

Candy Differential

Infinitely Adjustable Rotary Positioner

- 1:1 differential gearbox for precise rotary motion control
- Low backlash and transmission error provides superior accuracy
- Unique modular design allows for a variety of mounting configurations



OVER 50 YEARS OF INNOVATION



Description

The Candy Differential is a precision gearbox used to advance or retard the rotary position of machine components. Installed in the drive train, these infinitely adjustable differentials may be manually or motor adjusted, while running or stopped. With the control shaft stationary, input and output shafts rotate in a 1:1, counter-rotating relationship. When a rotation is applied to the control shaft, a differential action occurs between the input and output elements, making the Candy Differential ideal for precise timing and positioning applications. This unique modular design allows for a variety of accessories and mounting configurations, providing unmatched application flexibility. The Candy Differential represents the latest in engineering development and is ideal for both machine retrofits and new machine designs.

Principle of Operation

The Candy Differential consists of six major components: an input shaft, an output shaft, spiral-bevel drive gears, spiral-bevel idler gears, a worm gear designated the “carrier”, and a worm designated the “control shaft.”

Power transfer through the Candy Differential begins at the input shaft with a spiral-bevel drive gear affixed at its inboard end. This drive gear transfers power at right angles through the idler gears, which are pinned to the carrier, and then to the output drive gear and shaft. The input and output shafts incorporate a patented backbone support system, preventing over-hung loads from being deflected into the gear mesh.

When the carrier is held stationary, the power transfer results in a 1:1 ratio transmission with counter-rotating shafts. Applying a rotation to the control shaft

causes the carrier to rotate intermittently or continuously in one direction or the other. This rotation changes the position of the bevel gear assembly about the main shaft center line, causing a differential action between input and output elements. Since this control action is independent of the drive function, phase adjustments can be made while the Candy Differential is in motion providing precise timing or position control.



Technical Data

CONSTRUCTION

The Candy Differential is engineered from quality materials. The housing is cast from lightweight aluminum for heat dissipation and is coated with a corrosion-resistant, USDA approved epoxy finish. The input and output shaft are 303 stainless steel and are supported by tapered roller bearings for high radial load capacity. Internally, the spiral-bevel gears are picked as a set and through-hardened for precise, prolonged performance.

INPUT/OUTPUT CONFIGURATION

Either drive shaft on the Candy Differential may be used as the input. The output shaft, however, will always rotate in a direction opposite that of the input. Shaft-reversing boxes and right-angle boxes may be added to change the direction of rotation.

MOUNTING CONFIGURATION

These foot-mounted differentials can be mounted in any horizontal, vertical or inverted configuration. Please consult the factory for ceiling or wall mount configurations which require simple factory modification for oil level, sight gauge, drain plug and pressure relief valve relocation.

POSITION INDICATOR DIAL

The Candy Differential has a standard, built-in dial which indicates, in degrees, the amount of correction applied to the output shaft. The 360 degree Lexan scale provides an accurate, numerical reference of rotary position.

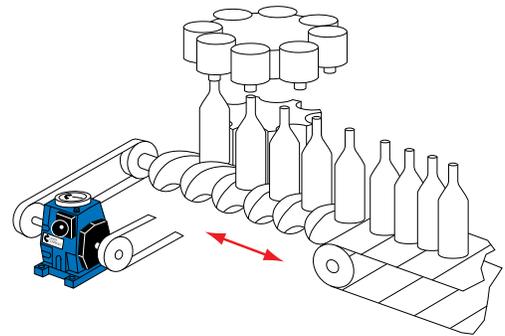
KEY LOCK

The Candy Differential has a built-in lock which not only prevents unauthorized adjustments, but also ensures that the differential will not drift out of adjustment under severe vibration and load. The key is chained to the unit to prevent loss; when security is a problem, the key may be removed.

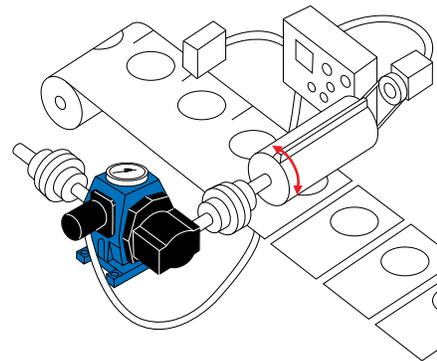
LUBRICATION

The Candy Differential is factory filled to the control shaft level with synthetic gear oil. USDA food grade lubrication is available upon request.

