A SHORT COURSE IN INDEXING: TRICKS OF THE TRADE

TYPICAL INDEXING ACTUATOR APPLICATIONS

Equal spacing of random items (star wheel)
Drive chain or toothed belt conveyor
Orient parts on conveyor
Rotate carousel work table
Position parts for coating, deposition or etch
Index parts for spot welding
Operate multi-position valve or switch
Position spray nozzle or part

SHOCK LOADS

DO NOT OPERATE THE INDEXER WITH AN INERTIAL LOAD WITHOUT SPEED (FLOW) CONTROL. ARRANGE CONTROL LOGIC TO SHUT DOWN IN THE LOCKED POSITION TO AVOID UNCONTROLLED ROTATION AT STARTUP.
See impact computations. Avoid shock loads caused by load momentum; they can break the shaft or do other mechanical damage. Determine the dwell time in the work cycle for machine operations and use the remaining time for transport, using flow control of the exhausting cylinder to limit rotation speed. If high speeds must be maintained, external shock absorbers can be used to reduce load energy before the index stop, but the shocks must be positioned to allow full rotation. Do not allow load impact to cause visible torsional vibration of the shaft; such stress will break it.

TORQUE REQUIREMENT

Specification of an indexer must be based upon the load torque requirement with margin to account for variations in load, system pressure at the indexer and friction in the indexer (See "Breakaway Friction"). Indexer and load static friction occur at the start of the cycle and must be allowed for. Load torque should be measured rather than computed to avoid errors from unanticipated factors. Temporary torque arms and "fish scale" force measurements will usually suffice. With the load torque known, an indexer can be specified on the basis of minimum system pressure and a reasonable margin; 40% is used by many designers to assure reliable production. Note also that the indexer size may be dictated by the load it must stop; see "Shock Loads".

TORQUE AND PRESSURE RATINGS
DRIVE TORQUE

The torque and pressure ratings are both determined by the torque rating of the drive clutch. The clutch is conservatively rated and will last indefinitely if used reasonably. Since the ratchet stops the shaft prior to the full completion of the possible rack stroke, the drive clutch sees all the torque developed by whatever pressure is applied to the unit, so the pressure rating is also set by the clutch rating.

REVERSE TORQUE

Excess torque in the reverse direction may deform the indexer housing and reduce the holding power of the non-return clutch. With pressure applied in the drive direction, reverse torque should not exceed the sum of developed torque and the reverse torque rating. Without pressure in the drive direction, applied reverse torque should not exceed the reverse torque rating.

INDEXING ROTATION ACCURACY

Indexer shaft rotation is determined by the ratchet and may have an angular error of ±0.2 degree; this error is characteristic of each step and does not accumulate. In the index position the shaft is locked in both directions. Control logic should be arranged to leave the unit in index condition until operations requiring load position are complete. The reset can then be accomplished in as little as 0.1 second. In the reset condition, the cam holds the pawl out of the ratchet so an outside torque can produce forward rotation. If no motion can be tolerated during reset, install an air or other controlled brake. The reset operation may impart a small forward impulse to the shaft; load inertia and friction will damp the motion, and a cushion will reduce noise.

MAXIMUM OPERATING RATES

Rotomation indexers can operate at high cycle rates; the rates are often limited by the angular momentum of the load. Provisions in "Shock Loads", above, are pertinent. The X1 and X2 series have been run at rates above 200 operations per minute with closely controlled load inertia and friction characteristics.

SELECTION OF OPTIONS

The most useful options for the indexer are flow control of the exhausting cylinder in the drive direction and the extended pawl shaft equipped with switches, pilot valves or proximity detector. The flow control sets load velocity and the extended pawl shaft and signal elements indicate completion of index or reset for sequencing system operations. A cushion or bumper on the reset cylinder will quiet that operation. Cushioning the drive stroke is not effective without friction in the load and adjustment of rotation is impossible. For maintenance of position of overhung loads, a double shaft for installation of a brake may be appropriate.

SPECIAL ANGLE COMBINATIONS

For some operating systems, irregular angle sequences may be appropriate. For example, 90 deg., 90 deg., 180 deg. has been used to provide a "skip step" sequence to speed up a task. Other combinations are possible. The basic rule is that the total of the specified angles must equal 360 deg. and that all the steps must be equal to or larger than 30 deg. or must all be smaller than 30 deg.

BREAKAWAY FRICTION

The pressure energized nitrile seals used allow breakaway at low pressure. Indexers start and move smoothly at or below 7 psi. Pretensioned seals or FKM increase this pressure significantly.

PHONE & FAX SUPPORT
For technical support and additional information, call 386-676-6377 or fax 386-676-6379.