Airflex® Selection Procedure

EATON

for AR, AS, and CH Elements

General

Technical Section Y of the catalog contains useful information pertaining to the selection, mounting, alignment and control of clutches and brakes in general. Formulas, symbols and units are also identified. it is recommended that Section Y be reviewed before attempting to size a specific product for an application.

Element Torque Adjustment

AR and AS elements are designed for use within a transmission box and are furnished with disc friction packs suitable for wet operation. Recommended coolant is Type F automatic transmission fluid (ATF). Their torque ratings $\mathbf{M_r}$ are based upon an actuating pressure $\mathbf{p_r}$ of 150 psi (10,3 bar).

CH elements can be furnished with disc packs for either wet or dry operation. Dry disc pack element ratings are based upon an actuating pressure $\mathbf{p_r}$ of 90 psi (6,2 bar). Wet disc pack element ratings are based upon an actuating pressure $\mathbf{p_r}$ of 150 psi (10,3 bar). Recommended coolant oil to be type C3 approved or SAE10W to SAE50 oil suitable for CC or SE service or EP oils within SAE10W to SAE50 viscosity range with no free chlorine or free sulphur.

AR, AS and CH torque ratings must be adjusted for operating pressure $\mathbf{p_o}$ and parasitic loss $\mathbf{p_p}$. Maximum allowable operating pressure should not exceed the values listed in the following table.

Maximum Allowable Pressure

Type	Wet Operation		Dry Operation	
	English psi	SI bar	English psi	SI bar
AR	200	13,8	N/A	N/A
AS	150	10,3	N/A	N/A
CH	200	13,8	120	8,3

The elements have an inherent parasitic pressure $\mathbf{p_p}$ which represents the pressure to overcome internal friction and disc pack release springs. Parasitic pressures are given in the following table and must be deducted from the rated pressure and operating pressure.

Parasitic Pressure p_p

Type	English	SI
	psi	bar
AR	10	0,7
AS	10	0,7
CH	30	2,0

Adjusted element torque $\mathbf{M_e}$ is then calculated from:

$$M_e = \frac{p_o - p_p}{p_r - p_p} \cdot M_r$$

The adjusted element torque $\mathbf{M_e}$ must then be equal to or greater than the required clutch torque $\mathbf{M_c}$.

Operating Speed

Consideration must be given to the maximum disengaged speed for AR and CH elements. If the speeds given on the catalog data page are exceeded, centrifugal force will maintain a fluid head in the actuating cylinder, causing the disc pack to remain engaged.

The AS actuating cylinder does not rotate and does not subject the actuating fluid to centrifugal force. The maximum speeds shown for the AS elements are based upon bearing limitations.

AS bearing life is determined by actuating pressure and operating speed. At 150 psi (10,3 bar) and 1000 rpm, the B-10 bearing life will average in excess of 3000 hours.

Example

Determine the torque of an AS600 element operating at 8 bar.

$$M_e = \frac{p_o - p_p}{p_r - p_p} \cdot M_r$$

$$= \frac{8 - 0,7}{10,3 - 0,7} \cdot 807$$

$$= 614 \text{ N·m}$$

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Thermal capacity

Clutch thermal capacity is greatly influenced by the method used to cool the disc pack. Coolant can be sprayed or splashed on the outside of the disc pack, or it can be forced out through the disc pack by means of an internal shaft passage and cross drilling in the hub. The preferred method is forced cooling. However, the most commonly used methods are sprayed or splashed.

Clutches can also be operated partially submerged in oil. However, care must be taken to ensure that the fluid level and speed of rotation do not combine to generate excessive heat through churning of the fluid.

Types A and AA

The thermal capacities charts are based upon the use of a Type F-ATF coolant under spray or splash conditions. The capacities are conservative and will produce a safe temperature rise. Operating above these values will result in high temperatures and increased wear.

Type

Thermal capacities P_r for CH elements for wet and dry service are given on their respective data sheets.

