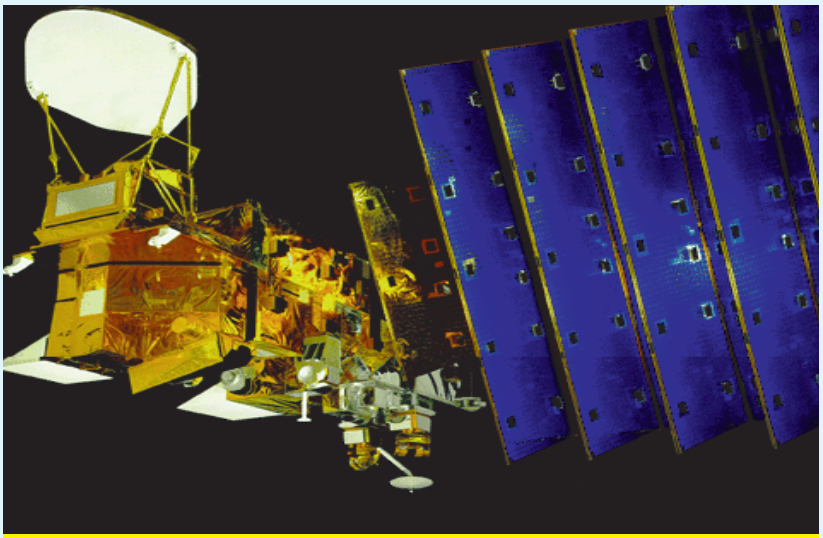
EDDY CURRENT DAMPER APPLICATION DATA



CDA INTERCORP

CDA InterCorp

Introduction

This application manual defines the performance capabilities of CDA InterCorp's Eddy Current Damper Product line, in-line and right angle gearing, and linear damper interface options.

The design data contained herein reflects the continuous demand for improved performance, efficiency, and reliability, while simplifying drive techniques, and minimizing size and weight. CDA InterCorp's eddy current dampers are designed to operate under the most demanding requirements of MIL-STD–810, while maintaining robust, reliable damping characteristics. These dampers, and similar products are used in aerospace, outer space, defense, commercial aviation, "down hole", robotic, nuclear, and high reliability industrial control applications.

With 30 years in the industry, CDA InterCorp's core philosophy of modular standardization has withstood the test of time. Each module design utilizes the same inventoried piece part standards, materials, processes, and construction techniques. Inherent in our standard modules are unequaled reliability and ruggedness, while maintaining flexibility in providing custom damper requirements and extremely responsive prototype and production deliveries.

CDA maintains a quality inspection system which provides traceability, product assurance, and performance. A government quality representative is available to provide source inspection, as required.

For responsive support for your specific requirements , please write, phone, fax, or e-mail CDA InterCorp directly. CDA's system application engineers are available to visit your facility to assist in the design and selection of the proper Eddy Current Damper Assembly for your specific application.

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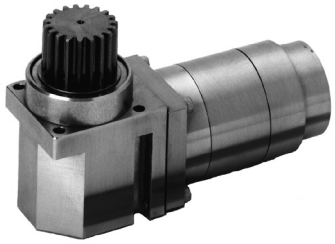


Eddy Current Dampers

CDA InterCorp's Rotary and Linear Eddy Current Dampers offer reliable, repeatable, and linear damping characteristics over a wide operating temperature range. These rugged devices are offered in a range of sizes and damping rates. The Eddy Current Dampers (ECD's) are complemented with single or multiple stages of high reliability gearing. Ideal for demanding applications, these devices will operate reliably at high angular rates, accelerations and radial loads.

