

## HYDRA 4 HYDROSTATIC TRANSMISSION DESIGN AND DEVELOPMENT

The design philosophy of a rail vehicle fitted with hydrostatic transmission has already been reported. This report details the mechanical design considerations in producing an improved design of transmission for increased mechanical reliability coupled with the inclusion of a hydrostatic braking facility. These modifications have been incorporated in a re-built transmission, two of which have been fitted to the test vehicle "HYDRA" to create a totally hydrostatically driven vehicle.

The modifications also include fitting more powerful prime movers to provide a more rigorous test of the transmission, auxiliary circuits to power friction brakes and cooling fans, a hydraulically operated friction brake, a microprocessor controller for the engine/transmission/brake package and a computer controlled data acquisition system.

The hydrostatic transmission has undergone an extensive development and endurance running program of up to 42,500km. Very few mechanical problems were experienced, these being mainly due to defects in bought-in components. The pressurised reservoir was however underspecified due to the presence of a pressure peak not previously detected, so a suitable replacement was designed.

Endurance running revealed a weakness in the motor design resulting in increased internal leakage. The problems arose too late to allow a major investigation of the cause, but high standards had been maintained to avoid oil contamination and it is thought the cause could be the unusual conditions of use. Had time been available it is probable that an improvement could be made.

An overall transmission efficiency at high speed of 80% was measured, though based on manufacturers engine power data due to the inability to measure engine power. This is slightly lower than predicted, but could be affected by non-optimal component sizing and the motor problems. The pump is the area where greatest efficiency benefits could be achieved.

Motor switching was incorporated to allow higher operating speeds, and operated faultlessly. Hydrostatic braking also operated successfully and very smoothly, and there was no difficulty in complying with braking requirements.

It has been shown that a hydrostatic transmission for a suburban rail vehicle is a technically feasible proposition. From the work described a transmission could be produced, in collaboration with a hydraulic equipment manufacturer, to overcome the particular problems of motor leakage and to improve efficiency.