SECTION 21
ASPHALT EMULSION EQUIPMENT PUMPS

21.1 Introduction

The purpose of this guide is to assist the asphalt emulsion end user in pumping emulsion. The brochure covers the pros and cons of positive displacement and centrifugal pumps, the need for specific pump features, proper pump installation, and suggested pump sizing. Proper cleaning, maintenance and off-season storage procedures are given. Finally, a troubleshooting guide is included.

21.2 Pumps

The most common type pumps used for emulsions are positive displacement and centrifugal pumps. The following is general information on these two types of pumps.

21.2.1 Positive Displacement Pumps

21.2.1.1 Mechanical Operations of the Pump

The rotating member(s) inside the pump creates a vacuum at the suction port. Liquid is drawn into the port and carried between the rotating member and the pump housing since there is close tolerance between the two. As the liquid reaches the outlet port it is forced outward as the pumping chamber is squeezed down by some means. For each revolution of the pump, a fixed amount of liquid is displaced. The liquid must flow somewhere since there is little slippage and thus the name positive displacement.

21.2.1.2 Pump Features

The following are special suggested pump features:

1. Relief Valve
   In case of downstream blockage, this valve opens dumping liquid back to the suction side of the pump or back to tank, depending on the type relief valve used. Most valves are adjustable so relief pressure can be regulated.
2. Jacketing
   These pumps require some type of heat and can be ordered with various jacket arrangements for the circulation of hot oil, water or low pressure steam.
3. Extra Clearance
   Due to the nature of asphalt emulsion, most pump manufacturers suggest special clearances between certain pump members. This varies for different pump manufacturers. Be sure to emphasize the material to be pumped is asphalt emulsion, not asphalt cement or asphalt cutback.
4. Special Materials
   Since asphalt emulsion pumps can be exposed to shock loads during startup or while running, it is suggested that a steel alloy fitted pump be considered

rather than a standard fitted one. However, many pumps are in operation whose working members are made of ductile iron or high grade carbon steel.

5. Packing Seal
   Normally specified for any type of asphalt usage because of its lower cost and because mechanical seals damage easily due to asphalt glued faces.

21.2.2 Centrifugal Pump

21.2.2.1 Mechanical Operations of the Pump

Material is fed into the center of the pump by gravity and a high speed impeller slings the material to the outside of the pump casing and through the outlet.

21.2.2.2 Pump Features

Normally, no special pump features are required with a centrifugal pump.

21.2.3 Pros and Cons Between the Two Types of Pumps

21.2.3.1 Positive Displacement

1. Will create a suction lift.
2. Is reversible.
3. Will pump to a higher discharge head.
4. Meters

21.2.3.2 Centrifugal

1. Is less expensive since the initial pump cost is less and a direct non-reducing drive can be used.
2. Requires heat only with high viscosity materials, or cold weather.
3. Less efficient with higher viscosity emulsions.
4. Takes more power.
5. Not all are self-priming.
6. Max. speed should be 1750 RPM or less.

21.3 Sizing the Pump and Motor

In specifying the size pump required, considerations should be given to the primary use of the pump. By contacting your local pump vendor, they will be able to help size the appropriately-fitted pump for your application.

Items to consider and to have on hand should include the desired pumping capacity, a viscosity/temperature curve for the material, specific gravity, and expected temperature range for the material being pumped. This will allow the vendor to accurately choose the pump that most econonomically meets your demands. Be sure to specify to your vendor that the pump is for asphalt emulsion service. Most manufacturers will machine additional tolerances into their equipment to compensate for large temperature differences. It is also recommended to specify heavy duty versions on the vendor's pump styles. Pumps used in asphalt emulsion plants see severe duty.

Over-sizing pumps should be given careful consideration. This practice may be beneficial for long-term flexibility, but may unnecessarily raise the initial cost of the project. Additional costs will come from installing larger piping, increased motor size, motor starter costs, etc. Ultimately, each organization needs to decide what is right for them at the time of purchase.

Electrical wiring should comply with local standards.

If the pump or equipment is used at a 25% or greater duty cycle, they should specify a “Premium” efficiency style motor. This will save them money in the long run.

