss between the outlet and inlet without interfering with the water flow. Filters can contain two screens or one. This unit has a high resistance to chemicals and fertilisers. Refer Figure 3 alongside.

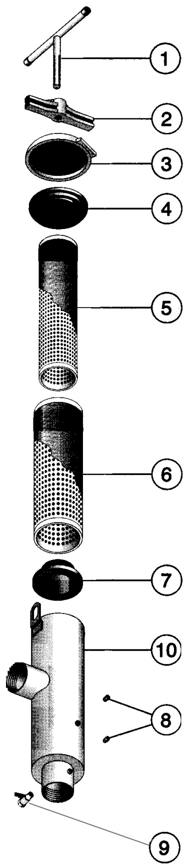


Figure 3

Parts

1 Handle	2 Tightening Bracket
3 Cover	4 Cover Gasket
5 Inner filter screen	6 Outer filter screen
7 Inner gasket	8 Pressure Test points
9 Drain Valve	10 Filter body

This is mainly used as a check filter in agriculture, designed to handle small quantities of impurities. Also suitable for domestic, landscape, construction site and industrial applications Key points or features are

- Maximum pressure of 10 Bar (8 Bar working)
- End connections available as Threaded, Victaulic and Flanged.
- "Normal" working condition is a headloss is less than 2.5m (4 psi) with clean filter screens
- Install the filter vertically

- *Manual flushing* achieved by [1] opening drain valve #9 at the bottom for about 10 to 30 seconds. [2] check pressure reading again to ensure PD is less than 2.5m
- *Periodic Cleaning* by [1] closing filter inlet valve and opening drain valve to release pressure and drain filter [2] Gently remove filter screens 5 and 6, rinse with clean water and use a brush to remove particles (not a wire brush). [3] Keep water level below collar of gasket to prevent contaminated water entering the network. [4] Replace undamaged screens carefully [5] If the brush does not clean the screens consider an acid or alkali wash.

Recommended Flow Rates for the 1000 series filter can be found in Table 2 below
Table 2

Model	**Inlet and Outlet Diameters**		**Recommended Flow Rate**
	Inch	**mm**	**m³/hr**
1115	1½	40	Up to 15
1220	2	50	Up to 23
1320	2	50	Up to 30
1430	3	80	Up to 38

5.2 Odis 1900 Series Filters

The 1900 series was developed mainly as a Control filter after gravel /sand filter arrays, but is also used as an economic compact “check” filter in agriculture. The single stainless steel screen is extra strong. Features are similar to the 1000 series except the unit

- Is available in 3”, 4”, 6”, 8”, 10” and 12” sizes.
- Up to 10” is available in angle configuration, and up to 12” in in-line configuration.
- Standard screen rating is 40 mesh. (80, 120 and 200 mesh available upon application.)

Please refer Figure 4 below

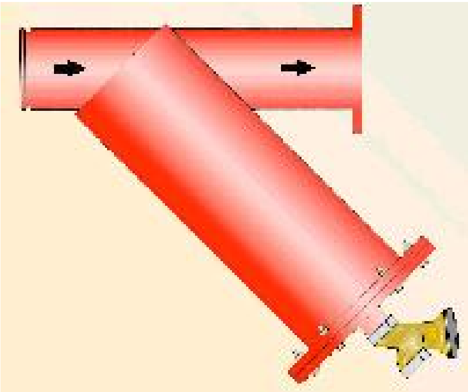


Figure 4

Odis 1900 series filter Inline on LHS and Angle on RHS

These high capacity filters have recommended flows as found below in Table 3

Table 3

Model	Inlet & Outlet		Recommended Flow Rate m³/hr			
	Inch	mm	200 mesh 72 μ	120 mesh 122 μ	80 mesh 180 μ	40 mesh 435 μ
19003 & 19903	3	80	30	40	50	60
19004 & 19904	4	100	45	60	80	100
19006 & 19906	6	150	90	120	200	250
19008 & 19908	8	200	145	190	270	350
19010 & 19910	10	250	195	260	370	500
19012 & 19912	12	300	240	320	510	650

Key points or features are

- Maximum pressure of 10 Bar (8 Bar working)
- End connections available as Victaulic and Flanged.
- "Normal" working condition is a headloss is less than 2.5m (4 psi) with clean filter screens
- Install the filter horizontally (usually) and according to array requirements. Water inlet and outlets are clearly marked by arrow.

Flushing and *Cleaning* are as per 1000 series above.

5.3 Odis 2000 Series Filters

The main features are very similar to the 1000 series above except the 2000 series

- Has a horizontal inlet and outlet for in-line installation and has an oblique body
- Sizes available are 1", 1½", 2", 3", 4" and 6".

Please refer to Figure 5 below

Recommended Flow rates can be found in Table 4 below

Table 4

Model	Inlet and Outlet Diameters		Recommended Flow Rate
	Inch	mm	m³/hr
2010	1	25	Up to 7
2015	1½	40	Up to 15
2020	2	50	Up to 30
2030	3	80	Up to 40
2040	4	100	Up to 80
2060	6	150	Up to 180

Key points or features are

- Maximum pressure of 10 Bar (8 Bar working)
- End connections available as Victaulic, Threaded and Flanged.
- "Normal" working condition is a headloss is less than 2.5m (4 psi) with clean filter screens
- Install the filter horizontally with body pointing upwards and drain valve pointing downwards. Water inlet and outlets are clearly marked by arrows.