CDA InterCorp's seven standard frame size ECD's and our complementary line of gearboxes offer nearly unlimited damping rates, configurations, and torque capacities. Our compact and efficient gearboxes are so robust and compact, that we often rival the size and mass of fluid dampers for equivalent damping rates and torques; however, our ECD's are much more reliable and temperature stable than fluid dampers. ECD's are extremely linear and have low temperature coefficients, where the damping rates and performance are very stable over operating temperature ranges. Our ECD damping rates are so linear and predictable, that temperature compensation is usually not required. Where fluid dampers usually suffer from "dead band" with up to ten or more degrees of lost motion, our geared ECD's have only a few arc-minutes of lost motion, providing a more robust, controlled deployment. Our ECD's do not require, and are not dependent on seals. The elimination of seals, and no potential for leaks gives ECD's a clear advantage in performance or outgassing critical applications. Also, the ECD's performance does not change inside a vacuum. The increased reliability and performance of our ECD's typically save many hours of assembly and integration time.

Our efforts to develop a low static friction, high reliability ECD has proven successful. We can now offer low static friction values without compromising capacity or reliability. Our current line of ECD's have reduced static friction by 75% for a given frame size and damping rate. Often our geared ECD's can form fit function replace fluid dampers in deployment actuation systems with the high reliability and temperature stability inherent in our ECD modules.

Linear Stroke Dampers: CDA InterCorp may also provide Linear Eddy Current Dampers (LECD's) by incorporating a high efficiency ball screw to the output of our rotary dampers. These LECD's may incorporate various mounting configurations for flexible system integration. For Linear ECD analysis, refer to CDA InterCorp's Product Summary brochure for rotary to linear translation equations, and linear mounting interface options.

Damping on Command: CDA InterCorp may provide our ECD's with a damping enable feature which allows the damping restrictive torque to be turned off and on at will. This may offer advantages to the system or mechanism design by allowing the flexibility to command the damping. Contact CDA's engineering department for further information about Damping on Command.

System Level Calibration can also be reliably achieved on our ECD's. Unlike fluid dampers which have a screw provision which may vibrate loose and change position during launch, CDA InterCorp's ECD's can be system level calibrated by adding a proper load resistor across external leads. CDA can provide a matrix of load resistors vs. damping rate at the output of a given ECD.

The damping rates, maximum torques, radial loads, and peak velocities are determining factors in selecting the proper ECD or LECD. This Application Data summary is formatted to assist in the design and selection of an ECD for a specific application.

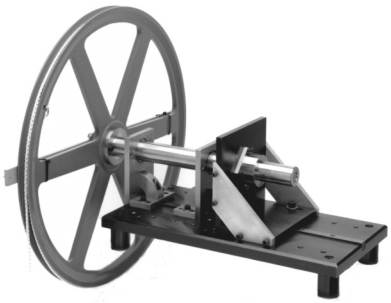
HIGH TORQUE CAPACITY GEARING

As with our standard damper frame sizes, CDA InterCorp inventories the fundamental gear blanks and piece parts for our line of high torque gearboxes. These durable devices are manufactured with the same high precision tolerances as our damper modules. The critical interface between the high speed ECD shaft and the high efficiency gearbox is held to very tight tolerances. This assures high reliability performance at high velocities, maximizing efficiency, and minimizing weight, while maintaining linearity.

As with the damper modules, our gearing consists of high grade stainless steel construction with matched coefficient of thermal expansion. Our standard geared actuators have operated from 4 Kelvin (-269° C) to +250° C. High torsional and radial stiffness with low backlash are also inherent in our standard gear modules making them ideal for high torque deployment mechanisms.

