STANDARD OPERATING PROCEDURE

Filter Press, Plate and Frame

Model: #12–12A/SS/RO/BD
Manufacturer: Star Systems, The Hilliard Corporation
Location: Wet Processing Pilot Plant, 1091 Food Sciences Building
Publication Date: 04/29/2015
Description and Uses

The Star Systems round, plate-and-frame filter press was designed to separate solids from liquids. The filter press is fabricated from #304 stainless-steel bar stock, plates and tubular steel with no cast parts. The press consists of a press screw, a stack of filter plates and frames, and a heavy-duty stand. The standard-unit maximum design pressure is 60 psi and can be used at temperatures as high as 425°F (218°C). The material to be filtered is pumped through the filter system which consists of paper filter media between each plate and frame that allows liquid to pass through while trapping the solids. The solids form a “cake” that is left inside the frames after the filtration cycle is complete. The media functions as parallel filters. One drop of oil passes through only one filter media on its path through the press.

Power Specifications

Motor Identification: TYP DK15LS
Power (Wattage): 2200 W
Voltage/Amperage: 208-220V/10A
Speed/Frequency: 1730 rpm @ 60 Hz.

Potential Hazards and Safety Precautions

<table>
<thead>
<tr>
<th>High Voltage/Possible Electric Shock (208-220V)</th>
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<tr>
<td>• Make sure that the wall outlet receptacle is properly wired and grounded, and matches the instrument’s power cord and plug. The machine must be electrically grounded for safe operation.</td>
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<td>• Make sure the area around the outlet, floor and your hands are completely dry when plugging or unplugging the electrical cord to/from the outlet.</td>
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<tr>
<td>• Before doing any work on the press, be sure that all electrical controls to the pump are shut off.</td>
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<th>High Pressure and Temperatures/Possible Burns and/or Injury</th>
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<tbody>
<tr>
<td>• The filter press operates at high temperatures and force (pressure). Never place any body parts near the filter press while it is in operation.</td>
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<tr>
<td>• Check the pressure gauge on the inlet to be sure no pressure remains inside the filter press. Note: If the press is opened while it is still pressurized, hot liquid may spray out causing serious injury to anyone standing nearby.</td>
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<tr>
<th>Mechanical Pinch Points/Possible Entanglement of Clothing, Jewelry, Hair, and/or Extremities</th>
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<tr>
<td>• Keep hands and extremities clear of all moving parts at all times.</td>
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<tr>
<td>• Make sure to secure long hair and any loose clothing or jewelry before operating the machine.</td>
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Flying Debris/Potential Eye Damage

- Always use proper personal protective equipment, including safety goggles, at all times while operating the filter press.

Fire Hazard/Possible Injury Due To Explosion

- Never use the filter press with flammable materials or with substances capable of developing flammable or explosive vapors.

Required Personal Protective Equipment

- Safety Goggles
- Hair Net
- Lab Coat
- Tie Back Long Hair
- Heat-resistant Gloves
- No Open-toed or Open-heeled Shoes
- Long Pants and Sleeves
- No Loose Fitting Clothing

Training

**Required Training**

*Denotes courses offered online

- Machine & Site-Specific Training
- Fire Safety & Extinguisher Training*
- Laboratory Safety: Core Concepts*

**Recommended Training for Frequent Users**

*Denotes courses offered online

- Electrical Safety & Lockout/Tagout
- Laboratory Safety: Spill Procedures
- Shop Safety Fundamentals: Basic Procedures & Policies*
Operation

Operation: Positioning the Press

1. The Star Filter “Installation and Operation Instruction Manual” (on file in the pilot plant office, 1955 Food Sciences Building) provides a more detailed description of the instrument including diagrams, cleaning and maintenance procedures, and directions for operating the press. Be sure to read the instruction manual before operating this device.

2. Use of this equipment requires site-specific training and supervision by the pilot plant manager.

3. Be sure to wear all personal protective equipment that is listed.

4. Position the machine so that there is ample space around the filter press so that it can be easily operated. **Note:** It is very important that the ratchet has enough room to swing. When tightening the ratchet, it is always best to push down on it rather than pull up!