Flushing and *Cleaning* are as per 1000 series above.

Figure 5

5.4 Odis 7000 Series Filters

This filter was developed before the 1900 Series especially to be used as a secondary filter after gravel/sand filters without additional valves, and for back flushing in automated irrigation installations. The reinforced stainless steel screen is designed to withstand inverted flow.
Two configurations available, In-line and angle – please refer to Figure 6 below

Figure 6

In Australia the 7000 series has largely been superceded by the 1900 series.

6 Automatic Screen Filters

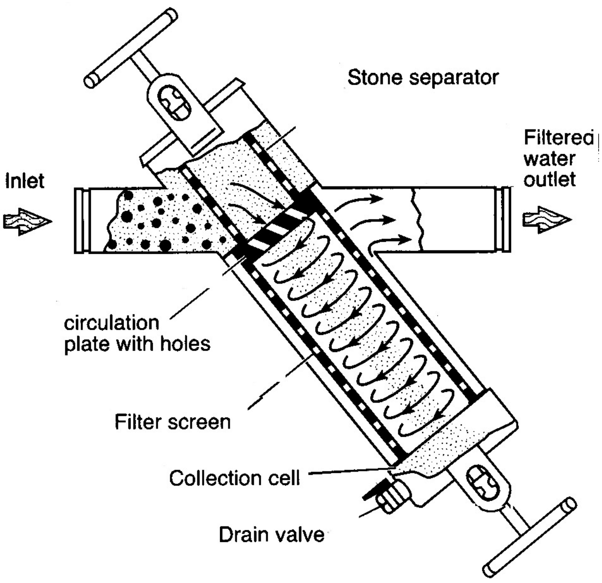
The Odis family of automatic screen filters consists of

6.1 Odis 3000 Series Filters

A self-cleaning filter for handling sand and light organic loads. Also used as a secondary filter after gravel/sand filters for improved performance. They can to an extent replace hydro cyclones for water containing small quantities of sand.
The Odis 3000 series automatic water screen filter uses a method of filtering water by circulation. It can maintain a flow of filtered water without a significant increased loss of pressure. The filter is designed to automatically remove residue from the screen during the entire filtration process. This is accomplished by a specially designed "circulation plate" with holes (installed at the top of the screen) which passes incoming water through directional holes into the filter in a descending circular pattern. This continuous downward spiral flushes the screen and forces the debris to the collection cell, which can be drained during the filtering process either automatically, manually, or continuously by a bleeder.
The filter provides effective filtration and trouble-free operation because the filter may be adjusted according to the system actual flow rate. Depending on the flow rate, an appropriate number of directional holes must be blocked with rubber stoppers.
Refer to Figure 7 below

Automatic water circulating filter with stone separator (Schematic drawing)

Figure 7



- Available in 1½", 2", 3", 4" and 6"
- In various configurations such as
1) Horizontal inlet and outlet (3015, 3020, 3030, 3040 and 3060)
2) Horizontal inlet and outlet *with stone separator* (3740 and 3760*)*
3) Horizontal inlet and vertical (down) outlet (3915, 3920, 3930, 3940 and 3960)
4) Parallel vertical inlet (up) and outlet (down) *with stone separator* (3840 and 3860)
- End connections available as Victaulic, Threaded and Flanged.
- Correct working conditions are achieved when the headloss across the filter is 3m to 5m.

Refer to Tables 5, 6, 7, 8 and 9 below

Table 5 **1½"**

Number of Open holes	Head	Loss	PD	(m)
	3	4	5	6
	Flow	Rate	Q	m³/hr
2	3.1	3.6	4.0	4.4
3	4.4	5.1	5.7	6.3
4	5.8	6.7	7.5	8.2
5	7.5	8.7	9.7	10.6
6	8.7	10.0	11.2	12.2

← Recommended Range →

Table 6 **2"**

Number of Open holes	Head	Loss	PD	(m)
	3	4	5	6
	Flow	Rate	Q	m³/hr
2	10.4	12.0	13.4	14.7
3	15.1	17.4	19.4	21.3
4	18.5	21.3	23.8	26.1
5	21.4	24.7	27.6	30.2
6	23.8	27.4	30.7	33.6

← Recommended Range →

Table 7 **3"**

Number of Open holes	Head	Loss	PD	(m)
	3	4	5	6
	Flow	Rate	Q	m³/hr
2	11.6	13.4	15.0	16.4
3	16.3	18.8	21.1	23.1
4	20.9	24.1	26.9	29.5
5	26.3	30.4	33.9	37.2
6	30.0	34.7	38.7	42.4

← Recommended Range →

Table 8 **4"**

Number of Open holes	Head	Loss	PD	(m)
	3	4	5	6
	Flow	Rate	Q	m³/hr
2	19.7	22.8	25.5	27.9
3	28.5	32.9	36.8	40.3
4	36.5	42.1	47.1	51.6
5	43.3	50.0	55.9	61.2
6	49.3	56.9	63.6	69.7