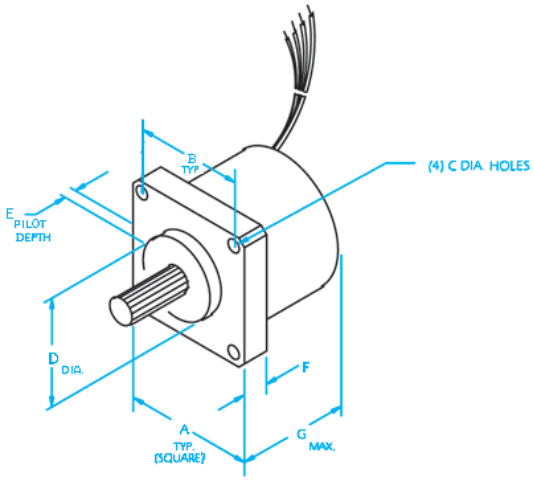
For length critical applications, CDA InterCorp has an entire line of right angle gearboxes to complement each frame size of our planetary gearboxes. Our placement of the critical right angle conversion is at the optimum ratio of torque and velocity which results in a gearbox which has the identical torque, stiffness, and backlash ratings as the comparable in line planetary gearbox. See pages 6 and 7 for our right angle drive damper performance and composite dimensions.

Extensive field heritage and continuous endurance testing provides for a large data base of performance and reliability for our geared packages. Most of our applications are mission critical, and some are even flight safety critical. We are able to accommodate all these demanding applications with our standard modular design concept. Another advantage derived from this concept is responsive prototype deliveries. Since our fundamental module piece parts are inventoried as blanks, we can accommodate fast deliveries and provide custom mounting and interface configurations. Additionally, prototype dampers are manufactured with the same materials, processes and build standards as our flight hardware.



ECD Test Stand Assembly

ECD Mechanical Data

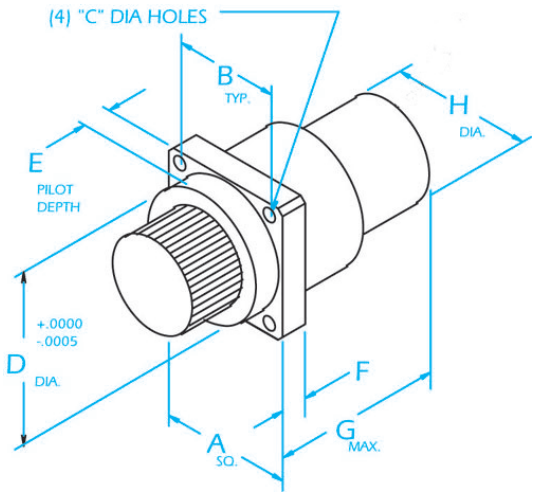


IMPERIAL DIMENSIONS (Inches)											
DAMPER TYPE	A	B	C	D	E	F	G	WEIGHT (Oz.)	INERTIA (Oz-In-s^2)	Coulomb Friction (Lb-In)	Damping Rate (Lb-In-sec/rad)
12	0.750	0.620	0.081	0.5000	0.040	0.125	0.780	1.2	9.50 E-06	3.0 E-03	2.58 E-04
16	1.000	0.828	0.110	0.6250	0.125	0.187	0.995	2.8	3.70 E-05	7.3 E-03	1.15 E-03
20	1.250	1.030	0.129	0.7500	0.125	0.250	1.280	5.0	1.00 E-04	1.3 E-02	3.70 E-03
24	1.500	1.250	0.149	0.8750	0.125	0.250	1.550	8.5	2.40 E-04	2.6 E-02	9.30 E-03
32	2.000	1.670	0.177	1.1250	0.125	0.375	1.911	19	1.00 E-03	5.0 E-02	4.98 E-02
40	2.500	2.080	0.266	1.5000	0.125	0.500	2.170	32	3.38 E-03	1.0 E-01	1.03 E-01
48	3.000	2.500	0.266	1.7500	0.125	0.500	2.500	64	7.78 E-03	2.0 E-01	2.54 E-01