5. The filter press operates best when positioned on a level surface and the weight of the machine is evenly distributed. After the press is in the desired location, use a level on the lower cross-support of the stand to check its position. If the press has leveling blocks, use a wrench to raise or lower each corner leg to level it.

Operation: Assembly

1. The press does not have an attached, dedicated pump (as shown in Figure 1). A positive-displacement pump is required to run the press and this must be supplied by the operator. Several such pumps are located in the Wet Processing Pilot Plant. The choice of pump is determined by the size and nature of the sample to be filtered. Consult with the pilot plant manager for assistance in selecting the appropriate pump.

2. The inlet should be hooked up with the same type of material as the pump itself (for example, if the pump is stainless steel, use stainless steel fittings and pipe; if the pump is iron, use iron fittings and pipe, etc.) **Note:** If filtering hot oils, do not use brass, bronze or galvanized iron fittings, as they will contaminate the oil.

3. The suction piping to the pump (the Star Filter inlet), should be one pipe size larger than the pump inlet (see Figure 1). For example, run 2" suction piping to a 1½" pump.

4. Put a drain valve in the feed line to drain the liquid when filtration is over. **Note:** Be sure this valve is at the lowest possible point so the lines can be completely drained. Also, be sure the inlet piping connection does not leak so that the pump will perform correctly.
5. As with the inlet, when attaching the outlet of your filter, use the same material as the pump (see Figure 1). **Note: Do not use brass or bronze.**

6. Include a drain valve with the filter outlet as well. **Note: Unlike the filter inlet, the pipe size can be the same as the outlet of the Star Filter.**

7. The filter press motor should be hooked up correctly by a licensed electrician. **Note: Motor overload controls should be used to prevent damage to the motor due to potential electrical overloads.**

8. After the inlet, outlet and motor are correctly hooked up, turn the pump by hand with the press unplugged and the power OFF to be sure the pump can turn freely. If it does, safely plug in the machine. **Note: Make sure the area around the outlet, floor and your hands are completely dry when plugging or unplugging the electrical cord to/from the outlet.**

9. Turn the power ON and run the pump momentarily to be sure it operates correctly. **Note: Be sure there is liquid in the pump while doing this to prevent damage. Never run the pump dry!**

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**Operation: Preparing the Press**

1. Check that all plates and frames are lined up with the “00” on the stationary head and in the correct consecutive order ... 1, 2, 3, etc. (see Figure 2).

2. Starting with the #1 plate, place media in each slot (i.e., on both sides of every plate) and press the plate or frame by hand toward the stationary head of the filter (see Figure 2).

3. Make sure all sealing edges around the plates, frames, and port holes are clean and free of lint or other foreign material to prevent internal bypassing and external leakage during filtration.

4. Reverse the knob on the ratchet handle (refer to Figure 2). Crank the hand bar clockwise and slowly close the press.

5. Make sure that all the plates and frames are in place (i.e., that the bushings in the plates slide completely into the ports of the frames) before tightening the press. Also, make sure that the holes in the filter media are lined up with the holes in the plates and frames. This prevents the tubes in each port hole from binding during tightening.

6. When the moving head is snug against the plate stack, press down on the ratchet handle clockwise to seal the filter press tightly.

7. As soon as the filter media becomes wetted by the liquid inside of the filter, hand tighten the ratchet again as much as possible. **Note: Tighten only by hand! Do not use a cheater bar!**
1. If the pump can turn freely by hand, see “Operation: Assembly” Step 8, turn ON the feed pump to begin filtration.

2. Make sure that all valves in the feed line that lie ahead of the pump and between the pump and filter are open, and that the bypass valve is closed.

3. Usually, there is zero pressure on the gauge when filtration starts. Note: This does not affect operation of the filter which operates best at low pressure.

4. During the first operating cycle, the pressure must be closely monitored over the entire cycle. Usually the filter shows no pressure during the first few minutes of operation, and may take a few hours until a pressure reading is observed. The optimum pressure drop across the filter is 0; however, the filter is engineered to operate properly anywhere between 0 and 60 psi, which is the maximum design pressure. Note: Higher pressures can cause excessive damage, and may cause excessive leakage from the plate stack as well as bypassing and breaching the filter. When the pressure reaches a preset level of 60 psi, the motor will shut off.

