NipcoFlex and TissueFlex –
Shoe press technology for the dewatering of all paper grades

The important technological and economic advantages have expanded the use of shoe press technology to the dewatering of all paper products from pulp to tissue. Whereas the development of NipcoFlex technology began in packaging paper machines 20 years ago, this technology can today be found in virtually all applications for the mechanical dewatering of the paper web in new and modernized production systems. The portfolio offers an economic solution for increasing productivity and efficiency for any requirement, whether a rebuild or a new machine. The advantages of shoe press technology are now also utilized in calendering in the paper industry.

Application range

Since the introduction of closed shoe presses in the paper industry in 1984, over 400 shoe presses have been put into operation. Of these, Voith has received orders for 280 systems (Fig. 1). The size of these systems is between 2 m to almost 11 m paper width in the press nip. Equally large is the range of the speeds that have been implemented. These extend from 50 m/min in pulp dewatering up to 2,000 m/min on tissue machines.

Graphic paper

The first shoe press for graphic papers was put into operation in 1995. The benefits of shoe press technology have led to the fact that today more than 100 NipcoFlex Presses are used for the production of these grades. In contrast to a conventional press nip, the shoe press offers the possibility of varying the pressure in the press nip. The pressure profiles are individually adapted to the technological requirements of the production process concerned and the pressure shoes are manufactured accordingly. The pressure profile is designed for gentle dewatering for a uniform sheet structure with as high a bulk and dryness as possible. In the NipcoFlex Roll (Fig. 2) the pressure shoe is pressed-on by individual loading elements. The pressure shoe is generally made in two parts. The top and bottom are thermally isolated from each other in order to extensively avoid deformations due to temperature. To achieve the most favorable inlet geometry for the press sleeve, the pressure shoe is shifted towards the ingoing nip. Shortly after the outgoing nip, cool lubricating oil is applied to the inside of the sleeve. A large part of this lubricating oil is removed out of the oil sump that forms ahead of the ingoing nip. The other part of the lubricating oil serves for hydrodynamic lubrication between pressure shoe and press sleeve. If the production speed, linear
load and nip width require it, additional lubrication (Fig. 3) can be applied in the press nip.

**Board and packaging**

As mentioned at the beginning, the use of shoe press technology began with the production of board and packaging grades. Almost all new machines for these grades are equipped with at least one shoe press. Shoe presses are also integrated into the press sections during the modernization of many board and packaging paper machines. The pressure profile and linear load are selected taking into account the technological requirements. These, together with the installation geometry in the framing of the press section, define the shoe press module. In particular for the modernization of machines with a small to medium trim width, the use of press rolls as a backing roll for the NipcoFlex proves useful (Fig. 4). For the press roll as a backing roll, all possi-
ble roll cover variants from rubber to ceramic can be used as for the Nipco P Roll. The press roll is a compact unit that eliminates the bolted connection between roll head and body. A further advantage of the NipcoFlex and press roll in multi-roll presses is the use of CARB Bearing Technology. In this way, efficient shoe press modules can be integrated into compact framing of the press sections. It goes without saying that press rolls can also be used in many graphic paper machines as well as in pulp dewatering.

**Tissue**

One of the latest developments is the use of shoe press technology in the production of tissue. Ten TissueFlex are currently in operation and another system will start production this year.

A characteristic feature of a TissueFlex module is the flexible press sleeve and the loading of this press sleeve over the concave pressure shoe. The advantages of an extended press zone permit gentle dewatering with flat pressure gradients and low max. pressures compared to conventional presses. The pressure profile in the nip can be established by the shoe contour and is particularly characterized by the steep pressure drop in the outgoing nip (Fig. 5). This is not possible with conventional rolls and permits the minimization of rewetting. Particularly in the production of tissue – where maximum specific bulk in addition to high drynesses is required – this is of great significance. The maximum linear loads depend on the loadability of the Yankee dryer and are up to 200 kN/m.

To meet the special requirements of tissue production, the loading unit, the pressure shoe and the flexible QualiFlex press sleeve have been specially further developed for use with tissue. On other functional parts the well proven technology of the NipcoFlex has been taken over from packaging paper and graphic paper applications (Fig. 6). The flexibility of the pressure shoe and the type of pressure shoe loading by individually adjustable front-side and drive-side loading cylinders ensure an even moisture profile.

**Pulp**

Through the economic advantages of shoe press technology and the high drynesses, NipcoFlex Presses are increasingly used for pulp dewatering. This applies both to new machines and to the rebuild of existing installations. Due to the high linear loads required and the, in many cases, large working widths of the pulp dewatering machines, the Nipco P Roll is suitable as a backing roll for the NipcoFlex shoe roll. The Nipco P Roll (Fig. 7) unites the advantages of position-stable support with the features of a
conventional Nipco Roll on which the roll sleeve is hydrostatically supported by hydraulic loading elements. The fact that the Nipco P Roll sleeve is directly supported in the plane of the bearing center distance makes it independent and position-stable with respect to the unavoidable cross shaft deflection. This in turn permits the most uniform linear load distribution in cross direction of the press nip. The loading elements in the NipcoFlex and Nipco P are characterized by equally large pressure areas, which enable the joint supply of hydraulic oil to the rolls with one pressure line.

**Calendering**

Shoe nip technology is now also used for the finishing of board. On the basis of the proven NipcoFlex technology, the NipcoFlex Calender (Fig. 8) has been developed. In contrast to conventional soft calender technology, the NipcoFlex Calender is characterized by the functional separation of the main operating parameters of nip pressure and dwell time in the nip. This allows specific thermoplastic deformation of the paper and board. Here, too, the possibility of varying the pressure profile in the nip is of decisive importance. The first commercial installation went on stream at the beginning of this year. Intensive research and pilot trials are being conducted at the moment in order to evaluate the potential of shoe press technology for further calendering applications.

**Outlook**

Shoe press technology is today state of the art in the dewatering of board and packaging papers as well as graphic papers. This is proven by the success of over 400 shoe presses in operation for these grades. For the newer applications, pulp dewatering and tissue, the trends are clear: in addition to the very important increase in dryness and productivity for the user, technological result can be improved still further with shoe presses, especially for tissue. The latest development, the use of shoe presses in calendering, will certainly still require further trials and also operating experience. However, the significant advantages of shoe press technology have already been confirmed today: the possible variation of the pressure in MD as well as the independence of nip width and linear load.