← Recommended Range →

Table 9 **6”**

Number of Open holes	Head	Loss	PD	(m)
	3	**4**	**5**	**6**
	Flow	**Rate**	**Q**	**m³/hr**
2	44.4	51.2	57.3	62.7
3	64.6	74.6	83.4	91.4
4	82.2	94.9	106.1	116.2
5	101.3	117.0	130.8	143.3
6	117.8	136.0	152.0	166.5

← Recommended Range →

The holes in the circulation plate need to be blocked in a certain manner – please refer to Figure 8 below

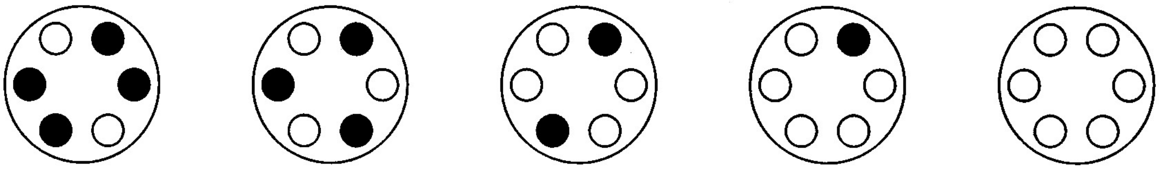


Figure 8

Please note that the water circulation in the filter will be reduced if the number of open holes is inappropriate – this will impair the filter performance. Insert or remove the rubber stoppers as required.

Figure 9

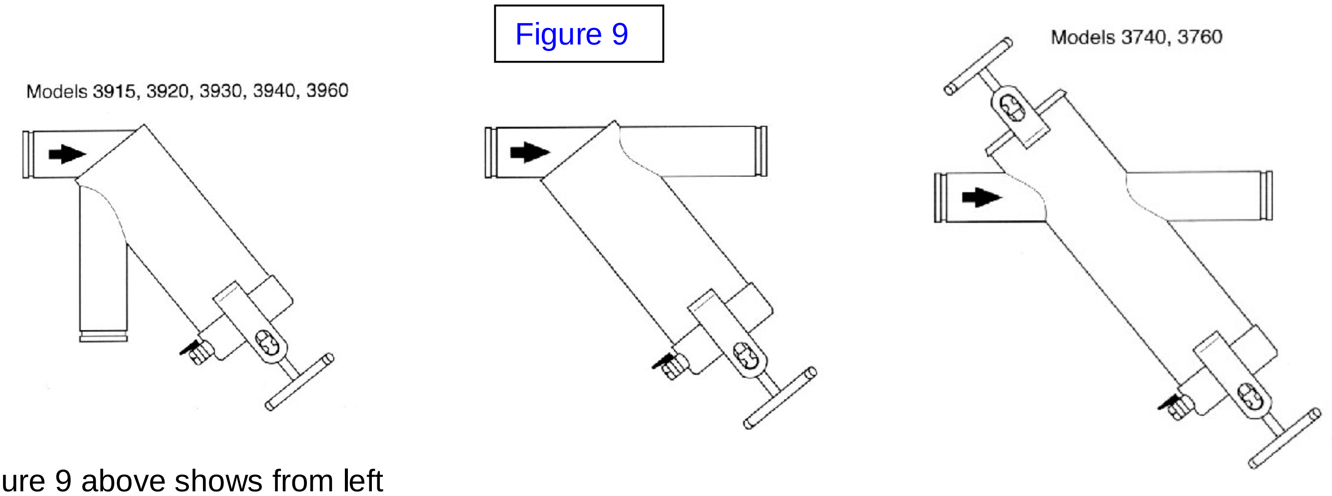


Figure 9 above shows from left
1) Horizontal inlet and vertical outlet (*no stone separator*)
2) Horizontal inlet and outlet in-line (*no stone separator*)
3) Horizontal inlet and outlet in-line (*with stone separator*)

The function of the stone separator is to prevent larger size inorganic particles entering the filter and damaging the screen.

The collection cell should be drained at regular intervals, determined according to working conditions and the quality of the water. The methods of draining are

1) Manually, by opening the drain valve
2) Continuously, by a bleeder tube (usually 5 to 10m of 8mm poly tube). The tube should be straight and not coiled. If dirt continues to accumulate in the cell shorten the bleeder tube. Refer Figure 10 alongside
3) Automatically, by a controller on a time basis. The drain valve will then be hydraulically/electrically operated. Refer Figure 11 below

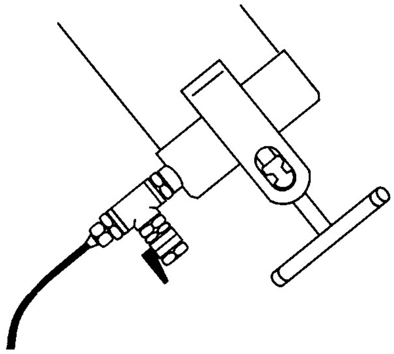


Figure 10

Automatic Draining Unit, Schematic Drawing

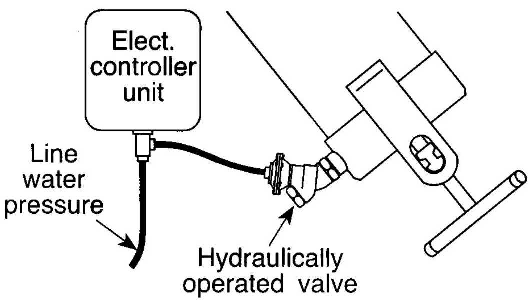


Figure 11

As far as **installation** is concerned special attention must be paid to hanging the filter body downwards to allow the dirt to accumulate in the collection cell and limit the angle to 45 degrees – see Figure 12 below

