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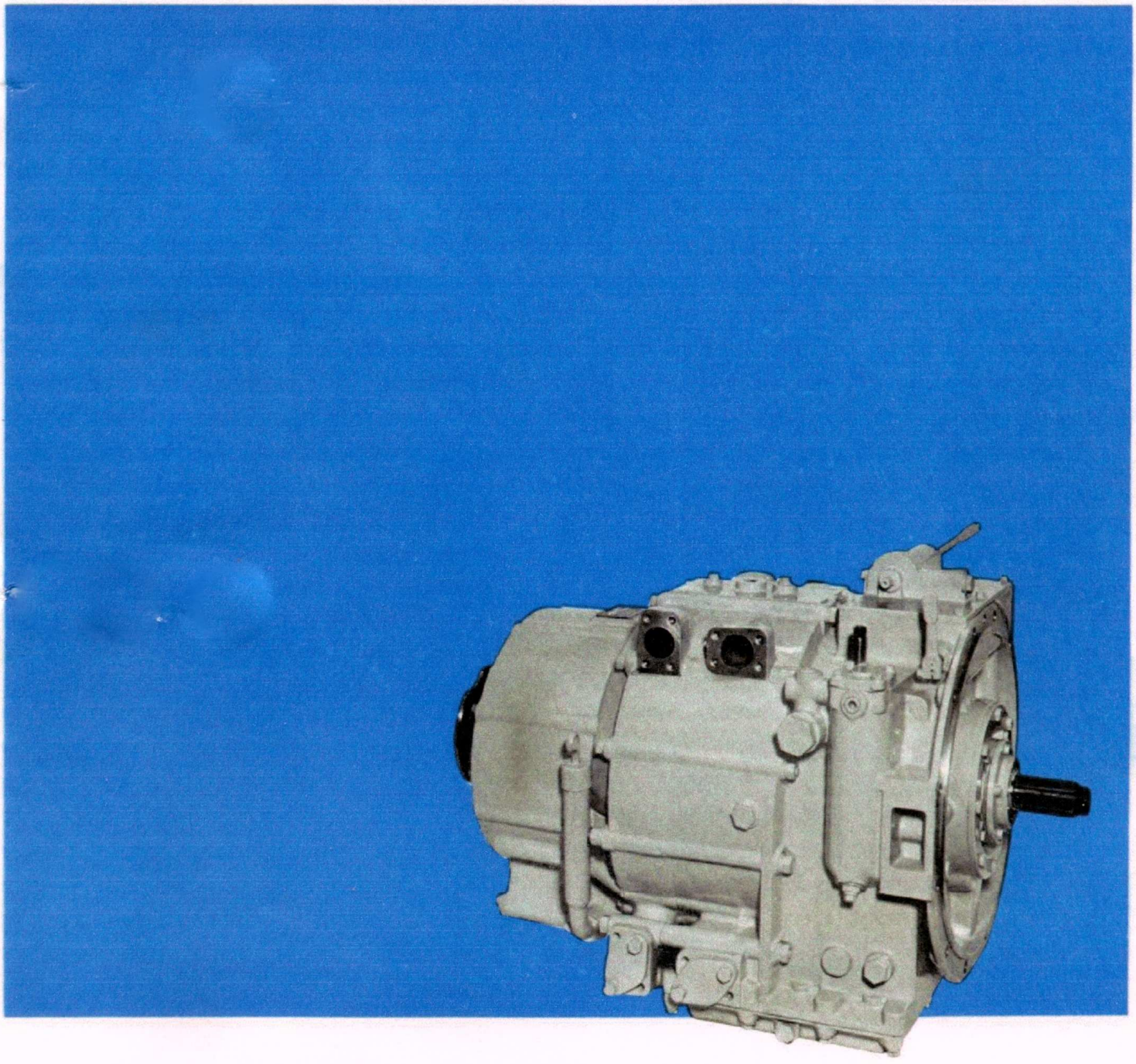
# Voith DIWAbus 145 U 2 Transmission

