

Practical formulae, graphs and conversion tables

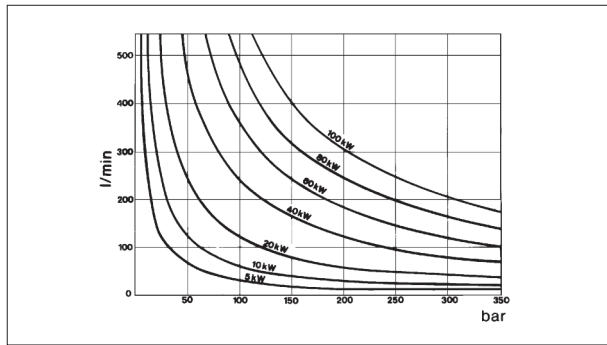
1 UNIT OF MEASUREMENT CONVERSION TABLE

QUANTITY	S.I. UNIT	SYMBOL	OTHER UNITS	SYMBOL	EQUIVALENCE
MASS	kilogram	[kg]	Pound	[lb]	1 [lb] = 0,4536 [kg]
			Ounce	[oz]	1 [oz] = 0,02335 [kg]
LENGTH	millimeter [10 ⁻³ m]	[mm]	Inch	[in] or ["]	1 [in] = 25,40 [mm]
			Foot	[foot]	1 [foot] = 304,8 [mm]
AREA	square centimeter [10 ⁻⁴ m ²]	[cm ²]	Square inch	[sq in]	1 [sq in] = 6,4516 [cm ²]
			Square foot	[sq ft]	1 [sq ft] = 929,034 [cm ²]
CAPACITY	cubic centimeter [10 ⁻⁶ m ³]	[cm ³]	Liter	[l]	1 [l] = 1000 [cm ³]
			Cubic inch	[cu in]	1 [cu in] = 16,3870 [cm ³]
			Cubic foot	[cu ft]	1 [cu ft] = 28317 [cm ³]
			UK gallon	[Imp gal]	1 [Imp gal] = 4546 [cm ³]
			US gallon	[US gal]	1 [US gal] = 3785 [cm ³]
FLOW RATE	liter per minute	[l/min]	Cubic foot per minute	[cu ft/min]	1 [cu ft/min] = 28,32 [l/min]
			Gallon (UK) per minute	[Imp gal/min]	1 [Imp gal/min] = 4,5456 [l/min]
			Gallon (US) per minute	[US gal/min]	[US gal/min] = 3,7848 [l/min]
FORCE	Newton [kgm/s ²]	[N]	Kilogram force	[kg _f]	1 [kg _f] = 9,806 [N]
			Pound force	[lb _f]	1 [lb _f] = 4,448 [N]
PRESSURE	bar [10 ⁵ N/m ²]	[bar]	Pascal [1 N/m ²]	[Pa]	1 [Pa] = 10 ⁻⁵ [bar]
			Atmosphere	[atm]	1 [atm] = 1,0132 [bar]
			Kilogram force/cm ²	[kg _f /cm ²]	1 [kg _f /cm ²] = 0,9806 [bar]
			Pound force/in ²	[lb _f /in ²] or [psi]	1 [psi] = 6,8948•10 ⁻² [bar]
ANGULAR SPEED	revolution per minute	[rpm]	Radian per second	[rad/sec]	1 [rpm] = 9,55 [rad/sec]
POWER	kilowatt [1000 Nm/s]	[kW]	Kilogram per meter second	[kg _f •m/s]	1 [kg _f •m/s] = 9,803•10 ⁻³ [kW]
			Metric horse power	[CV]	1 [CV] = 0,7355 [kW]
			Horse power	[HP]	1 [HP] = 0,7457 [kW]
KINEMATIC VISCOSITY	centistoke [10 ⁻⁶ m ² /s]	[Cst]	Square meter per second	[m ² /s]	1 [m ² /s] = 10 ⁶ [cSt]
			Engler degree	[°E]	1 [°E] = 7,598 [cSt]
TEMPERATURE	Celsius degree	[°C]	Kelvin degree	[K]	1 [K] = 1 [°C] + 273,15
			Fahrenheit	[°F]	1 [°F] = 1,8 [°C] + 32
MOMENTUM (TORQUE)	Newton per meter	[Nm]	Kilogram f per meter	[Kg f m]	1 [Kg f m] = 0,102 Nm
			Pound force per inch	[lbf in]	1 [lbf in] = 0,113 Nm