Also

1) Check that the actual flow rate through the filter is within the recommended rate. Inadequate flow rate will reduce performance
2) Install an integrated air relief valve for 3" and larger models
3) Install a quick acting check valve where back flow may occur

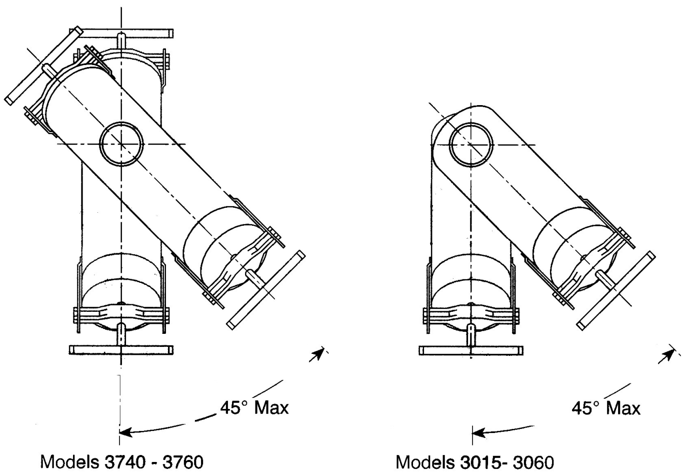


Figure 12

6.2 Odis 8000 Series Filters

The 8000 series filters are similar in principle and concept to the 3000 series except the units are

- Automated (standard) with a flushing controller
- With an Acceleration plate with 4 holes (rather than 6 holes in the circulation plate)
- Available in sizes 2", 3", 4" and 6" in in-line and angle configuration – Refer Figure 13 below

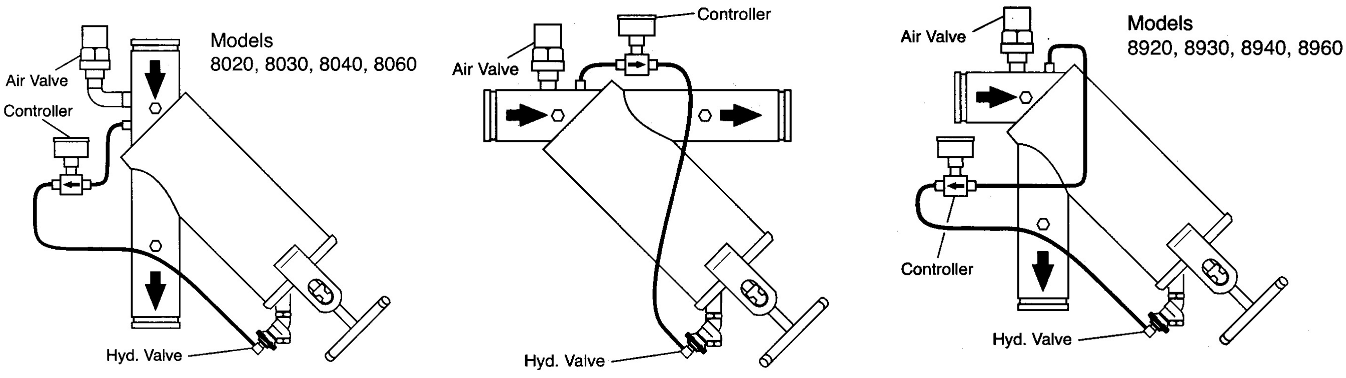


Figure 13

Maximal exploitation of the screen area is achieved by the spiral groove backing the screen.
The recommended operating head loss (PD) is 2.5m to 5m.
Only one rubber stopper is employed with this filter, used according to the actual flow rate
As far as recommended flow rates are concerned please refer to Table 10 below

Figure 14 (opposite) shows the 1" Air valve, DC Back wash controller, flow direction arrows, hydraulic tube plumbing, pressure check points (upstream and downstream) plus hydraulic flush valve mounted on the base of the collection cell

Figure 14

Table 10

Recommended flow range for ODIS 8000 series

Models	**Head**	**Loss**	**PD**	**(m)**	
	2.5	**3.0**	**4.0**	**5.0**	
	Flow	**Rate**	**Q**	**m³/hr**	
8020 8920	18	19	22	25	4
8030 8930	32	35	40	45	Open
8040 8940	53	58	67	75	Holes
8060 8960	106	116	134	150	(All)
8020 8920	13	15	17	19	3
8030 8930	25	27	31	35	Open
8040 8940	41	45	52	58	Holes
8060 8960	81	89	103	115	(1 stopper)

For a breakdown of parts for 8000 series filter please refer to Figure 15 below

1) Handle
2) Tightening bracket
3) Cover
4) Inner gasket (neoprene)
5) Cover gasket (neoprene)
6) Filter screen
7) Acceleration plate
8) Rubber stopper
9) Pressure testing/check point
10) Hydraulic drain valve
11) Flushing controller
12) Air valve
13) Centering piece
14) Filter body