**A fully automatic hydraulic transmission**



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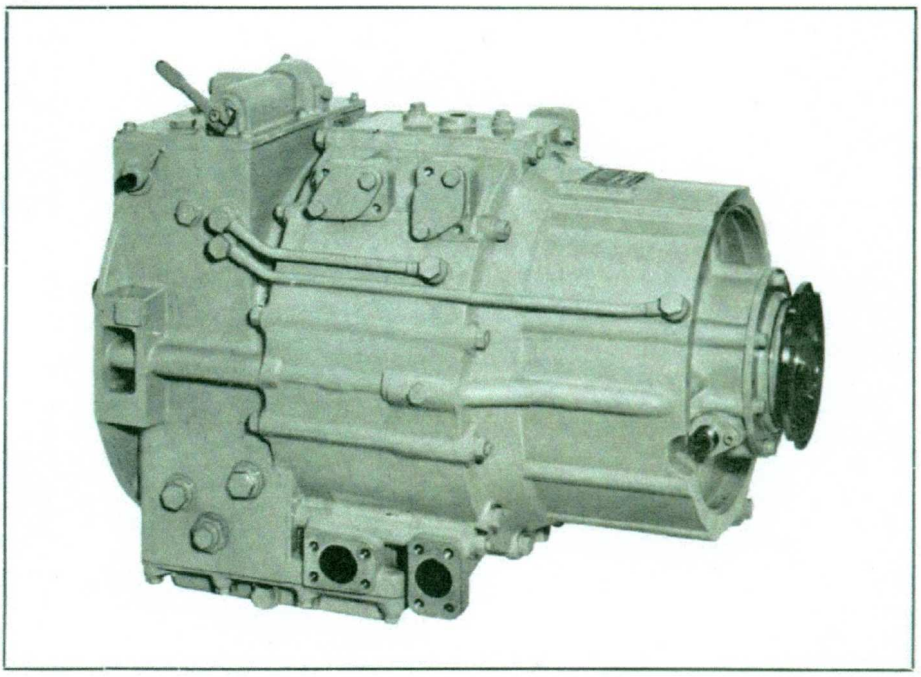
# Voith DIWAbus Differential Converter Transmission Type 145 U 2

A fully automatic hydraulic transmission suitable for
Road Vehicles
Rail Vehicles
Haulage Vehicles
Earth Moving Equipment
Special Vehicles

The Voith DIWAbus Transmission Type 145 U 2 is intended to work in combination with high speed Diesel engines of 50 to 145 HP. This transmission which has equal reduction ratios in forward and reverse gear has been developed and improved as a result of the practical experience gained with over 5000 DIWAbus transmissions supplied by us from 1952 to 1963 for city buses, rail cars, shunting and mine locomotives, fork-lift trucks, shovel loaders, graders and other machines. Voith DIWAbus Transmissions are dependable and economical in operation. Simplicity of control and ease of maintenance are characteristic of this type of transmission.

## Advantages of the Voith DIWAbus Differential Converter Transmission

High unit work capacity
Less operator fatigue
Increased overall operating efficiency
Longer life of engine and drive
No clutch operation, no gear shifting
Simple automatic control which can be overridden by the driver
Two-pedal control:
accelerator and brake
Smooth, fast pick-up from standstill even on steep hills
Stopping without clutch operation and gear changing
High average running speeds even on short runs
Stepless automatic adjustment to load without interruption of tractive effort
No stalling of engine



## Principle of the Voith DIWAbus Differential Converter Transmission

The Voith DIWAbus Transmission 145 U 2 is a fully automatic hydro-mechanical power transmission in which a hydraulic torque converter is used in conjunction with a differential distributing gear and an epicyclic final drive.

At low-speeds, engine power is divided between a hydraulic channel and a mechanical channel. The arrangement is such that the proportion of power transmitted hydraulically decreases as the vehicle speed increases. With this split drive, the efficiency of the torque converter is substantially boosted. Its inherent advantages such as high tractive effort, rapid stepless acceleration and automatic adjustment to load are exploited to the full.