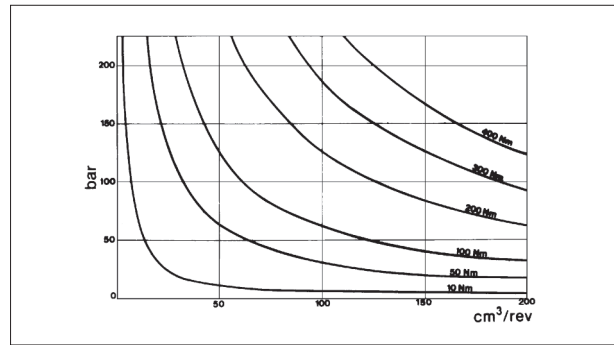
* See diagrams of section **4**

2 PRACTICAL FORMULAE AND DIAGRAMS FOR PUMPS AND MOTORS

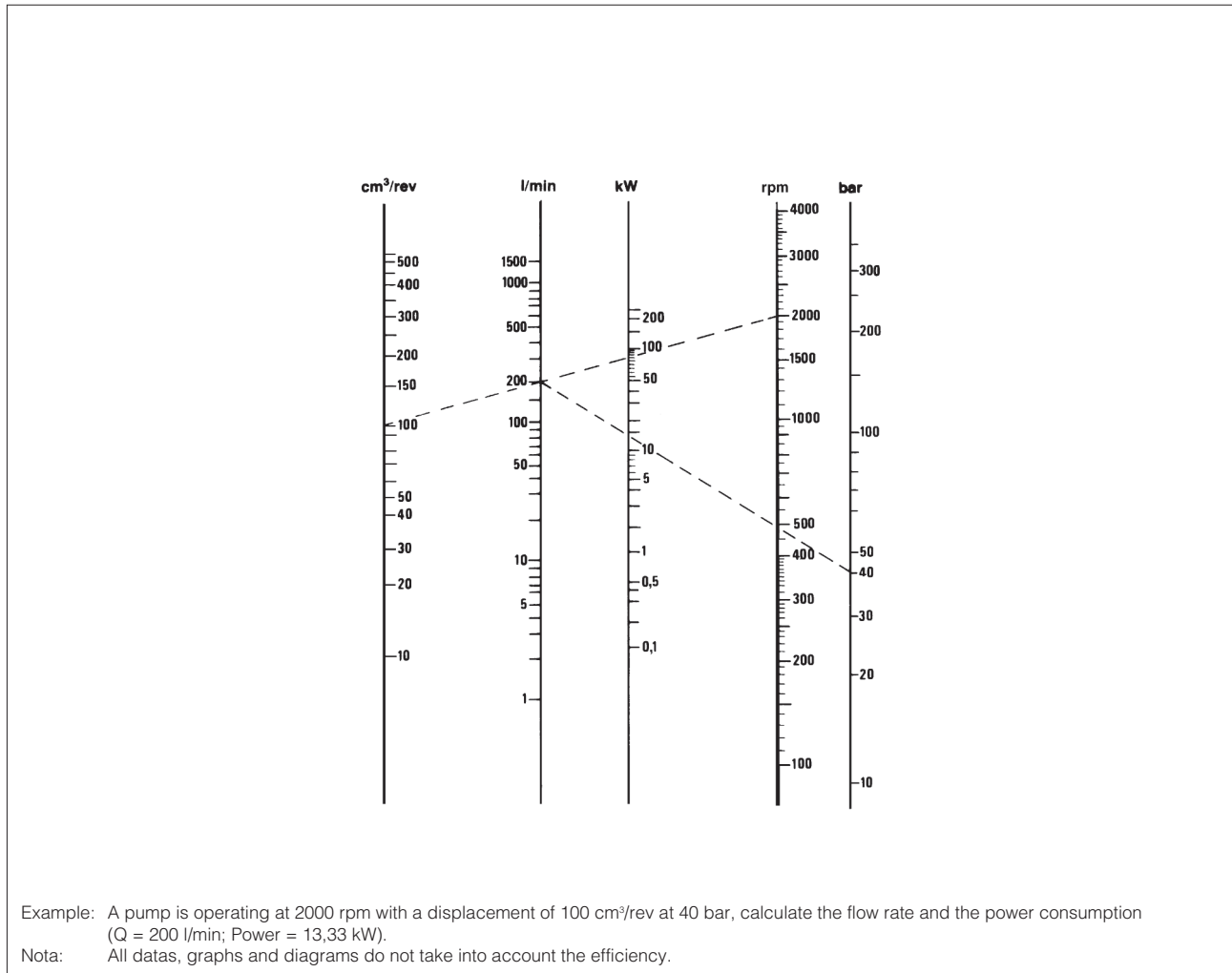
2.1 Power



2.2 Torque



2.3 Graphs used in calculations with pumps



2.4 Main formulae

Pumps:

