6.5 OPERATION OF PUMPS IN SERIES AND PARALLEL

Pumps are chosen for particular requirement. The requirements are not constant as per example the pressure required for flow through a piping system. As flow increases, the pressure required increases. In the case of the pump as flow increases, the head decreases. The operating condition will be the meeting point of the two curves representing the variation of head required by the system and the variation of head of the pump. This is shown in Figure 6.5.1.

![Figure 6.5.1 Pump-load characteristics](image)

The operating condition decides about the capacity of the pump or selection of the pump. If in a certain setup, there is a need for increased load, either a completely new pump may be chosen. This may be costlier as well as complete revamping of the setup. An additional pump can be the alternate choice. If the head requirement increases the old pump and the new pump can operate in series. In case more flow is required the old pump and the new pump will operate in parallel. There are also additional advantages in two pump operation. When the load is low one of the pump can operate with a higher efficiency when the load increases then the second pump can be switched on thus improving part load efficiency. The characteristics of parallel operation is depicted in Figure 6.5.2.
Figure 6.5.2 Pumps in parallel

The original requirement was $Q_1$ at $H_1$. Pump 1 could satisfy the same and operating point is at 1. When the flow requirement and the system characteristic is changed such that $Q_2$ is required at head $H_1$, then two pumps of similar characteristics can satisfy the requirement. Providing a flow volume of $Q_2$ as head $H_1$. It is not necessary that similar pumps should be used. Suitable control system for switching on the second pump should be used in such a case. When the head requirement is changed with flow volume being the same, then the pumps should work in series. The characteristics are shown in Figure 6.5.3.

Figure 6.5.3 Pumps in series
The flow requirement is $Q$. Originally head requirement was $H_1$ met by the first pump alone. The new requirement is flow rate $Q$ and head $H_2$. This can be met by adding in series the pump 2, which meets this requirement. It is also possible to meet changes in both head and flow requirements by the use of two pumps. Suitable control system should be installed for such purposes.