At high speeds, the input power is transmitted entirely mechanically and thus advantage is taken of the high efficiency of the mechanical transmission.

Diagram 1 shows the internal arrangement of the transmission. The engine drives pinion shaft "a" of distribution gear "B" via the flexible slip clutch "A". During starting the intermediate shaft "b" is at standstill, the planet gear carrier of the distribution gear "B" and the pump impeller "P" are driven at approximately double the engine speed.

Under these conditions the engine speed, in spite of the throttle being wide open, is lugged down to about 65 % of the rated speed and the engine is thus operating in the range

of maximum torque and minimum specific fuel consumption. This engine torque is multiplied hydraulically in the converter "C" and provides high acceleration at starting.

As the vehicle speed increases the speed of shaft "b" and the sun wheel also increases. Thus the gear ratio for the drive of impeller "P" is reduced and also the proportion of power which is transmitted hydraulically via turbine wheel "T" and freewheel "I" of the intermediate shaft "b". Simultaneously the proportion of power transmitted mechanically via the sun wheel of distribution gear "B" increases and is transmitted directly to the intermediate shaft "b". This is the "Hydro-mechanical drive". (Diagram 2 and 4)

At approximately nominal engine speed the band brake "h" of distribution gear "B" is automatically applied and converter "C" brought to a standstill. At the same time freewheel "I" separates turbine wheel "T" from the intermediate shaft "b". This is the "Change Over" to the "Mechanical drive" (Diagram 3 and 5).

This change over to the mechanical drive is effected by a single hydraulic control piston.

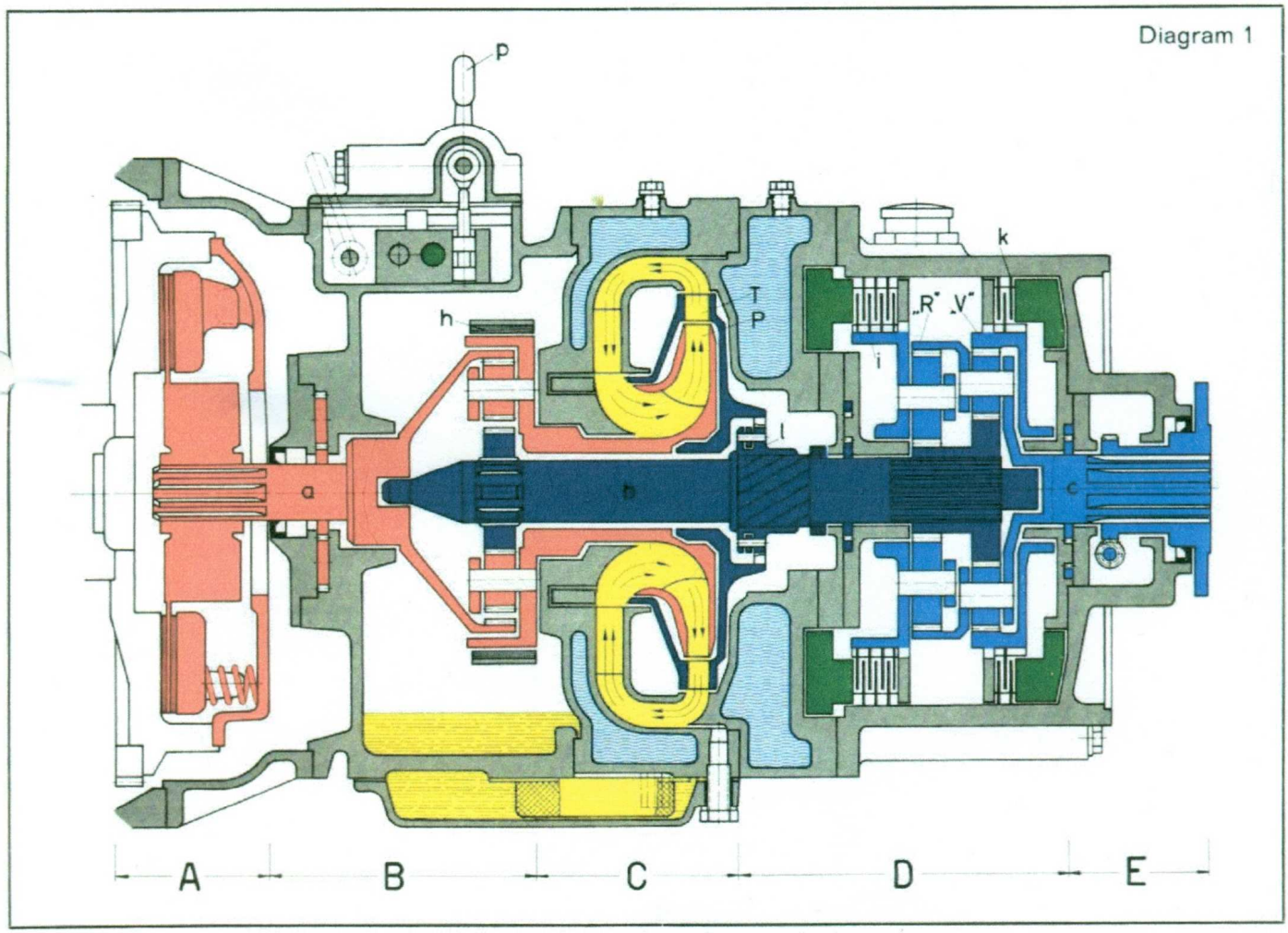
Located behind the differential converter is the epicyclic gear box "D". The planetary gear sets for forward gear "V" and reverse gear "R" are controlled by oil pressure actuated disc clutches "i" and "k" which transmit the engine power to output shaft "c". If both disc clutches are released then the drive is disconnected.