– power consumption [kW]: $\frac{Q P}{612 \eta}$

– required shaft torque [Nm]: $\frac{v P}{20 \pi \eta} \cong \frac{v P}{62,8 \eta}$

Motors:

– power delivered [kW]: $\frac{Q P}{612} \eta$

– shaft torque produced [Nm]: $\frac{v P \eta}{20 \pi} \cong \frac{v P \eta}{62,8}$

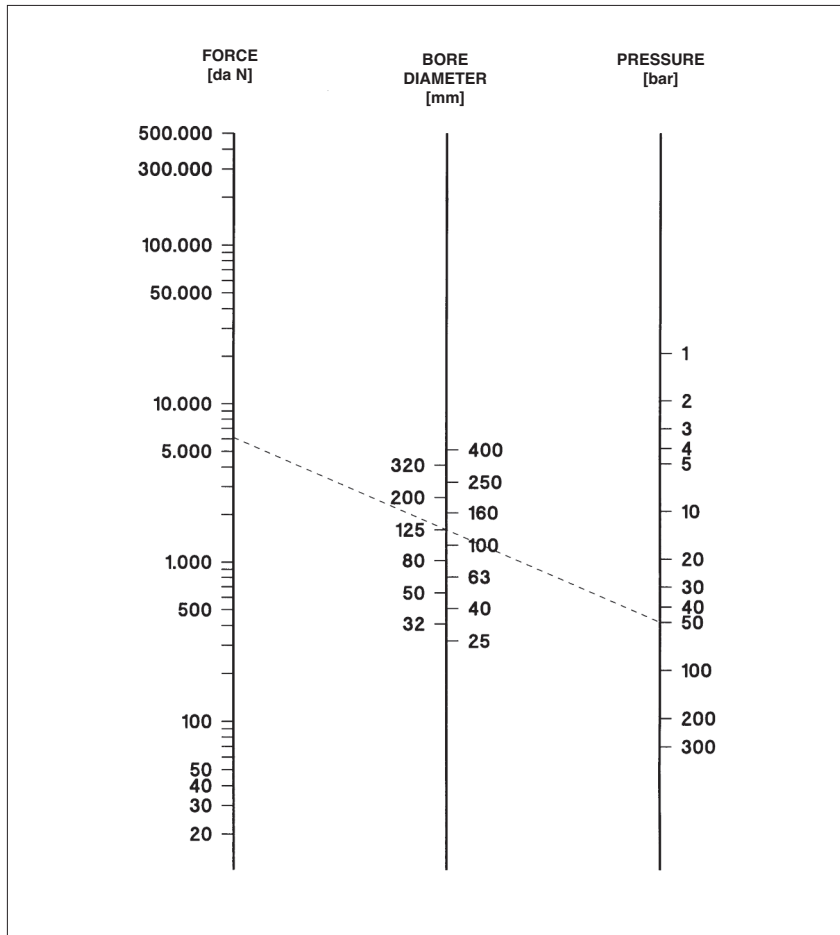
– power supplied [kW]: $\frac{n [Nm]}{9545}$

LEGENDA:

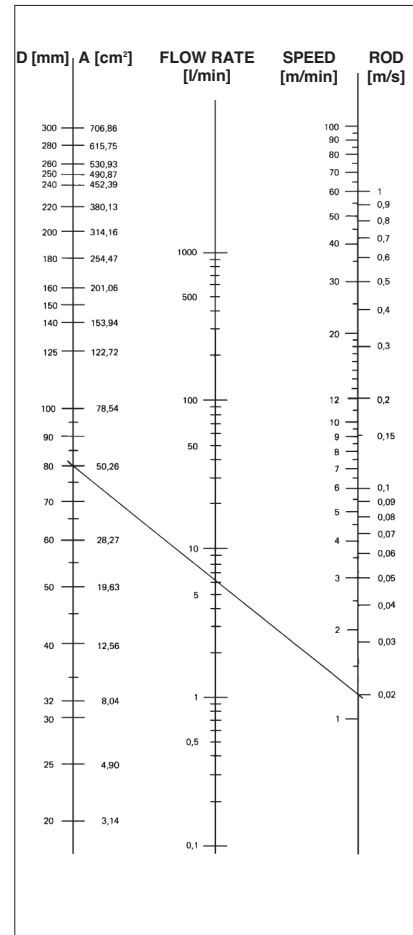
Quantity	Unit	Symbols	Quantity	Unit	Symbols
Displacement	cm³	V	Flow rate	l/min	Q
Angular speed	rpm	n	Efficiency	-	η
Pressure	bar	P			