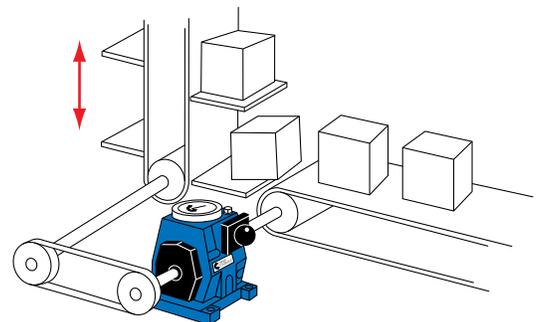
Applications



Position food, beverage and pharmaceutical containers for forming filling and sealing applications.



Register printing, perforating and die cutting cylinders with open or closed loop control systems.



Synchronize the timing of machine components driven from a common line shaft.

Differential Options

CONTROL SHAFT



Standard units are shipped with a control knob for manual phase adjustments. The control shaft, a keyed shaft extension, may be ordered as an option and installed in place of the standard knob. The control shaft may then be used to mount a control motor or flexible shaft assembly. The control shaft may be installed on the knob side, the lock side, or on both sides of the Differential.

The control shaft ratio is 36:1. One revolution equals ten degrees of correction. Maximum control shaft speed is 1800 rpm.

CONTROL MOTOR

For remote or automatic positioning, a motor may be mounted on either side of the Differential, or it may be mounted above the Differential using the control motor mounting bracket.

Candy Differentials are supplied from the factory with 120VAC or 240VAC synchronous motors. These motors have extremely rapid starting, stopping and reversing characteristics. Basic motor speed is 72 rpm, with available correction rates shown below. The correction rate must be selected upon order entry and is achieved through the use of a gear head or timing belt assembly. The motors are provided with a separate capacitor and W 1/2"-14 NPT wire entry.

The preferred method of motor mounting is shown in Illustration A (standard). The motor may be mounted to either the control knob side, or the lock side. No lock is provided when the control motor option is specified. The motor may also be mounted over the Candy Differential using a motor mounting plate with a timing belt assembly stepping down to the control shaft as shown in Illustration B.



Side Mount



Top Mount

CONTROL MOTOR DIMENSIONS (INCHES)

Label	DIFF-1 & 2	DIFF-7 & 10	DIFF-20 & 30
A	3.38	3.38	3.38
B	6.10	8.65	11.44
C	10.60	11.48	15.02
D	8.10	8.10	9.71
E	10.31	12.75	16.25
F	4.38	5.25	7.19
G	7.63	7.63	9.25

SIDE MOUNT CORRECTION RATES (INCHES)

Gearhead Ratio	Correction Rate	Movement of output shaft (deg/min)	.25 Second jog (degrees)	Time for 90 degree correction (seconds)
3:1	Fast	240	1.00	22.5
5:1	Medium	144	0.60	37.5
9:1	Slow	80	0.33	67
20:1	Precision	36	0.15	150

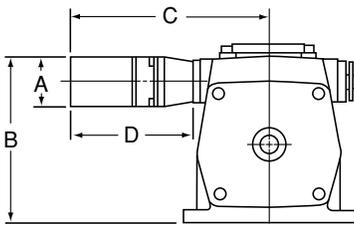


Illustration A

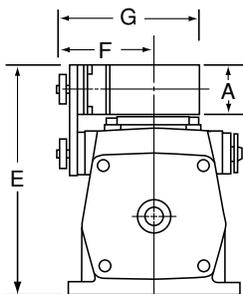


Illustration B

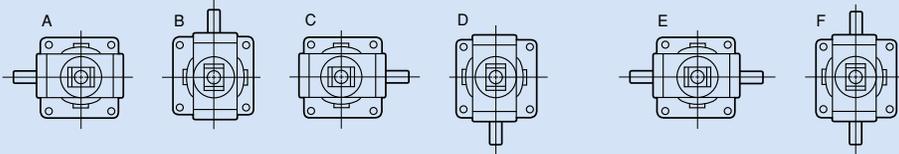
TOP MOUNT CORRECTION RATES (INCHES)

Additional Output Shaft Correction Rates (degrees/minute)						
DIFF-1 & 2	53.30	104.70	205.7	420.00		
DIFF-7 & 10	16.00	40.00	72.0	144.00	201.60	240.00
DIFF-20 & 30	12.00	19.20	30.0	50.00	75.00	90.00

RIGHT-ANGLE GEARBOX

A 1:1 right-angle gearbox is available for the Candy Differential 1, 7 and 20 HP units. The right-angle box may be mounted to either or both sides of the Differential, including single or through-shaft configurations. The shaft rotation of the right-angle gearbox may be specified in either direction.

The single-shaft right-angle gearbox may be mounted to the Candy Differential in any of four positions. The through-shaft option is available for mounting in two positions, vertical or horizontal.