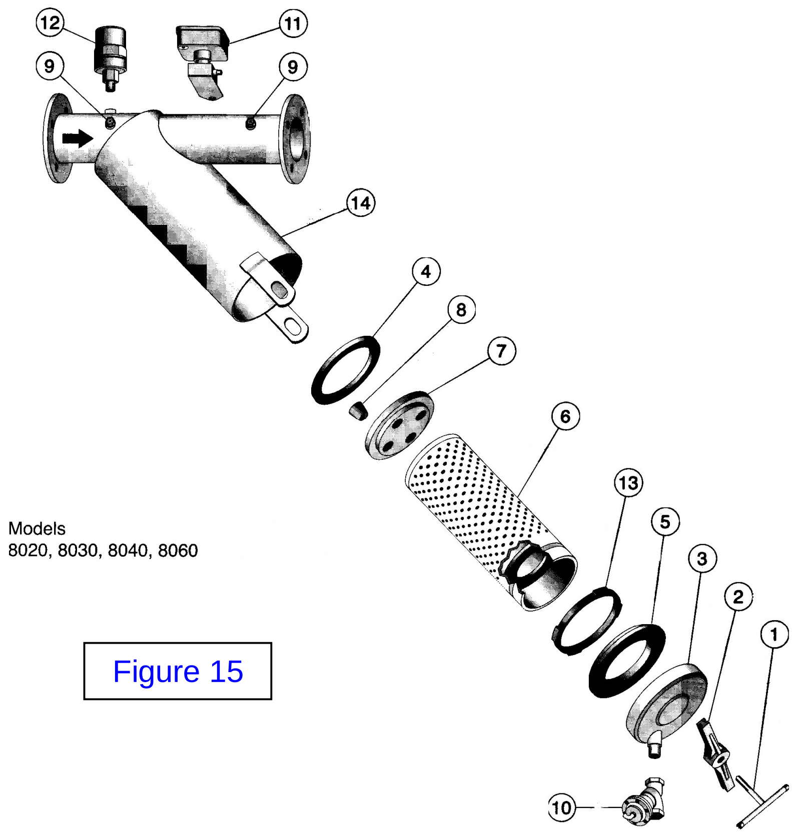


Figure 15

6.3 OdisMatic® 8500 Hydraulic Filter

The Odis 8500 series are the latest generation automatic screen filters. A motor propelled by in-line water pressure hydraulically operates the filter's self-cleaning system, so external power is not required. The standard features of this unit are

- High screening efficiency while maintaining low head loss
- Filtering capacity range (by various models) from 2 to 1100 m³/hr
- Total independent operation – water powers the filter
- Automatic and efficient self cleaning with low water consumption during flushing and no interruption of filtered water flow

Refer to Figures 16 and 17 below

Figure 16

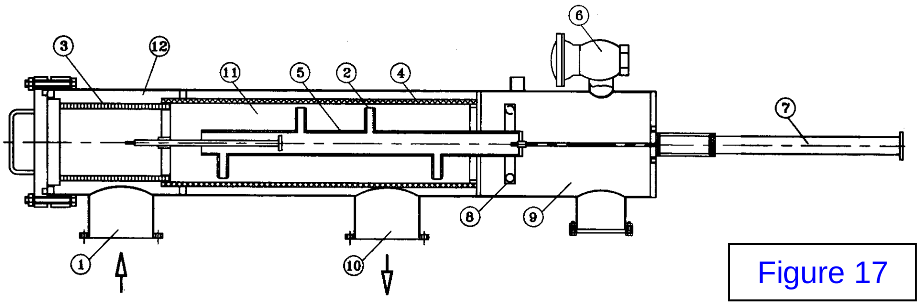


Figure 17

1) Inlet
2) Suction nozzle
3) Coarse screen
4) Fine screen
5) Collector
6) Flushing valve
7) Piston
8) Hydraulic motor
9) Motor chamber
10) Outlet
11) Filtration chamber
12) Inlet chamber

Principle of Operation (see schematic drawing above)

Two filtration stages.

- First Stage (Coarse Filtering) Coarse filtering is carried out by the coarse screen (3) in the inlet chamber (12) to prevent large particles from entering the filter's cleaning mechanism in the filtration chamber (11).
- Second Stage (Fine Filtering) After passing through the coarse screen (3), the raw water proceeds to the filtration chamber, passes through the fine screen (4) and out through the outlet (10) to the user.

The process of filtering creates a cake of sediment on the surface of the fine screen itself. This sediment improves filtration efficiency, augmenting the efficiency of the fine screen. The filtration process creates differential pressure (DP) across the screen that rises as the volume of the sediment increases until a predetermined value is reached (normally 5m) to activate the flushing process.

Self cleaning:

The self-cleaning mechanism is automatically activated by a pressure switch-gauge or by a timer. On a flushing command, the flushing valve (6) opens to atmospheric pressure and creates a pressure drop in the motor chamber (9). This pressure drop causes the dirt suctioned from the fine screen to drain through the collector (5) in a linear motion. Simultaneously, the hydraulic motor (8) spins the collector; these two processes create a helical motion which covers the entire surface of the fine screen, thus enabling complete and effective cleaning.