3 CYLINDER'S NOMOGRAPHS

3.1 CYLINDER FORCE

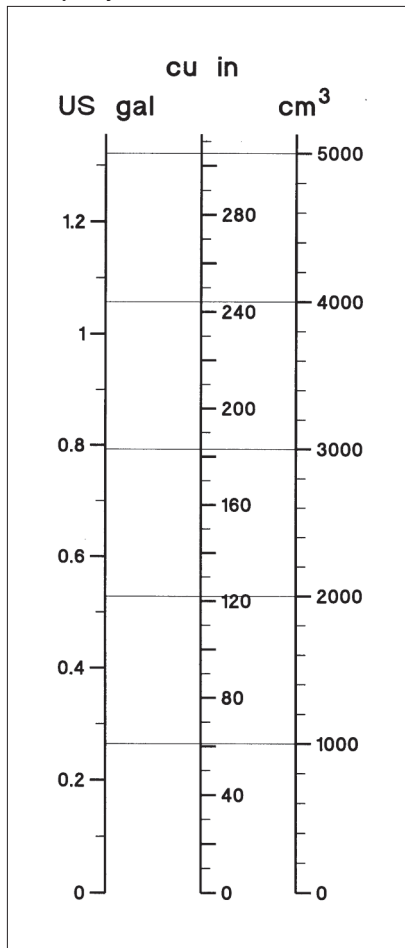


3.2 CYLINDER SPEED

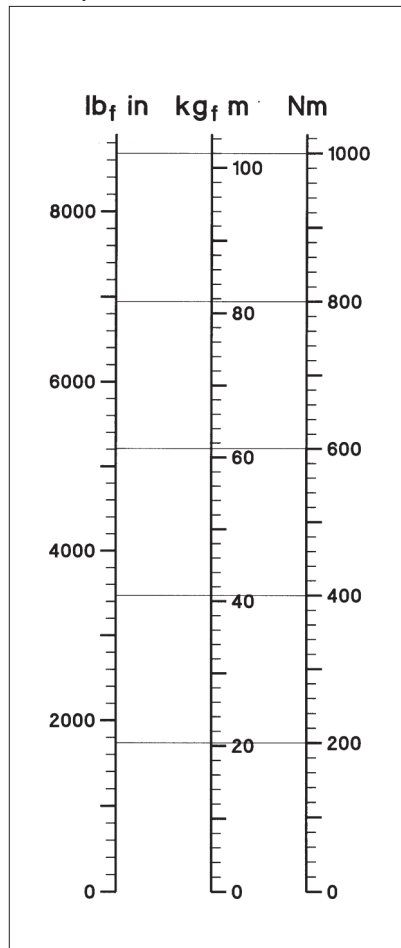


4 CONVERSION DIAGRAMS

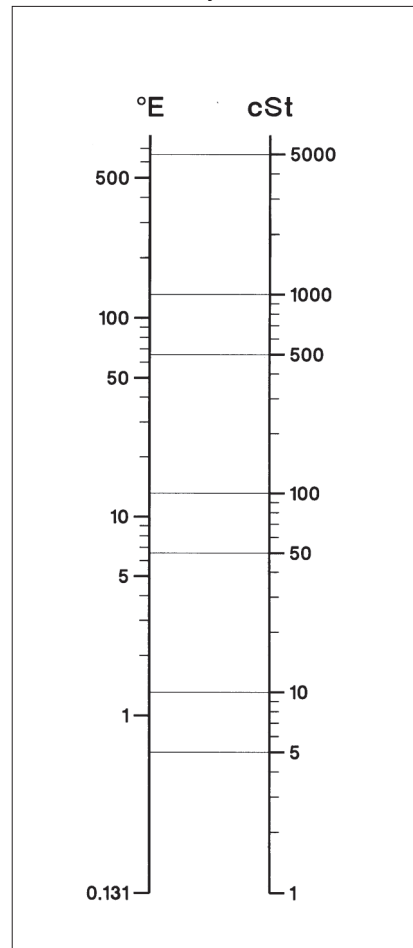
4.1 Capacity