21.4 Installing the Pump-Motor-Tank Systems

21.4.1 Pump-Motor Foundation

A solid foundation to help absorb any abnormal loads is important. It is suggested the pump and motor be mounted together on a separate integral base before being plumbed into the system. Do not attach pump mounted base to the floor since expansion and contraction caused by hot and cold cycles cause plumbing to draw and the base to move.

21.4.2 Direct versus Indirect Drive

Most pumps are driven by an indirect drive by V-belts. This is a more economical installation, as opposed to a gear box, and, in case the pump stops, the belts will usually break, preventing a more costly breakage; and the indirect drive gives more flexibility in pump mounting. The major disadvantage of the indirect drive is size since reducing the pump speed often requires a large pulley. Centrifugal pumps are nearly always driven by a direct drive since they turn at a much faster speed. Always provide suitable belt or coupling guards for protection.

21.4.3 Proper Pump Installation

Motor Alignment-Some pumps require the use of an outboard bearing near the shaft end. Exact centering of the shaft in relation to the pump housing is of extreme importance. It may be necessary to use shim material to insure correct centering. In the case of the indirect drive, drive pulleys of the pump and motor must be aligned properly. For the direct drive, the same proper alignment applies to coupling halves. The following examples are given for proper alignment. Always turn the pump over by hand after mounting and plumbing to make sure there are no tight spots. Some pump manufacturers recommend removing the head of the pump and checking between internal members and the pump casing for proper clearances with a feeler gauge.Fai

Failure to properly align the pump and its motor will result in increased wear and maintenance for the unit.

21.4.4 Pump Location

Always locate the pump as close to the source of the liquid to be pumped as possible. Remember a pump can push material easier than it can suck it. Also, locate the pump

so it is accessible for maintenance and repair. Being able to remove the pump's internal members without removing the pump from the base is often very handy. If at all possible be sure a positive suction head exists, that is, the liquid level of the tank is always above the suction port of the pump.

21.4.5 Pump Heating

Can be accomplished by hot water, oil or low pressure steam if the pump is jacketed, or by electrical trace lines. Insulation around the pump helps hold the heat. Means should be provided to regulate the amount of heat to the pump. If electrical trace lines are used, fill the pump jacket(s) 80 to 90% full of heating oil.

21.4.6 Strainer

Most pump manufacturers will normally specify a basket strainer. They are, in fact, rarely used in the field because a strainer fine enough to protect the pump needs a very large surface area and is very expensive. They also require isolation valves for cleaning.

21.4.7 System Plumbing

General comments:

- Plan the system to provide maximum flexibility and utilization.
- Plan for future expansion.
- Be sure suction piping is at least the same size as the suction port of the pump or larger for long suction lines and more viscous materials.
- Keep suction piping as short as possible.
- Use of a swedge or bell reducer one size larger than the suction line is recommended at the tank outlet, Also, the use of an elbow inside the tank will permit sucking near the bottom of the tank and still leave scum buildup inside.
- Always put a length of return or recirculate line inside tank to permit better tank circulation which maybe required.
- Design piping systems to allow for the transfer of materials from one tank to another. This system may also be used to mix or re-circulate the product.
  - **Note:** This should only be done on a limited basis. A continued need for mixing should be addressed by the use of a side entry mixer.
- Never use the same pump for anionic and cationic emulsions, unless thoroughly cleaned and flushed.
- Always turn the pump by hand after final installation to make sure the plumbing has not caused any bind.
- Minimize all tees, elbows, and other restrictions in the suction line. Use of full port valving is recommended.
- Provide plumbing to accommodate a vacuum or pressure gauge in the suction and discharge lines.
- Use of direct flame heat on any part of the plumbing or pump should be done with extreme caution.
- If a positive displacement pump is used, it is suggested to take advantage of its reversing ability to clean lines at end of loading. When installing positive displace-

ment pumps, you should also install some type of pressure release system.

- Use of unions, flanges, and spools will permit rapid removal of components for maintenance.

21.5 Pump Maintenance

21.5.1 Lubrication

Grease all points of the pump and the outboard bearing per manufacturer's recommendation.

The electric motor also needs to be lubricated according to the manufacturer's recommendations.