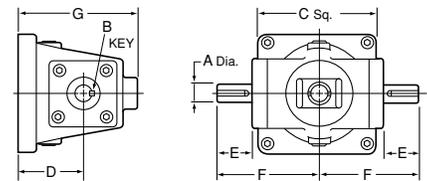


Optional Single-Shaft Mounting Arrangements

Through-Shaft Mounting Arrangements

RIGHT ANGLE GEARBOX DIMENSIONS (INCHES)

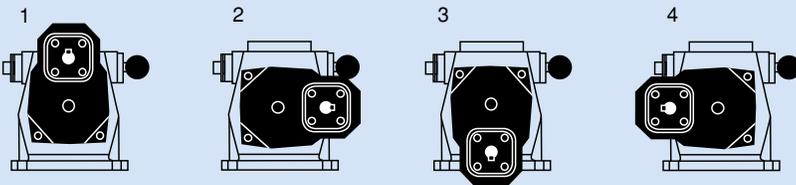
Label	DIFF/RA-1	DIFF/RA-7	DIFF/RA-20
A	0.500	0.750	1.250
B	0.125	0.188	0.250
C	3.380	5.120	8.120
D	2.000	2.690	4.600
E	1.000	1.500	2.630
F	3.310	4.250	6.550
G	4.000	4.940	7.750



SHAFT REVERSING GEARBOX

The SR (Shaft Reversing) gearbox may be mounted to either side of the Candy Differential in a variety of positions and may be used as the input or output element. The SR box is available for all sizes in either a 1:1 or 2:1 ratio. Standard Differential units have counter-rotating shafts. The addition of an SR gearbox allows for same direction shaft rotation between the input and output.

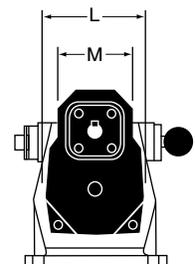
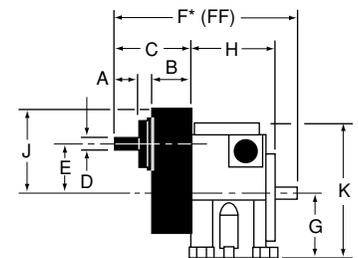
All options are rated for the same torque, overhung load and rpm as the Differential to which it is mounted.



SR Mounting Arrangements

SR GEARBOX DIMENSIONS (INCHES)

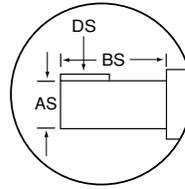
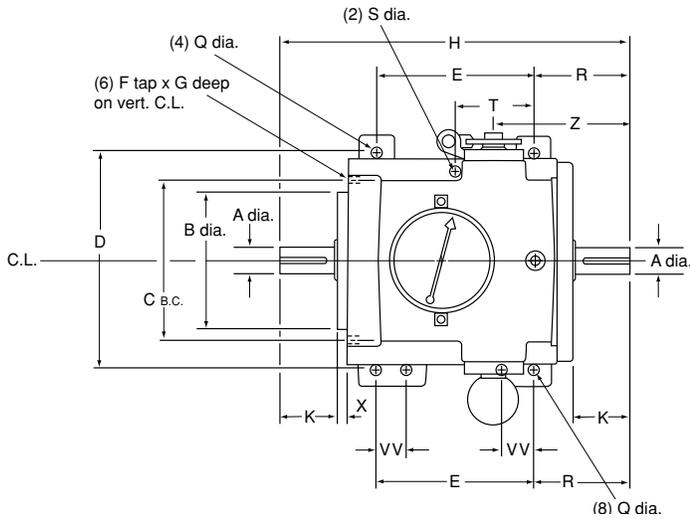
Label	DIFF/SR-1	DIFF/SR-2	DIFF/SR-7	DIFF/SR-10	DIFF/SR-20	DIFF/SR-30
A	1.000	1.500	1.500	2.500	2.750	4.13
B	1.840	1.840	2.500	2.500	3.310	3.310
C	3.530	4.030	4.810	5.810	7.310	8.690
D	0.500	0.625	0.750	1.125	1.250	1.875
E	2.000	2.000	3.190	3.190	4.690	4.690
F*	8.350	11.350	11.700	16.190	20.810	23.570
FF*	8.540	11.350	12.070	16.190	21.310	24.070
G	2.500	2.500	4.250	4.250	5.380	5.380
H	3.820	5.820	5.390	8.250	10.750	10.750
J	3.500	3.500	5.440	5.440	7.810	7.810
K	6.310	6.310	8.750	8.750	12.250	12.250
L	3.500	3.500	5.250	5.250	7.880	7.880
M	2.880	2.880	4.130	4.130	6.630	6.630



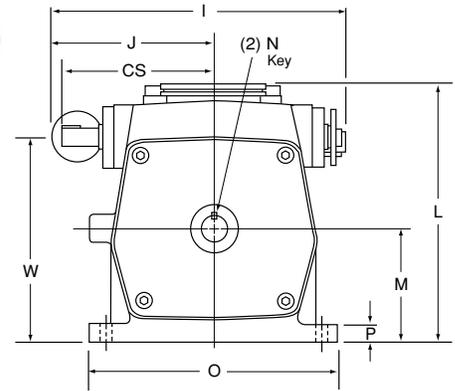
Standard mount shown

* F left side mount, use FF for right side.