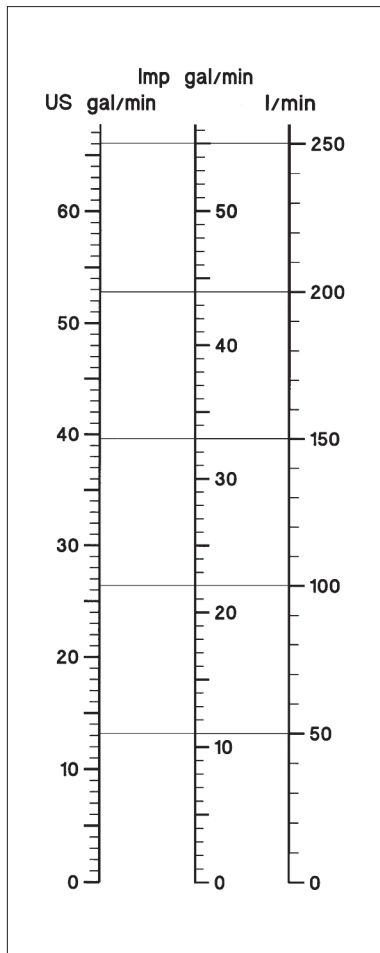
4.2 Torque



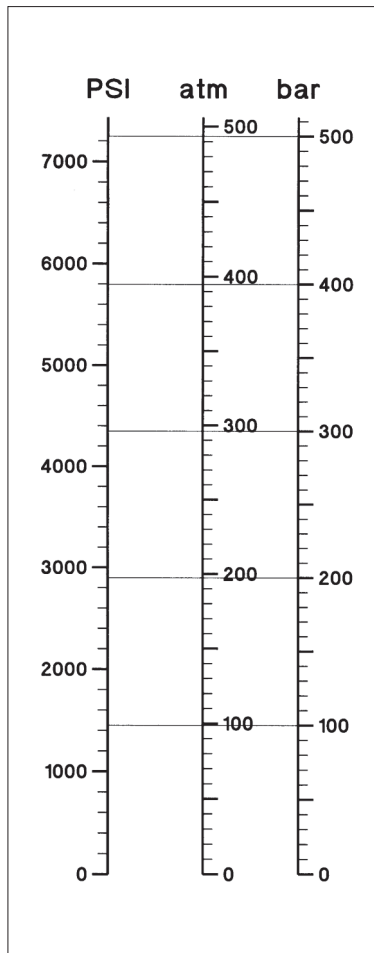
4.3 Kinematic viscosity



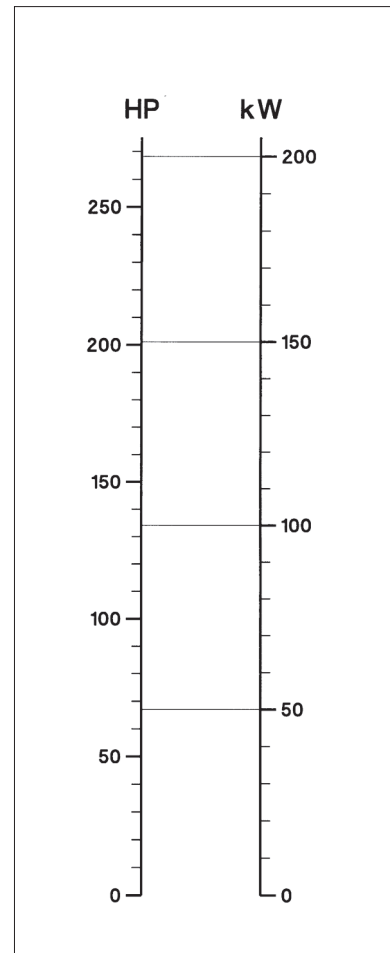
4.4 Flow rate



4.5 Pressure



4.6 Power



5 CHARACTERISTIC CURVES FOR CALIBRATED ORIFICES' SELECTION