Technical Specifications

Minimum pressure: 30 psi (2 bar)

Maximum operation pressure: 10 bar (150 psi)

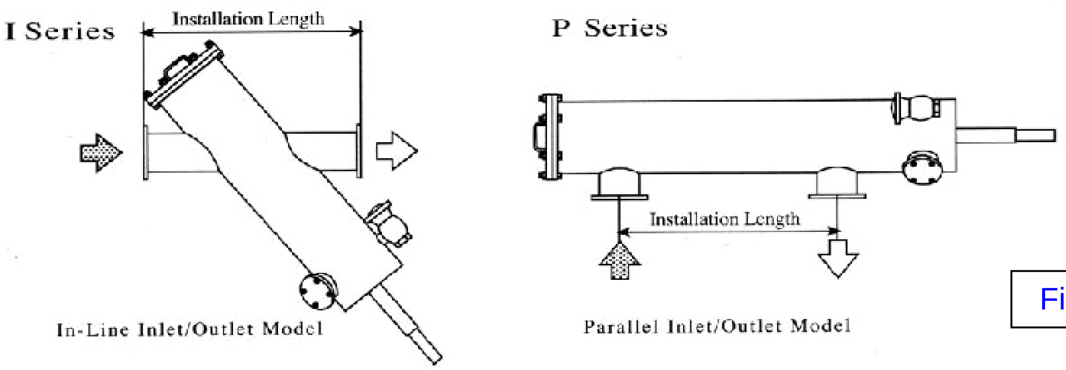
Temperature Range: 0ºC - 50ºC. For higher temperature capability consult your "Netafim" representative.

Automatic self-cleaning system activated by differential pressure and timer back up.

Stainless steel fine screen.

The steel body has 100 micron extra durable polyester applied electrostatically and oven-cured on a zinc-phosphate layer - inside and outside, for maximal anti corrosion resistance.

Filter configurations can be seen below in Figure 18



Key for Models Configuration : I - In Line, P - Parallel; S - Standard, E - Extended

Figure 18

Recommended flow rates for the Odis 8500 models can be found in Table 11 below

Table 11

Model	**Inlet Outlet diameter (mm)**	**Recommended flow rate up to (m^3/hr)**
85002	50	25
85003	80	40
85004	100	80
85006	150	150
85008	200	300
85010	250	400
85012	300	600
85014	350	900
85016	400	1100

The various applications that the 8500 series filter can handle are

- Irrigation *Agriculture, Golf courses and Turf*
- Recycling *Municipal sewage and Industrial wastewater*
- Industry *Cooling towers, process water and nozzle protection*

6.4 OdisMatic® 8600 Electric Filter

The Odis 8600 series are electrically operated by AC voltage where available otherwise by 24v DC and solar chargers where not. Standard features are

- Unique fine filtering element made of multi layer stainless steel mesh sintered together to form a strong fine filter element requiring no support. The OdisMatic® features a significantly larger filtering area than PVC supported weave wire screens.
- An electric motor with worm gear drive which drives the suction system in a helical motion, enabling the entire screen to be cleaned.
- A booster pump (on AC models) which generates a high-speed stream of water that is sprayed on the surface of the screen to assist in the cleaning process.
- A Programmable Logical Controller (PLC) programmed to ensure effective cleaning while maintaining low wastewater during flushing. The PLC operates when necessary to intensify flushing for the cleaning of heavy dirt loads.

Refer to Figures 19 and 20 below

Figure 19

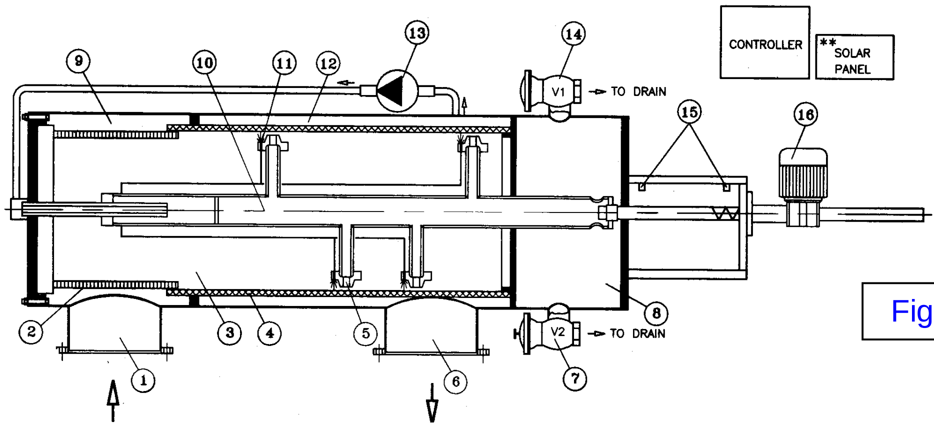


Figure 20

1) Inlet
2) Coarse screen
3) Filtration chamber
4) Fine screen
5) Suction nozzle
6) Outlet
7) Intensive flushing system
8) Flushing chamber
9) Inlet chamber
10) Collector
11) Spraying nozzle
12) Low pressure chamber
13) Booster pump*
14) Flushing valve
15) Limit switches
16) Worm gear motor

Principle of Operation (see schematic drawing above)

Two filtration stages.