The controls necessary for changing directions are arranged within the transmission and can be actuated mechanically by the control lever "p", pneumatically or electrically. The automatic "change over" with increasing or decreasing speed can be influenced by the driverby means of the accelerator pedal or the engine throttle control so that it takes place at a higher or lower vehicle speed.

By pressing the accelerator pedal down beyond the full throttle position, the "Kick-down" position, the hydro-mechanical drive with its inherent higher tractive effort can be either retained or, if a change over has already taken place, re-introduced. If for operational reasons a change-over into the mechanical drive is not desirable, a lock can be fitted.

When in »mechanical drive", engine braking, with or without exhaust braking, is possible in the usual way down to 30 – 35 % of the maximum vehicle speed.

Diagram 1



If part of the engine power is required for an auxiliary drive, such as lifting pumps on fork lift trucks or the blade control of a bulldozer, and the rest for driving the vehicle, then the power consumption of the hydraulic converter can be reduced by an additional control unit.

If desired a standard single or two range gearbox can be mounted directly on to the output side of the DIWAbus 145 U 2 transmission.

The forward and reverse gear ratios are the same which makes the transmission ideal for bi-directional vehicles.

The DIWAbus 145 U 2 transmission can be connected directly to water-cooled or air-cooled engines, or may be mounted separately in the vehicle frame. With water-cooled engines, the DIWAbus Transmission is cooled by interposing the cooling jacket of the converter in the cooling-water circuit between cooler and engine. In general there is no need to increase the capacity of the engine cooler. In the case of air-cooled engines, the oil in the converter is cooled by a separate oil cooler.

Only engine oil grades with a viscosity complying with SAE 10 and approved by us should be used for the DIWAbus Converter.

