A northern Ontario mill has achieved improved brown stock washing, substantial BOD reduction and significant savings in defoamer use with a new Kamyr pressure diffusion washer. The 735-tpd unit has proven so successful the company recently installed a second system.

The first North American installation of a Kamyr pressure diffusion washer at Great Lakes Forest Products Ltd.’s kraft pulp mill in Thunder Bay, Ont., has been such a success that company officials recently invested in a second unit.

When the company installed the 735-tonne-per-day pressure diffusion washer ahead of the drum washers in its “A” mill in September, 1983, its primary objective was environmental; to reduce effluent BOD loading. Not only has this been accomplished, but the mill is also realizing important savings in defoamer and bleach plant chemical use.

BOD load has been reduced substantially, by as much as 10,000 lbs./day, defoamer chemical use has decreased by more than 50 per cent, and pressure diffuser displacement ratios (DR) have usually been above 90 per cent.

“The A-mill unit is running extremely well,” says Clare Gain, manager, kraft operations. “Our stock is now much better washed before going to the bleachery, with the result of far less off-quality pulp being produced.”

Since the first such unit was installed at the M. Peterson & Sons A/S mill at Moss, Norway in 1979, roughly 25 Kamyr pressure diffusion washers have been sold around the world. However, Great Lakes is the first North American company to install such a unit. The Kamyr washers presently range in size from 170 tpd to 1,100 tpd and are operating on hardwood and softwood, sulphite and kraft pulps.

Great Lakes likes the Kamyr pressure diffusion washer because of its several advantages over conventional brown stock washing. These include high washing efficiency, low energy use, relatively low maintenance, ease of operation, and ease of installation. Another plus was that the unit was the least expensive to retrofit in an existing washing system.

Great Lakes installed the pressure diffusion washer on the “A”-digester blow line ahead of the blow tank in September, 1983. Because the unit is shop-assembled, installation was easy and was completed in only two weeks. No downtime was necessary as the tie-ins were made previously during a regular shutdown. Because of the unit’s compactness, Great Lakes was able to erect it between the digester and the existing brown stock washers.

The normal wash medium is effluent from the screen room decker. This is used counter-currently through the existing brown stock washer drums, through the pressure diffuser, and then to the wash zone in the Kamyr digester.

From start-up to June, 1984, the unit averaged washing displacement ratios of 75 to 78 per cent based on solids removal. In June, following studies by Great Lakes and Kamyr, the unit was modified to improve stock distribution and eliminate any pulp mixing. The major changes made consisted of reducing the degree of taper on the screen and changing the open area of the screen.

Since the installation of this modified screen, washing DR has been quite constant, averaging above 0.90 DR.

A side benefit of the diffuser installation has been the significant reduction in defoamer use in the screen room. Great Lakes had expected some savings but not the 60 to 70 per cent reduction actually achieved. They had previously been using 1.5 kg./tonne and are now down around 0.5 kg./tonne.

Prior to installation of the washer, effluent BOD load for the brown stock
Great Lakes has run the “A”-line at up to 100 per cent screen room closure since installing the washer, reducing BOD levels by as much as 10,000 lbs./day.

The pressure diffusion washer requires very little operator attention. As it is closely related to the digester, the digester operator is responsible for monitoring operation. One of the changes made by Kamyr for ease of operation was the installation of a “black box” linear displacement transducer, which controls the speed of the diffuser screen to allow the operator to run the unit either on automatic or computer control.

The unit is very stingy on energy consumption. The reciprocating actions of the screen are powered by a single hydraulic unit which uses only 100 hp. The only other moving part is the discharger mechanism, which consumes only 40 hp.

The pressure diffusion washer consists of a cylindrical perforated stainless steel screen (slightly tapered), mounted vertically in a carbon steel shell. The 735-tpd unit has a nominal diameter of two metres, with a height of 15 metres. A hydraulic cylinder moves the screen downward at a speed matching the pulp velocity (about 3.5 seconds for a 20-inch stroke). The same cylinder is used to pull the screen rapidly upwards (in about 0.3 seconds) thus wiping the screen clear of any fibres. The taper of the screen creates an automatic liquor backflush flow through the screen, which momentarily pushes the fibre mat away from the screen, for easier wiping of the screen during the upstroke cycle.

The major components of the pressure diffuser washer are: pressure vessel, liquor chamber, diffuser screen, rotating discharger, and hydraulic system and cylinder.

The screen is installed inside a pressure shell which is designed to accept full digester pressure. However, the actual operating pressure of the unit is determined by the pressure in the blow line, which will usually be in the range of 75-100 psig.

The pulp enters the top of the discharger at digester blowline consistency and moves downward between the stationary liquor chamber and the diffuser screen and discharges at the bottom of the unit.

Output pulp consistency from pressure diffusion washers may be adjusted by varying the liquor extraction flow with relation to the wash liquor flow. The “discharger” is designed so as to

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Displacement ratios have been above 90 per cent.

The wash liquor is pumped into the liquor chamber (which is stationary), flows outward through the pulp mat, passes through the diffuser screen into the area between the shell and screen, and exits through the extraction header on continuous flow control. The pressure diffuser allows the pulp temperature to be controlled by indirect heating or cooling of the ingoing wash medium.

At Great Lakes, the blowline consistency is 10-11 per cent. The diffuser allows the pulp to be washed without any dilution.

As the pressure diffuser is totally enclosed, it has no air being exhausted, thus eliminating TRS emissions from the washer system. Because there is no entrained air in the filtrate, there is need for only a small filtrate tank (2.4-metre diameter) with the diffuser.

In contrast to the pressure diffuser, the conventional drum washer requires the incoming stock to be diluted to approximately one per cent, resulting in the use of large volumes of filtrate. These high dilution flows require large pump capacities and high horsepower usage. Also drum washer filtrate tanks must be quite large (12-metre dia) to allow for liquor deaeration, due to the large volume of air which is pulled through the vacuum washers. There is also considerable heat loss due to the cooling of the pulp as air is sucked through the pulp mat of the drum washers.

Great Lakes is so pleased with the operation of the Kamyr pressure diffusion washer that it is installing a second unit in its “B” mill. Rated at 1,000 tpd, this second washer came on stream in January and is located on the Kamyr digester blow line ahead of the existing atmospheric diffusion washer.

This installation requires no additional stock pumps, as the digester pressure provides the driving force for moving the pulp through both the pressure diffuser and the existing two-stage atmospheric diffuser. The existing diffuser is running well above the original design rate and may be converted from a two-stage unit, to a single-stage when the new pressure diffuser comes on line.