Wet thermal capacities are based upon a coolant sump temperature of 100°F (38°C) and a maximum outlet coolant temperature of 200°F (93°C).

Capacities at other sump temperature can be calculated from:

$$P = P_r \cdot \left[\frac{200 - T_s(°F)}{100}\right] (HP)$$

or

$$P = P_r \cdot \left[\frac{93 - T_s(°C)}{55}\right] (kW)$$

With the element engaged, coolant pressure at the inlet should fall within the range of 20 psi (1,4 bar) minimum and 40 psi (2,8 bar) maximum. Coolant should be a type C3 approved oil or SAE10W to SAE50 oil suitable for CC or SE service.

Air cooled thermal capacities are based upon an ambient air temperature of 100°F (38°C). Capacities at other ambient temperatures can be calculated from the formula given above for wet thermal capacities.

Air cooled thermal capacities are also a function of operating speed. Values are given for various peripheral velocities at the friction disc outside diameter.

Disc diameter in inches can be calculated by dividing the element size by 100. For instance, the CH1050 had a friction disc diameter of 1050/100 = 10.50 inches.

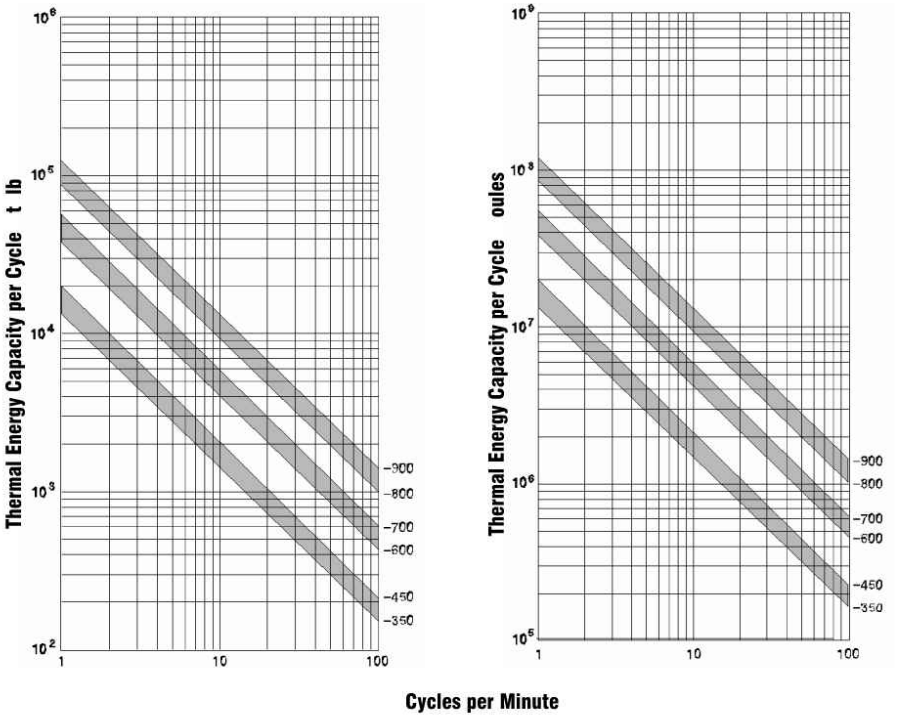
Response Time for A and AA Elements

The time required for the AR and AS element to develop rated torque can be calculated knowing the flow rate of the actuating fluid.

$$T = 0.1 \cdot \frac{\text{rated flow}}{\text{actual flow}}$$

Rated flow rates are obtained from the element data tables.

AR and AS Thermal Capacities



Example

Determine the PM required to actuate an AR800 element in 0.15 seconds.

$$T = 0.1 \cdot \frac{\text{rated flow}}{\text{actual flow}}$$

$$\text{actual flow} = 0.1 \cdot \frac{\text{rated flow}}{t}$$

$$= 0.1 \cdot \frac{15.7}{0.15}$$

$$= 10.5 \text{ PM}$$