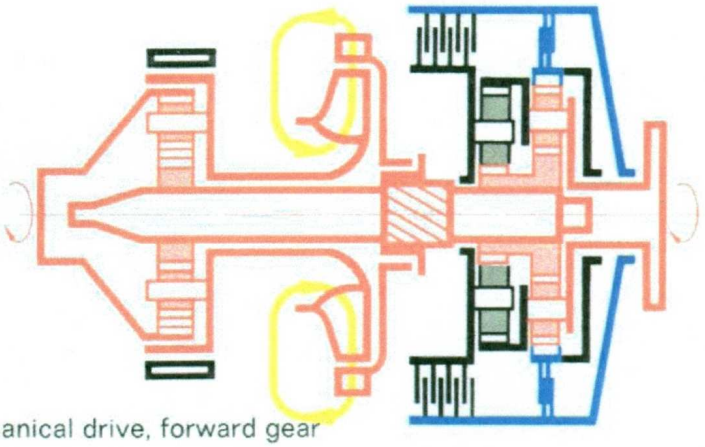


Diagram 2
Hydro-mechanical drive, forward gear

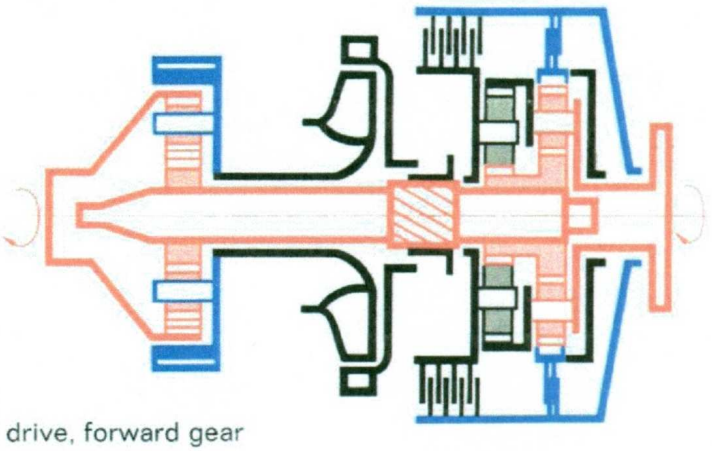


Diagram 3
Mechanical drive, forward gear

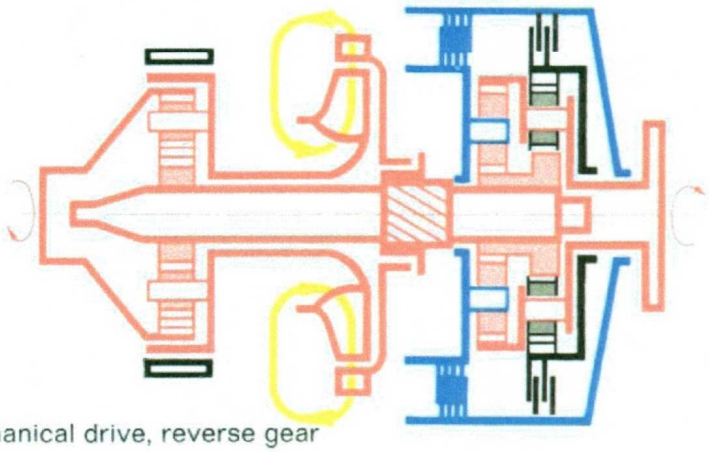


Diagram 4
Hydro-mechanical drive, reverse gear

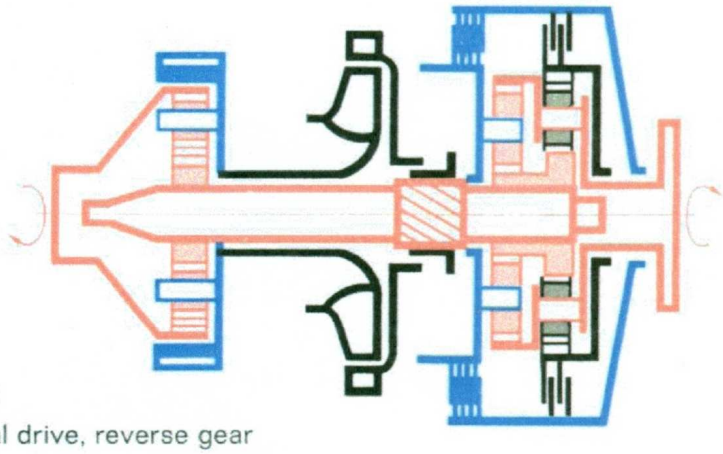
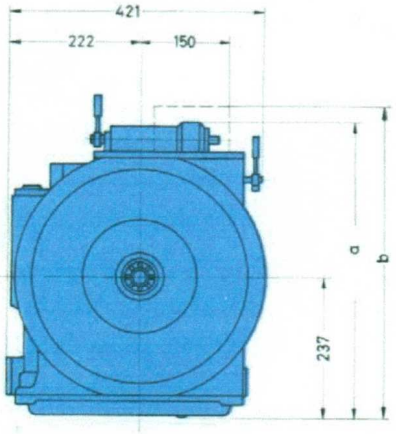