21.5.2 Packing Adjustment

For a new pump make sure the packing gland is loose (by hand). Do not tighten gland until pump has run and the packing has expanded from absorption of the pumped liquids. With pump stopped, adjust gland evenly just enough to reduce leakage to a drip every few seconds. Packing is designed or intended to leak. This process allows the shaft to be lubricated. NEVER tighten packing too tight. It will cut a groove in the pump shaft causing a leak which will be very difficult to repair. All appropriate safety measures should be taken when adjusting the packing gland.

21.5.3 Replacing Packing

The packing gland can be slid up the shaft and a new ring of packing added as required. If the total packing is replaced, the new rings should slide over a well lubricated shaft, with the connected ends of the ring staggered in relation to the one next to it. Always turn pump by hand after installing packing to make sure it turns freely.

21.5.4 Ground Packing Material

Material is poured into the pump stuffing box in place of packing rings. Adjust carefully with packing gland to form a light but flexible seal.

21.6 Cleaning And Winter Storage

21.6.1 Cleaning

If the pump is properly installed, has suitable means for heating, and the emulsions being pumped are in specification, little or no cleaning during the work season is normally required. Vent the line and remove as much emulsion from the line and pump into the tank as possible. Fill the pump with diesel fuel and close the necessary valve down stream to cause the pump relief valve to open. This will cause the diesel to circulate within the pump, causing it to warm up and provide good cleaning.

NOTE

Be careful not to allow the diesel to be mixed with the tank emulsion since even a little diesel may affect product quality. Proper disposal

should also be addressed.

21.6.2 Winter Storage

Always drain the tank, lines, and pump during the winter since emulsion will freeze. Leave diesel in the pump over the winter to prevent rust. If the emulsion is to be used in the winter, always drain the lines and pump after each use and provide heat for the tank.

21.7 Troubleshooting

The following are offered as helpful guides to solving a pump problem.

21.7.1 Pump Does Not Pump

1. Suction and discharge valves closed.
2. Relief valve set too low or stuck open.
3. Lost its prime; air leak or low tank level.
4. Lines plugged.
5. Belts may be loose.
6. Bent or broken internal pump member.

21.7.2 Pump Is Noisy

1. Pump is starved because possibly viscous liquid is not getting to the pump fast enough. Heat liquid to a maximum of 85° C (185° F) to reduce viscosity, increase suction pipe size or reduce suction length.
2. Check alignment.
3. Bent or broken internal pump member.
4. Relief valve chatter, increase pressure setting.
5. Securely anchor to base to reduce vibration.
6. Foreign object trying to enter pump or inside pump.
7. Suction line partially plugged.

21.7.3 Pump Delivery is Low

1. Starving: see **1. Pump is starved because possibly viscous liquid is not getting to the pump fast enough. Heat liquid to a maximum of 85° C (185° F) to reduce viscosity, increase suction pipe size or reduce suction length.** in **21.7.2 Pump Is Noisy**.
2. Air leak in suction side or through packing.
3. Relief valve set to loose or stuck partially open.
4. Running too slow, motor wired incorrectly.
5. Partial suction line blockage.
6. Pump worn out.

21.7.4 Pump Takes TOO Much power

1. Running too fast.
2. Viscous material-heat material.
3. Discharge pressure too high; lessen pressure relief setting, reduce length of

pipe, or increase pipe size.
4. Packing gland drawn too tight.

21.7.5 Use of Vacuum Gauge in Suction Port

21.7.5.1 High Reading.

1. Suction line blocked, valve closed.
2. Liquid too viscous to flow through plumbing.
3. Lift too high.
4. Line too small or too long.

21.7.5.2 Low Reading

1. Air leak in suction line.
2. End of pipe not in liquid.
3. Pump is worn.
4. Pump is dry; prime pump.

21.7.5.3 Erratic Reading

1. Liquid coming to pump in slugs; air leak.
2. Vibrating from cavitation, misalignment, damaged parts or foreign object in pump,

21.7.6 Use of Pressure Gauge in Discharge Port

21.7.6.1 High Reading

1. High viscosity and/or small and/or long discharge line.
2. Valve partially closed.
3. Line partially plugged.
4. Relief valve set too high.

21.7.6.2 Low Reading

1. Relief valve set too low.
2. Pump warm.

21.7.6.3 Erratic Reading

1. Cavitation.
2. Liquid coming to pump in slugs.
3. Air leak in suction hose.
4. Vibration