SYSTEM INTERNATIONAL (mm)											
DAMPER TYPE	A	B	C	D	E	F	G	WEIGHT (kg)	INERTIA (kg-m^2)	Coulomb Friction (Nmm)	Damping Rate [Nm-sec/rad]
12	19.05	15.75	2.06	12.700	1.02	3.18	19.81	0.037	6.71 E-08	3.4 E-04	2.91 E-05
16	25.40	21.03	2.79	15.875	3.18	4.75	25.27	0.078	2.61 E-07	8.3 E-04	1.30 E-04
20	31.75	26.16	3.28	19.050	3.18	6.35	32.51	0.142	7.06 E-07	1.5 E-03	4.18 E-04
24	38.10	31.75	3.78	22.225	3.18	6.35	39.37	0.241	1.69 E-06	2.9 E-03	1.05 E-03
32	50.80	42.42	4.50	28.575	3.18	9.53	48.54	0.540	7.06 E-06	5.6 E-03	5.63 E-03
40	63.50	52.83	6.76	38.100	3.18	12.70	55.00	0.91	2.39 E-05	1.1 E-02	1.16 E-02
48	76.20	63.50	6.76	44.450	3.18	12.70	63.50	1.80	5.49 E-05	2.3 E-02	2.87 E-02

Notes:
1. Pilot to pinion concentricity = 0.0007 inches [0.018 mm] TIR.
2. Flange to pinion perpendicularity = 0.0007 inches [0.018 mm] TIR.
3. Composite error of assembled pinion = 0.011 inches [0.028 mm] TIR.
4. Other mounting configurations are available on request.
5. Damping rates tabulated at +25˚ C.

Damper - Gearhead Composite Dimensions and Performance



TYPE		MAXIMUM RATINGS			IMPERIAL DIMENSIONS (Inches)								WEIGHT
GEARHEAD	DAMPER	DAMPING RATE	TORQUE	GEAR RATIO	A	B	C	D	E	F	G	H	Oz
		Lb-In-sec/rad	Lb-In	-									
AA	12	3.26 E+00	18	100	0.750	0.620	0.081	0.6875	0.156	0.188	1.744	0.750	3.0
AAA	12	3.26 E+02	18	1000	0.750	0.620	0.081	0.6875	0.156	0.188	2.304	0.750	4.0
CAA	12	3.26 E+02	84	1000	1.000	0.828	0.110	0.9375	0.188	0.250	2.381	0.750	5.0
CA	16	1.22 E+01	84	100	1.000	0.828	0.110	0.9375	0.188	0.250	2.036	1.000	6.5
CCS	16	2.00 E+03	84	1280	1.000	0.828	0.110	0.9375	0.188	0.250	1.975	1.000	6.5
DCA	16	1.22 E+03	168	1000	1.250	1.030	0.129	1.1875	0.250	0.250	2.686	1.000	10.5
DC	20	5.59 E+01	168	107	1.250	1.030	0.129	1.1875	0.250	0.250	2.407	1.250	12
DCA	20	5.59 E+03	168	1070	1.250	1.030	0.129	1.1875	0.250	0.250	2.967	1.250	15
FDC	20	5.11 E+03	456	1140	1.500	1.250	0.149	1.4375	0.313	0.313	3.200	1.250	18
DC	24	1.20 E+02	168	107	1.500	1.250	0.149	1.1875	0.250	0.313	2.696	1.500	17
FDC	24	1.10 E+04	456	1140	1.500	1.250	0.149	1.4375	0.313	0.313	3.491	1.500	25
HDC	24	1.20 E+04	744	1060	2.000	1.670	0.177	1.8750	0.375	0.375	3.674	1.500	36
FD	32	5.00 E+02	456	114	2.000	1.670	0.177	1.4375	0.313	0.375	3.162	2.000	31
HDC	32	5.84 E+04	744	1070	2.000	1.670	0.177	1.8750	0.375	0.375	4.109	2.000	56
JFCC	32	2.26 E+06	1500	6440	2.500	2.062	0.206	2.4375	0.437	0.500	4.990	2.000	74
FD	40	1.05 E+03	456	102	2.500	2.062	0.206	1.4375	0.313	0.500	3.500	2.500	43
JFC	40	4.61 E+04	1500	664	2.500	2.062	0.206	2.4375	0.437	0.500	4.550	2.500	74
MHDC	40	3.94 E+06	3000	6140	3.000	2.500	0.266	2.9687	0.500	0.500	6.590	2.500	100
HD	48	2.35 E+03	744	96	3.000	2.500	0.266	1.8750	0.313	0.750	3.950	3.000	90
JFC	48	1.30 E+05	1500	664	3.000	2.500	0.266	2.4375	0.437	0.750	4.920	3.000	105
NJFD	48	3.10 E+06	7000	3500	4.000	3.332	0.375	3.9689	0.562	0.750	6.990	3.000	220