Diagram 5
Mechanical drive, reverse gear

Power transmitting rotating parts

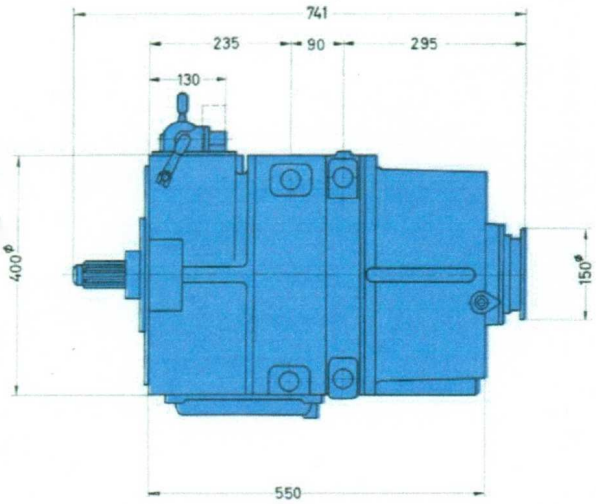
Power transmitting stationary parts

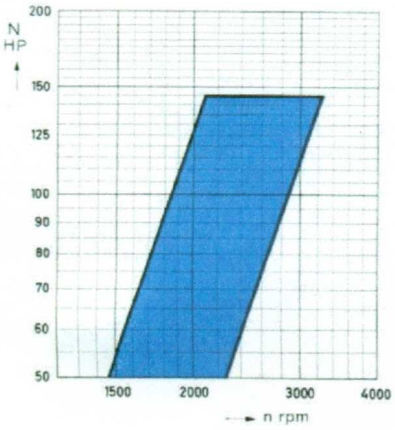
Parts not transmitting power



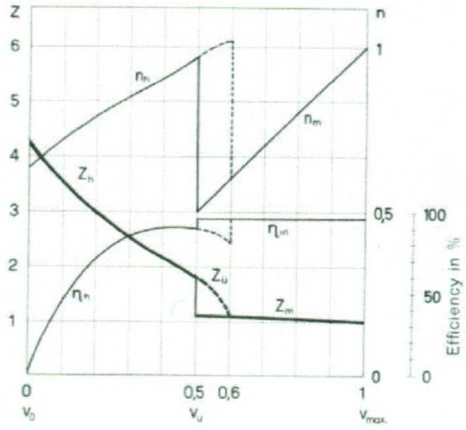

a = for mechanical and pneumatic control 500 mm

b = for solenoid control 520 mm




Power range diagram




Performance diagram

## Dimensions and technical data of Voith DIWAbus Transmission 145 U 2

| | |
|---|---|
| Maximum input power: | 145 HP |
| Maximum input torque: | 360 lb ft. |

Ratios:

a) hydraulic ratio at start (maximum output torque/ engine torque at nominal speed) for forward and reverse: 5.8

b) mechanical ratio: (engine speed / output speed) for forward and reverse: 1.47

| | |
|---|---|
| Weight: | 383 lb |
| Oil capacity: | 2.5 gall. |
| Cooling water jacket capacity: | 1.5 gall. |

An adapter ring is required for mounting the DIWAbus transmission to the engine. Its width is approximately 120 mm but this depends on the engine type.