- First Stage (Coarse Filtering) - Coarse filtering is carried out in the inlet chamber (9) to prevent large particles from entering the filter's cleaning mechanism in the filtration chamber (3).
- Second Stage (Fine Filtering) - After passing through the coarse screen (2), the raw water emerges through the fine screen (4) outward, to the user. The process of filtering creates, a "cake" of sediments on the surface of the fine screen itself. This sediment improves filtration efficiency augmenting the efficiency of the fine screen.

The filtration process creates a differential pressure across the screen that rises as the "cake" increases, until a predetermined value is reached (normally 5m) to activate the flushing process.

Self cleaning:

The self-cleaning process is automatically activated by a DP pressure switch-gauge or by a timer. Self-cleaning is performed by suctioning the dirt off the fine screen and flushing to drain. On a flushing command, the flushing valve (14) opens to atmosphere, causing a pressure drop in the flushing chamber (8) which suctions dirt off the fine screen (4) outward to drain through the collector (10) and the flushing valves.

Simultaneously the electric motor with the worm gear (16) spins the collector in a helical motion. The suction nozzles (5) move over the entire screen's surface and the booster pump* (13) creates a high speed water spray through the spraying nozzles (11) to assist in cleaning the clogged screen.

The PLC monitors the process and activates intensive flushing cycles where necessary to overcome heavy dirt capacity in the raw water.

Technical specifications

Min. pressure: 30 psi (2 bar).

Max. pressure: 10 bar (150 psi). For higher pressure capability consult your Netafim representative.

Electrical power: 3 x 380 V 50 HZ / 3 x 440 V 60 HZ or solar energized (24V DC).

Temperature Range: 0ºC - 50ºC. For higher temperature consult your Netafim representative.

The steel body has 100 micron extra durable polyester applied electrostatically and oven cured on a zinc-phosphate layer - inside and outside, for maximal anti-corrosion resistance.

Recommended flow rates for the Odis 8600 models can be found in Table 12 below

Table 12

Model	Inlet Outlet diameter (mm)	Recommended flow rate up to (m^3/hr)
86002	50	25
86003	80	50
86004	100	110
86006	150	200
86008	200	360
86010	250	470
86012	300	560
86014	350	650

The various applications that the 8500 series filter can handle are

- Irrigation *Agriculture, Golf courses and Turf*
- Recycling *Municipal sewage and Industrial wastewater*
- Industry *Cooling towers, process water and nozzle protection*

7 Selection and Design

Some of the principles of Selection and Design were covered in the previous Section “Filtration – Principles and Design”. We assume you the reader have a general understanding of water quality and sources.
For manual filters we tend to over design to compensate for the fact that they cannot clean themselves and that the water quality changes over time. So as “Rule of Thumb” we might say it is acceptable to design on a “clean flow” head loss of 1 to 1.5 m.
With automatic units we can “work” them harder and design on a higher “clean flow” head loss. Experience certainly helps, but in the absence of that we need to remain conservative and try to work with some objectivity and use the Tables supplied by the manufacturer.

8 Installation and Operation

Installation of the units is generally easy and user friendly since instructions are included. Once the selection has been made i.e. size of unit, auto or manual, mesh rating etc then the decision on positioning with respect to the pump, fertiliser injector, controller and shed walls can be made.
With the automatic units normally the following equipment is supplied as standard (on most models)

1. Pressure gauge mounted on 3 way Sagiv ball valve, with connections to HP (upstream) and LP (downstream) ports of the filter
2. PD Switch gauge for measuring pressure differential
3. Backwash controller (AC or DC powered)
4. Backwash valves to suit
5. Airvalve (2” Dual purpose or 1” Automatic)
6. Hydraulic plumbing and electrical connections already set up
7. The units come with a Manual, spare parts etc

The above points may illustrate how easy it is to work with units these days, a far cry from yesteryear when everything had to be built up from components. Even so the installer should be mindful of other ancillary equipment that may be needed such as

1. Check valve – placed downstream of the filter unit especially when the pump is at a low point in the block. This enables service work to be carried out on the filter unit.
2. Pressure relief valve – required if the pump can generate pressures in excess of the filter’s working range

With the manual filters all the extras need to be added, and drawings are available. The supporting pipe work can be of steel, poly, PVC or other materials provided it is sturdy enough to support the weight (and vibrations). It is good practice to position the filter with plenty of room around it to facilitate cleaning and service.

Operation of filters should be easy provided the correct selection and installation has been carried out. A quick check list for initial start up of automatic filters follows

1. Make sure all connections are secure
2. Open valve from command water filter to solenoids
3. Check settings on solenoids and relays (that they are on “Auto” mode)
4. Adjust settings on back wash controller to
   20 to 30 seconds for a flush
   About 2 hours between flush cycles
   About 5 - 7m on the DP switch gauge
5. Pressurise the system and check for leaks
6. Manually operate the solenoids/relays *one at a time* to check hydraulic circuits.
7. Run the controller through a “Manual” cycle to check electric and electronic circuits
8. Manually activate the DP switch gauge to check and see that it is OK.
9. Adjust the desired pressure setting on the hydraulic pressure sustaining valve (if present)
10. After Steps 6 to 9 above it should be clear whether the filter is back washing effectively or not
11. Measure Upstream and Downstream pressure to calculate DP in a “clean condition”. This will serve as a benchmark as when to chemical clean the screen. If the DP builds up over time after the back wash cycle with the same flow, then an acid or chlorine wash of the screen may be required.

