

## Hydraulics Help Development Of Recycling Machine Technology



Whether stationary or equipped with mobile track systems, modern shredders and recycling machines rely on hydraulic pumps and motors driven by diesel engines as large as large as 1300 kW.



**DR. WOLFGANG FLEISCHFRESSER**  
IS A HYDRAULICS ENGINEER AND  
CONSULTANT, AS WELL AS  
CO-FOUNDER OF HYDRAULIC  
COMPONENT AND SYSTEM  
DEVELOPER/SUPPLIER, HANSA  
TMP SRL, OF MODENA, ITALY.  
WEBSITE: [WWW.PIANETA.IT/HANSATMP](http://WWW.PIANETA.IT/HANSATMP)

**By Dr. Wolfgang  
Fleischfresser**

Stationary and mobile shears, shredders, crushers, complete scrap treatment equipment — less than 20 years ago, no importance was

given to this type of machinery. Today, it is one of the fastest growing markets.

The necessity of protecting the world's environment requires clean and uncontaminated air, soil and water. The increasing difficulties of procurement of raw materials, steel, aluminum, copper and others make recycling and the use of recycled materials more and more attractive. This means that the world is in need of new types of machinery and equipment in order to strip down cars, trucks, refrigerators, production machinery, ships, trains — nearly, every non-organic product needs to be scrapped down, cut, pressed or otherwise treated in order to allow it to be fully or partially recycled or safely stored in garbage stocks.

The development of recycling machinery started with relatively small shears and shredders, easily driven by electric motors. The capacity of the first equipment, therefore, was quite

limited and often not more than a ton/day, especially depending on the type of material. But with the enormous increase in the scope of recycling, bigger and bigger machines became necessary, and with this also came the need for different technology regarding the actuation of crushing hammers, shearing drums and shredding knives. Very soon the first hydraulic drives replaced the electric drives, often being driven by electric motors, as in common hydraulic powerpacks.

The requirements of higher output, higher speed and often 24-hour continuous duty, are reaching the limits of electrohydraulic powerpacks. There are, however, still some manufacturers that believe in electric drives, perhaps because of insufficient knowledge about other possible solutions.

In recycling, to do a good job, it is not necessary to have highly sophisticated components and controls, like,

# hydraulic lines



**The shredding knives in larger recycling shredders are often driven by high-torque load-speed radial piston motors that are splined into planetary gear assemblies that substantially increase the torque performance. A hydraulic manifold is used to assure protection against peak pressures and cavitation, for reversing of the knives in case of necessity and for quick unloading of the system pressure.**

for instance, in plastic molding machinery. The main features that distinguish an efficient machine are high power for high processing capacity. In shredders and crushers this means high torque for the scrapping rollers; strong and reliable construction, material and components; quick and easy maintenance; environmental compatibility with limited energy consumption; and low emissions.

Corresponding to these requirements, modern efficient recycling machinery operates with high-power diesel engines, often running with biodiesel fuel and observing Euro 4 emissions standards. Diesel engines provide an advantage for machines that need a drive power of 100 kW and more, and there is nearly no limit of power for always bigger and bigger plants. Machines with drive power as high as 1300 kW are series manufactured today.

A popular shredding machine on the European market — used for crushing and scrapping of large sheet steel, refrigerators, car parts, etc. — is equipped with a 735 kW diesel engine that drives a tandem variable displacement hydraulic piston pump with load-sensing control. Each stage of the tandem pump is rated 500 L/min and maximum working pressure is set at 250 bar. Between the pump and the hydraulic motors, which drive the crushing knives or shears, a huge manifold assures protection against

peak pressures and cavitation, for reversing of the knives in case of necessity and for quick unloading of the system pressure. A manifold of this capacity can only be manufactured by using logic elements.

The two crushing knives are run each by two high-torque load-speed radial piston motors, which must be of extremely robust construction to withstand these very hard operating conditions. Each hydraulic motor has a displacement of 4300 cc/rev and can develop a torque of 16 000 Nm. The crushing knives can rotate with a maximum speed of 50 to 60 r/min without load and the load-sensing pump continuously adjusts the flow and pressure according to the required torque.

Torque is the main feature that distinguishes such type of machinery, and torque means power. Power means high pressure and this may cause rapid wear of components, bearings, couplings and seals. It is for this reason that only few hydraulic pumps and motors have shown an acceptable lifetime of not less than 6000 working hours (continuous duty, 24 hours per day).

Operators of shredders and crushers used to have limited knowledge about hydraulics and maintenance. Nowadays, by experience they know that good quality hydraulic oil together with efficient filtration is essential for long-life operation of their equipment, so the same care is taken for the

hydraulics as for the diesel engine and other parts.

Besides a standard control board, which is most common on most of these recycling machines, many such machines include a PC-controlled system that supervises all functions and features. This is of great advantage mainly for automatic operation during night hours.

The crushers and shredders can be stationary — which is standard for equipment with more than 500 kW — smaller units can also be mobile, self-propelled by crawler tracks.

Stationary units have the complete power station integrated in a container-like enclosure, offering advantages of noise reduction and easy access for maintenance. The enclosure also contains the fuel and oil tanks, the filtering equipment, as well as necessary oil coolers.

The ambient conditions of a car-scraping operation are quite changed today, compared to some years ago when rust, dirt and oil used to give the general image of a low-quality and low-skills job. Nowadays we see specific machines for the scrapping, crushing and pressing of waste material which, properly treated, is recycled and through this activity, has an economic value. Today's scrapyards are a professional operation that requires high investment while at the same time offering a good return of the invested money. ♦