Z tractive effort as multiple of $Z_m$ at $v_{max}$

$Z_ü$ tractive effort of hydro-mechanical drive with accelerator pedal in "kick-down" position

v vehicle speed in percent of $v_{max}$

$v_u$ changeover speed with accelerator pedal in "full-throttle" position

n engine speed

$\eta$ efficiency

The suffixes denote

h hydro-mechanical drive

m mechanical drive

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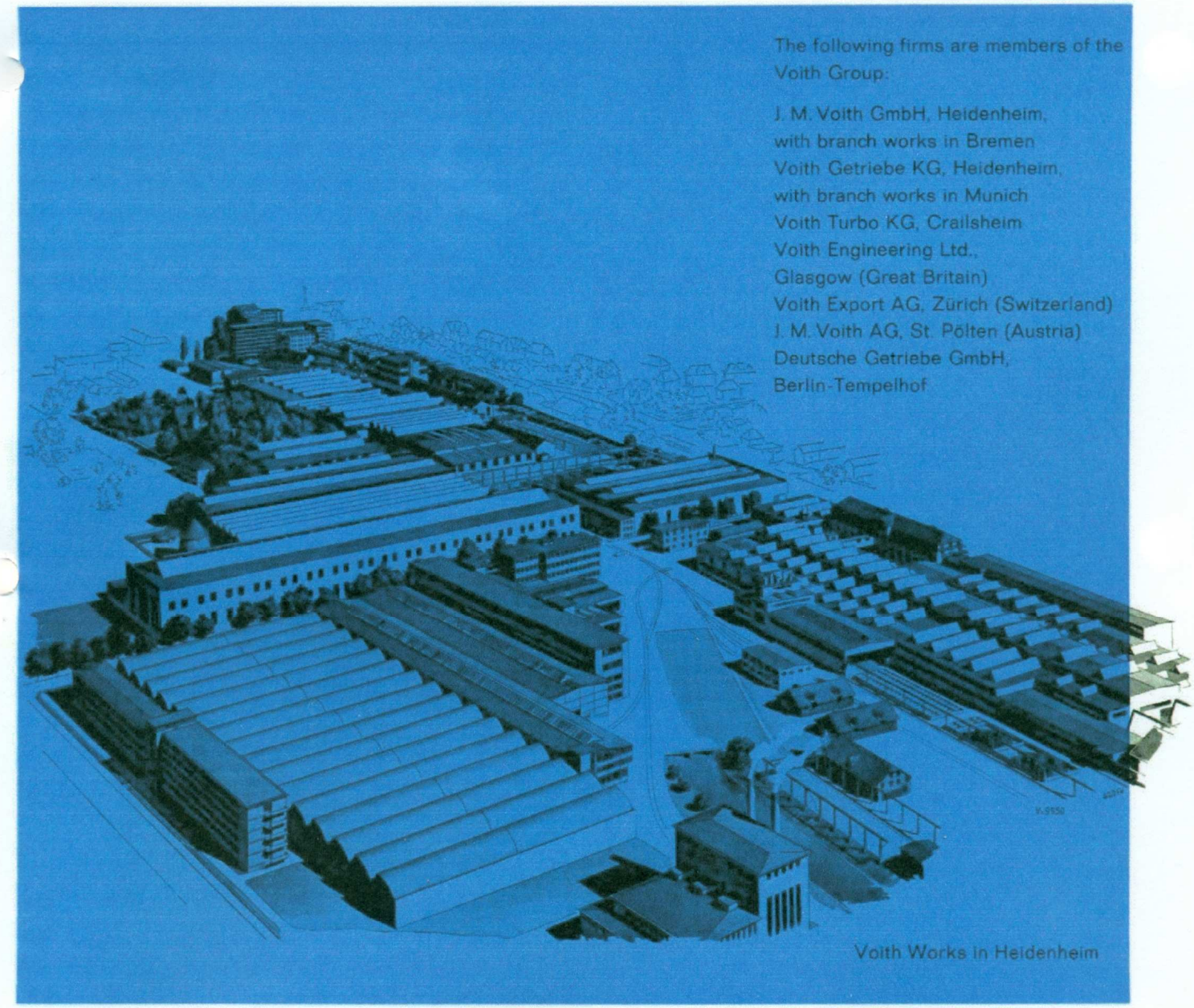

Voith Works in Heidenheim