9 Maintenance

For each filtration system, a maintenance program should be put into place. This should include both in-season and off-season tasks. The frequency of routine maintenance will depend on the type of filter system and the quality of the water source.
A General Maintenance program will look something like this

Daily
- Inspect system for leaks.

Weekly
- Check head loss across system: should be 7m or less,
- Check back flush controller operates correctly on manual cycle,
- Check automatic back wash operation,
- Check operation of back wash in response to the pressure differential (PD) switch.

End of Season
- Drain filter system,
- Open all filters and inspect screens,
- Wash screens with high pressure water - chemical clean if required,
- Check all “O”-rings for damage: replace if necessary,
- Grease all “O”-rings prior to installation using a silicon based product e.g. Molycote 111,

- Pressurise system and check for leaks,
- Trigger back wash and check operation of all back wash valves,
- Check operation of pressure gauges,
- Check head loss across system under normal flow is less than 4m.

10 Summary and Conclusion

Screen filters are widely used in Agriculture and Industry. The compactness, corrosion resistance offered with the special protective coatings and modularity allows long life and flexibility. They require less water to back wash and generally are cheaper than gravel filters.

11 Questions

These are divided into Beginner, Intermediate and Advanced levels

11.1 Beginner

1) What are the screens in the filters made of?
2) What types of screens exist?
3) What can happen if *flow velocity* in a filter is too high?
4) Describe in your words the different methods automatic screen filters in general clean themselves?
5) How many microns, nominally, is 80 mesh?
6) In your own words how would you carry out periodic cleaning of a 1000 series filter?
7) In the Odis filters how do you know what direction the water flows in and out?
8) What pressure range do most of the Odis filters operate up to? What if you need to go higher?
9) Where would we use the 7000 series instead of the 1900 series filters?
10) Can the Odis 3000 series filter replace a hydro cyclone?
11) For a flow of 31 m^3/hr which Odis 3000 series filter would you use?
12) Do you need to make any particular setting on the filter in Question 11 above?
13) Why does the Odis 8500 and 8600 filter have a First Stage (Coarse filtering) before the Second Stage (Fine filtering)?
14) Why do we have a PD switch gauge on an automatic filter?
15) How often should we inspect for leaks in a filtration system?
16) Why should we measure the upstream and downstream pressure of the filter in “clean condition”?

11.2 Intermediate

1) On a gravel/sand filter system we sometimes use screen filters as a secondary filter close coupled to the unit. What is the screen filter's main task in this application?
2) If we did not have a table showing Mesh to Micron conversions how do we calculate how many microns (nominal) 40 mesh is?
3) Why is the "Effective Filtering Area %" of a 40 Mesh screen filter greater than an 80 mesh filter?
4) We need an Odis filter to handle 10.5 Bar for a project coming up in about 4 months time – what do you do?
5) What grades of mesh does an Odis 1900 series filter have, and why?
6) Why would we use a 2000 series filter as opposed to a 1000 series filter?
7) *In your own words* describe how a 3000 series Odis unit filters and backwashes?
8) What is the main function of the *stone separator*?
9) Is it important as to which holes we block off and in what order on the *circulation plate*? Why?
10) What type of valve would we use on the *collection cell* of a 3000 series filter? Name a model of Netafim valve that would, and would not be suitable.
11) An irrigator wants an 8000 series filter for a new block. He has used one before and it can handle the water quality. The flow is. Which unit would you recommend and what settings would you set up?
12) Where would you use an 8500 rather than an 8600 series filter?
13) What causes the dirt to be removed from the *fine screen* and shifted to the *collector* in the 8500 and 8600 series filters?
14) An industrial customer wishes to protect his cooling tower from build up of dirt and residue that creates restrictions in the mainlines and pipe network For a flow of 200 m^3/hr what model of Odis filter would you select for *budget* purposes?
15) How often should maintenance on automatic screen filters be carried out?

11.3 Advanced

1) Where would we use an Odis 3000 series filter after a Gravel filter? Explain or describe a situation.
2) We do not have Mesh to Micron conversion table handy, but we know the *wire thickness* of the screen is 60 microns. How do we calculate what actual micron rating in this case a 120 mesh screen filter would have?
3) After washing with a hose and brushing the screen the Odis 2000 series filter's clean condition head loss is 5.5m? Explain *in your own words* the trouble shooting process you need to go through.
4) A grower has a 6" 3000 series filter and is fairly happy with it? He only wishes to use Netafim products and wants you to automate the unit. He has an existing Gal Compact controller – please explain in detail what extra equipment you would need to order to achieve this.
5) The grower in Question 4 now has your automation in place and the collection cell cleans itself OK, or so it seems. Before it was all right but now the head loss on the screen seems to build up more quickly? The flow and water quality is unchanged. What can be wrong?
6) Where would you use an 8600 series filter rather than an 8500?
7) A situation calls for a filter to handle 400 m^3/hr in "Bad" water using an 80 mesh screen. What are our filter options?
8) Why do we use a silicone-based lubricant for "O" rings and such like? What's wrong with Vaseline?
9) Describe *in your own* words to a farmer why he should use a Time *and* PD based controller on his auto screen filter.

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