TUBULAR SYSTEM BASIC OPERATION INSTRUCTIONS

Pretreatment

1. Equalization of wastes from throughout the plant combined with surge capacity.
2. Prescreen to remove large suspended material.
3. Free oil and settable solids removal.
4. Adjust pH to alkaline conditions (if needed) to stabilize the oil/water emulsion.

Start-Up

1. The return valves to the process tank must be fully open.
2. The discharge valve after the pump must be fully closed.
3. Turn on the pump.
4. SLOWLY open discharge valve (before the membranes) allowing approximately 15 seconds to reach 60 PSI of discharge pressure. **NOTE: Opening the discharge valve too fast will cause a "water hammer" affect that will delaminate the membranes, resulting in permanent membrane damage.**
5. Gradually adjust the final return valve so that the outlet pressure (after the membranes) is no less than 14 PSI. Each membrane tube in series should experience between 4-5 PSI pressure drop. It is expected that with a feed pressure of 60 PSI and 8 tubes in series, the outlet pressure should be between 20-28 PSI. **NOTE: Under no circumstance should the return valve be fully closed as this will result in permanent membrane damage.**
6. When operating in a Modified Batch mode (continuos feed), the rate of feed into the process tank must be adjusted to equal the permeate flow rate.
7. The system is now operational. It should be monitored once per 8-hour shift and performance data recorded in a permanent operating log. The data should include: Operator's initials, date & time, temperature, pressure in, pressure out, feed description (note any changes) and permeate flow rate.

Batch-Down

1. The wastewater feed to the process tank is shut-off while the system continues to operate.
2. The process tank is concentrated down to the final desired level (not to exceed 30% oil concentration).
3. Drain the contents of the process tank for further processing or for disposal.
4. Begin specified cleaning protocol (included).
5. Return to step 1 of start-up procedure.

TUBULAR MEMBRANE INFORMATION

1. Do not "water hammer" (hydraulically shock) the membranes. System should be pressurized slowly by starting the pump with the discharge valve closed and the return valves fully open then gradually open the discharge valve.
2. Permeate backpressure must not exceed 5 PSID at any time our membrane delamination may occur.
3. Store membranes at a temperature between 40 F (5C) and 100 F (38C). Freezing or excessive heat will damage the membranes.
4. Membranes must be kept moist at all times.
5. Membranes that are not to be operated for 1-4 hours should be rinsed with clean water.
6. Membranes that are not to be operated for 4-48 hours should be cleaned according to the specified cleaning protocol.
7. Membranes that are not to be operated for 48 hours or longer must be cleaned according to the specified cleaning protocol and preserved with glycerin or other approved membrane preservative.
8. Blisters on tubular membranes indicate excessive permeate backpressure and/or chemical attack. Correct condition and replace blistered membrane(s).
9. Dark brown membranes indicate exposure to pH above 11. Adjust/correct pH level to between 7-11. Monitor membrane performance and replace if needed.
10. Cloudy permeate indicates membrane failure. Inspect individual permeate lines to isolate failed membrane and replace.
11. Do not fully close return valves ("dead-head") the system. This will force entire feed flow rate through the membranes and will cause permanent damage.
12. Do not exceed a feed pressure of 80 PSI to the system.