1 General

Friction contact clutches and brakes are able to synchronize two machine components rotating with different speed, taking on the engagement work in this case. If, for safety reasons, no-volt operated brakes or clutches are required, spring-operated multi-disc brakes and clutches can be used, which are suited for oil and dry operation.

Positioning tasks in combined action with ball screws are carried out by backlash-free spring-operated holding brakes, which are, in dry operation, used as precision brakes.

The leaflet on hand represents a supplement to the dimension specification tables of the various clutch types contained in the file. Apart from the explanations regarding the characteristic data listed in these dimension specification tables, the design engineer can find any information significant for the application of the clutches and brakes.

2 Determination of the clutch size

According to the requirements, the suitable clutch type is chosen and the clutch size best meeting the conditions (outside dimensions, shaft diameter) is selected. If they are required to be to a large extent maintenance-free, or in the case of adverse operating conditions, the clutch must have sufficient reserves as regards the required technical data. Over dimensioned drives of heavy machines call for an equally ample clutch dimensioning. Special operating conditions, such as operation in the open, high ambient temperatures, have to be taken into account as well when choosing a suitable version. When selecting clutches for lifts, hoisting appliances or mining equipment, the appropriate safety regulations have to be observed. The so selected clutch has to be arithmetically verified with regard to the data listed in the table of characteristic data, such as torques, permissible max. values for friction work and heat absorptivity. The calculation is carried out by means of the blue-edged formulas given in the following chapters.

3 Meaning of the symbols

A	[m^2]	area
b	[m]	width
c	[J/(g°C)]	specific heat
D	[m]	diameter
E	[J]	friction work
E_{zul}	[J]	max. permissible friction work per engagement
F	[N]	force
h	[m]	thread pitch
I	[kgm^2]	mass moment of inertia
I_{red}	[kgm^2]	reduced mass moment of inertia
i	[Amp]	current rating
k	[−]	number of friction faces
m	[kg]	mass
M	[Nm]	torque
M_0	[Nm]	idling torque
M_1	[Nm]	dynamic torque
M_2	[Nm]	locked torque
M_3	[Nm]	load torque during operation
M_4	[Nm]	load torque during start
M_5	[Nm]	starting torque (engine torque)
n	[1/min]	speed
n_{rel}	[1/min]	relative speed between the two clutch halves
P	[W]	heat absorptivity
P_{zul}	[W]	max. permissible heat absorptivity
P_k	[W]	cooling capacity
P_a	[W]	drive power
q	[dm^3/min]	cooling oil volume
r	[m]	radius (friction radius)
R	[Ohm]	electrical resistance
s	[mm]	thickness of oil film between the friction faces
S	[−]	safety factor
t	[s]	time
t_1	[s]	response time
t_2	[s]	torque − time constant
t_3	[s]	disengagement time
t_4	[s]	acceleration (slowing-down) time
T	[°C]	temperature
U	[Volt]	voltage
U_1	[Volt]	operating voltage − coil voltage
U_2	[Volt]	mains voltage
v	[m/s]	velocity (relative velocity)
V	[dm^3]	volume (oil tank)
z	[1/hour]	operating frequency
μ	[−]	friction factor
γ	[m^2/s]	viscosity-density ratio
ρ	[kg/dm^3]	density
τ	[s]	operation interval
τ_{zul}	[s]	shortest permissible operation interval
τ	[Nm^2]	shearing stress in the oil film
φ	[rad]	angle of rotation
ω	[rad/s]	angular speed