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TECHNICAL INFORMATION

BULLETIN

Number 24

Packing for Centrifugal Pumps

Packing in a pump is intended primarily to restrict leakage around the shaft. It is intended to fill the annular space between the box and shaft so the packing may come as close as practical to the shaft or shaft sleeve without actually contacting it, and thus restrict the leakage. All packing manufacturers recommend a slight leakage through the packing for accomplishing water lubrication. There is a definite relationship of leakage rate to maximum life of packing. Less than the recommended leakage rate will tend to reduce the life factor. Excessive pressure of the packing against the sleeve will adversely affect sleeve life.

The success or failure of packing is almost always determined by the original packing procedure. Placing packing haphazardly into the box and clamping down on the gland is an assurance of poor performance and short life.

The proper procedure is to cut each ring to fit into position or use pre-cut rings without the ends overlapping. When installing, stagger the joints of

each ring as placed and be sure they enter the box square with the shaft. This can be accomplished by using the gland and a split bushing as each individual ring is inserted. When all packing is in place, position the gland and firmly seat it down on the packing to help form it around the shaft. Then back off the gland until it is free from the packing. As much as 1/16" clearance is desirable. Then start the pump and allow the packing to "breathe" into position. If leakage is excessive, tighten the gland by turning alternately the gland nuts approximately 1 / 6 to 1 / 4 turn at a time.

(Be sure at all times to see that the gland enters the box square to the shaft so that uniform pressure is exerted around the packing

-a tipped gland is an invitation for trouble.) Control the leakage slowly. Allow the packing to seat itself after each increment of adjustment, even if it takes readjustment for several days to get proper control. If, after an adjustment the leakage seems greater than before, do not continue tightening the gland. This is often a natural phenomenon and when the packing has a chance to reposition itself, the leakage will decrease.

Numerous complaints about packing failure have been investigated, and almost invariably it was found that the procedure was at fault, not the packing or the arrangement. If properly packed and run in, packing should give many months of trouble-free service. In general, the lubrication built into the packing plus the small amount of leakage as recommended will take care of all lubrication requirements for the life of the packing.

In those instances where special packing is used, close adherence to the manufacturer's instructions will guarantee long and trouble-free service.

These are the step by step procedures in repacking a pump:

1. Read the installation instructions furnished with the packing.
2. Clean out the old packing. This includes the packing below the lantern. Often the dead packing below the lantern is not replaced as it should be. Flexible packing hooks are available for removing the packing. If a lantern is used, it will be fitted with holes or slots into which a packing hook may be inserted to facilitate its withdrawal.
3. Check the shaft or sleeves for nicks and score marks, remove any that are present, then clean carefully. Clean up the bore of the box. Check the lantern to make sure the channels and holes are not plugged.
4. Begin by installing the first ring. It is recommended that a film of grease or oil be applied to the outside diameter of the ring to help the breaking-in process. Start by installing one end of the ring and bringing it around the shaft until it is completely inserted in the stuffing box.
5. Then, with the aid of split bushings (which incidentally, should have a nominal clearance of only approximately .005 in. to prevent the formation of a lip on the packing that is being seated), push the packing to the bottom of the box. Next, seat the ring firmly by replacing the gland and taking up on the bushing. Seat this bottom ring hard because it must seal on the face of the bottom end of the box. The first few rings under the gland do most of the sealing. If the packing is properly seated and compressed, as outlined, better sealing action will be obtained and longer more efficient packing life is assured.
6. Repeat this operation with each ring making sure to stagger the joints.
7. If a lantern is used, be sure it is properly positioned so that it is located under the hole in the box used for flushing or lubrication.
8. Position the gland-take up on it snugly, checking for squareness making sure that it isn't cocked in the box. Cocking causes uneven compression of the packing and,