Differential Dimensions and Specifications



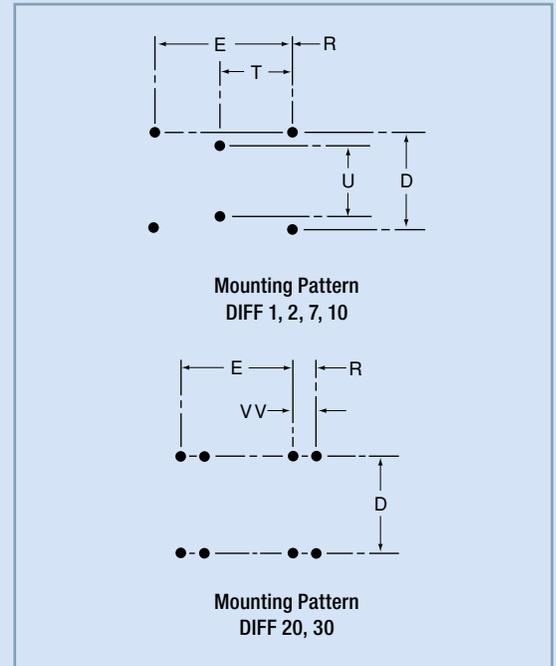
Expanded Detail Control Shaft



DIFFERENTIAL DIMENSIONS (INCHES)

Label	DIFF-1	DIFF-2	DIFF-7	DIFF-10	DIFF-20	DIFF-30
A	0.500	0.625	0.750	1.125	1.250	1.875
B	1.875	1.875	4.500	4.500	6.500	6.500
C	2.750	*	6.120	*	9.000	9.000
F	10-24	*	.31-18	*	.38-16	.38-16
G	0.370	*	0.750	*	0.750	0.750
H	6.000	9.000	8.750	13.250	16.750	19.500
I	7.950	7.950	10.120	10.120	14.000	14.000
J	4.420	4.420	5.810	5.810	7.750	7.750
K	1.000	1.500	1.500	2.500	2.750	4.120
L	6.310	6.310	8.750	8.750	12.250	12.250
M	2.500	2.500	4.250	4.250	5.380	5.380
N	0.125	0.187	0.187	0.250	0.250	0.250
O	5.250	5.250	7.750	7.750	11.870	11.870
P	0.500	0.500	0.630	0.630	0.870	0.870
R	1.750	3.250	2.120	4.380	4.620	6.000
W	4.470	4.470	6.970	6.970	9.750	9.750
X	0.190	0.190	0.380	0.380	0.500	0.500
Z	2.250	3.750	3.290	5.540	6.500	7.880

All Dimensions are inches
* Cannot be facemounted



DIFFERENTIAL SPECIFICATIONS

Technical Specification	DIFF-1	DIFF-2	DIFF-7	DIFF-10	DIFF-20	DIFF-30
Torque (in-lbs) (1750 rpm)	36	75	252	360	720	1080
Max Static Torque (in-lb)	135	270	900	1350	2700	4000
Max Overhung Load (lb)	75	125	150	450	500	1000
Control Shaft Torque (in-lb)	10	20	40	58	116	174
Max rpm	1750	1750	1750	1750	1750	1750
Full Load Efficiency	90%	92%	94%	94%	96%	96%
Weight (lb)	11	14	28	35	107	112

All dimensions and specifications are subject to change without notice.
* Depending on configuration and load, a cooling system may be required to operate at 1750 rpm and above.
** At midpoint of shaft length.
*** At 1750 rpm, full torque rating. At other speeds and torque, please consult Candy Mfg.

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CONTROL SHAFT & MOUNTING PATTERN (INCHES)

Label	DIFF-1 & 2	DIFF-7 & 10	DIFF-20 & 30
AS	0.373	0.498	0.623
BS	0.750	1.000	1.250
CS	3.500	4.500	6.880
DS (key)	0.125	0.125	0.187
E	2.690	4.130	7.500
D	4.500	6.250	10.250
Q	0.340	0.560	0.560
S	0.340	0.440	*
T	1.250	2.380	*
U	4.50	5.380	*
VV	*	*	1.500