5. If the motor shuts off due to high pressure, locate the cause of the high pressure and fix the problem before restarting the pump.

6. Once the pump is running and the pressure reaches between 5 and 55 psi, adjust the bypass valve in the piping loop around the filter-feed pump. Note: The valve should be closed at the start of filtration.

7. As the pressure drop increases to ~40 psi (typically late in the cycle), open the bypass valve slightly, to reduce both the feed flow and the pressure drop across the filter. Try to reduce the pressure to 20-30 psi. If the pressure continues to climb above 40 psi, the bypass can be fully opened.

8. If the pressure goes above 40-50 psi with the bypass fully open, stop the filtration cycle. To proceed, you must clean the filter and replace the filter media as per instructions listed under “Clean-Up Procedures.” Note: At higher pressures, filtration efficiency decreases. It is not necessary to operate the filter above 40 psi. Rather, a pressure drop of 30 psi or less is recommended while maintaining an adequate flow rate through the filter.

9. Keep the pilot plant manager informed of any filtration problems as they occur and proceed under his direction. Initiate clean-up procedures before departing.
Clean-up Procedures

1. Once filtration is complete, or when the filtration cycle must be stopped due to elevated pressure in the system, you must initiate clean-up procedures before another filtration cycle can commence.

2. The Star Filter “Installation and Operation Instruction Manual” (on file in the pilot plant office, located in 1955 Food Sciences Building) can provide more detailed information on proper clean-up procedures. Refer to the manual before initiating clean-up.

3. Before performing any clean-up procedures, make sure that all electrical controls to the pump are shut OFF and the filter press is unplugged from the power source. Note: Make sure the area around the outlet, floor and your hands are completely dry when plugging or unplugging the electrical cord to/from the outlet.

Changing the Filter Media and Removing Sludge

1. The media should always be changed after 8 to 12 hours of continuous operation or if the pressure drop is above 40 psi with the bypass valve fully open. In most cases, changing the media at 8-hr intervals is best. Note: Never keep media in the filter for more than a 24-hr period even if it has only small amounts of sludge.

2. Begin by removing and discarding the media.

3. After the media is discarded, the frames must also be cleaned of all sludge. Note: The filter will not function if the frames are packed with sludge. It is best to establish a schedule if sludge accumulation occurs very rapidly so that the filter sheets are changed before the frames are completely packed. Typically, packed frames coincide with high pressures, but not always. If the frames pack after a certain period of time but the pressure stays in the operating range, you should clean out the filter (see below) when the frames are packed regardless of the pressure.

4. Brush or scrape all sludge into the drain pan (refer to Figure 2). Note: DO NOT scratch or damage sealing surfaces with scraping tool! DO NOT bounce frames on sidebars to dislodge solids! This will misalign the plates and frames making the filter press difficult to close and seal. An option is to remove the frames from the press and clean them over a sludge container. When doing this, use a rubber or plastic container that will not damage the frames’ sealing surfaces.

5. Check and clean the sealing edges on both the plates and the frames thoroughly!

6. Always have the plates and frames inspected by the pilot plant manager before attempting reassembly.

Cleaning the Filter

1. The piping of the Star Filter should be cleaned at least weekly.

2. To begin, prepare a tank with a hot solution of detergent (caustic), at least 160-180°F (70-82°C).

3. Circulate the solution through the filter and back into the tank for at least 30 minutes.

4. Flush for 10 minutes with clean hot water. Repeat for 10 minutes.

5. Finally, flush the piping with clean food-grade oil to prevent rust.
Machine Care and Maintenance

- Inspect the machine after every use for any leakage or broken parts. Report any leak or broken parts to the pilot plant manager, who performs all final inspections.
- Weekly lubrication of the Star Systems filter press and pump must be maintained by the pilot plant manager or a trained service technician. Refer to the Star Filter “Installation and Operation Instruction Manual” (on file in the pilot plant office located in 1955 Food Sciences Building) for proper lubrication and greasing of parts.

Accessories

The user must provide a positive-displacement pump to use with this machine.