- (8) more importantly, damage to the sleeve. Good practice is to allow at least $\frac{1}{4}$ in. for gland nose entrance. This centers the gland and minimizes cocking.
9. Turn the shaft by hand a few times if possible. A properly packed box should be loose enough to be turned by hand on smaller pumps. A freely rotating pump is an indication that it is not over-tight.
10. If a lantern ring is being used, make certain that the lines carrying the lubricant are open and that lubricant is being fed into the lantern under pressure.
11. Start up the pump. If it is turbine driven, bring it up to speed gradually.
12. Permit sufficient leakage to keep the shaft and packing running cool. Adequate leakage at this time is a necessity. If the shaft and packing runs hot and the leakage begins to choke off, it is advisable to stop the pump and permit it to cool down.
13. If it has been necessary to shut down the pump, wait until it has cooled-then restart and follow the same procedure as above.
14. Allow pump to run 15 minutes and, if leakage rate is more than desirable, take up one-fourth to one-eighth turn on the gland nuts.
15. Repeat these adjustments at intervals until desired leakage control is obtained.
16. The packing will normally run warm for the first few hours until the packing has burnished in. Often the leakage rate will reduce by itself at this time.
17. Special packing is available for temperatures up to 450°F. So, even if the leakage is warmer than the fluid being pumped, it doesn't mean that the packing is being damaged.

18. Make periodic inspections of leakage but do not take up on the gland unless necessary. Over tightening wears out packing prematurely and causes scoring and damage to the shaft.

19. Note: While these instructions will apply generally to about 90% of packing installations, there are exceptions.

What causes compression packing to fail prematurely? Some of the common causes are conditions regarding finishes, clearances, selection of packing, installation and maintenance, abrasive or corrosive conditions, insufficient lubrication or leakage.

Abrasive in the fluids being pumped may be kept out of the stuffing box by using a filter or cyclone separator, or by using a flushing lantern and clean water from an external source. There are, however, other sources of abrasives such as scale in the pipe or solids that might be left when water evaporates. These are just as damaging as abrasive in the fluid itself.

Minimizing pressure differentials as far as possible is another way of prolonging packing life, since leakage is directly proportional to pressure differences. One common way to accomplish this is to bleed off at the base of the box to some point of low pressure such as the pump inlet. This is often done on multi-stage centrifugal pumps, for instance.

PACKING TROUBLES, THEIR CAUSE AND CURE

TROUBLE	CAUSE	CURE
No liquid delivered	Lack of Prime	Packing too loose or defective, allowing air to leak into suction. Tighten or replace packing and prime pump.
Not enough liquid delivered	Air leaking into stuffing box	Check that there is some leakage through stuffing box while operating- if no leakage after reasonable gland adjustment new packing may be needed or Lantern ring may be clogged or displaced and may need centering in line with sealing liquid connection or Sealing line may be clogged or Shaft or shaft sleeve below packing may be badly scored and allowing air to be sucked into pump.
	Defective packing	Replace packing and check for surface smoothness of shaft or shaft sleeve.
Not enough pressure	Defective packing	As for preceding.
Pump works for awhile and quits	Air leaks into stuffing box	See preceding.
Pump takes too much power	Packing too tight	Release gland pressure. Retighten reasonably. Keep leakage flowing- if none; check packing, sleeve or shaft.
Pump leaks excessively at stuffing box	Defective packing	Replace worn packing. Replace packing damaged by lack of
	Wrong type of packing	Replace packing not properly installed or run-in. Replace improper packing with correct grade for liquid being handled.
	Scored shaft or shaft sleeves	Put in lathe and machine true and smooth or replace.
Stuffing box overheating	Packing too tight	Release gland pressure.
	Packing not lubricated	Release gland pressure and replace all packing if any burnt or damaged.
	Wrong grade of packing	Check with pump or packing manufacturer for correct grade.
	Insufficient cooling water to jackets	Check if supply line valves opened or line clogged.
	Stuffing box improperly packed	Repack
Packing wears too fast	Shaft or shaft sleeve worn or scored	Re-machine or replace.
	Insufficient or no lubrication	Repack and make sure packing loose enough to allow some leakage.
	Improperly packed	Repack properly making sure all old packing removed and box clean.
	Wrong grade	Check with pump or packing manufacturer.
	Pulsating pressure on external seal	Makes packing move and prevents it taking a 'set'. Remove cause of pulsation.