Notes:
1. These tabulations DO NOT reflect all of the possible Damper / Gearbox assembly possibilities. Higher gear ratios, damping rates, and torque capacities are available on request.
2. Rate gearhead performance by the first letter of the gearhead type tabulated.

TYPE		MAXIMUM RATINGS			SYSTEM INTERNATIONAL (mm)								WEIGHT
GEARHEAD	DAMPER	DAMPING RATE	TORQUE	GEAR RATIO	A	B	C	D	E	F	G	H	kg
		Nm-sec/rad	Nm	-									
AA	12	3.68 E-01	2.0	100	19.05	15.75	2.06	17.463	3.96	4.78	44.30	19.05	0.085
AAA	12	3.68 E+01	2.0	1000	19.05	15.75	2.06	17.463	3.96	4.78	58.52	19.05	0.113
CAA	12	3.68 E+01	9.5	1000	25.40	21.03	2.80	23.813	4.78	6.35	60.48	19.05	0.142
CA	16	1.38 E+00	9.5	100	25.40	21.03	2.80	23.813	4.78	6.35	51.72	25.40	0.185
CCS	16	2.26 E+02	9.5	1280	25.40	21.03	2.80	23.813	4.78	6.35	50.17	25.40	0.185
DCA	16	1.38 E+02	19	1000	31.75	26.26	3.30	30.163	6.35	6.35	68.22	25.40	0.298
DC	20	6.32 E+00	19	107	31.75	26.16	3.30	30.163	6.35	6.35	61.14	31.75	0.341
DCA	20	6.32 E+02	19	1070	31.75	26.16	3.30	30.163	6.35	6.35	75.36	31.75	0.426
FDC	20	5.77 E+02	52	1140	38.10	31.75	3.80	36.513	7.95	7.95	81.28	31.75	0.511
DC	24	1.36 E+01	19	107	38.10	31.75	3.80	30.163	6.35	7.95	68.78	38.10	0.423
FDC	24	1.24 E+03	52	1140	38.10	31.75	3.80	36.513	7.95	7.95	88.67	38.10	0.710
HDC	24	1.36 E+03	84	1060	50.80	42.42	4.50	49.213	9.53	9.53	93.31	38.10	1.02
FD	32	5.56 E+01	52	114	50.80	42.42	4.50	36.513	7.95	9.53	80.32	50.80	0.881
HDC	32	6.60 E+03	84	1070	50.80	42.42	4.50	49.213	9.53	9.53	104.4	50.80	1.59
JFCC	32	2.55 E+05	170	6440	63.50	52.37	5.23	61.913	11.10	12.70	127.0	50.80	2.10
FD	40	1.19 E+02	52	102	63.50	52.37	5.23	36.513	7.95	12.70	88.90	63.50	1.22
JFC	40	5.24 E+03	170	664	63.50	52.37	5.23	61.913	11.10	12.70	115.6	63.50	2.10
MHDC	40	4.45 E+05	340	6140	76.20	63.50	6.76	75.405	12.70	12.70	167.4	63.50	2.84
HD	48	2.66 E+02	84	96	76.20	63.50	6.76	49.213	7.95	19.05	100.3	76.20	2.55
JFC	48	1.47 E+04	170	664	76.20	63.50	6.76	61.913	11.10	19.05	125.0	76.20	2.98
NJFD	48	3.50 E+05	780	3500	101.6	84.63	9.53	100.8	14.27	19.05	178.0	76.20	6.25

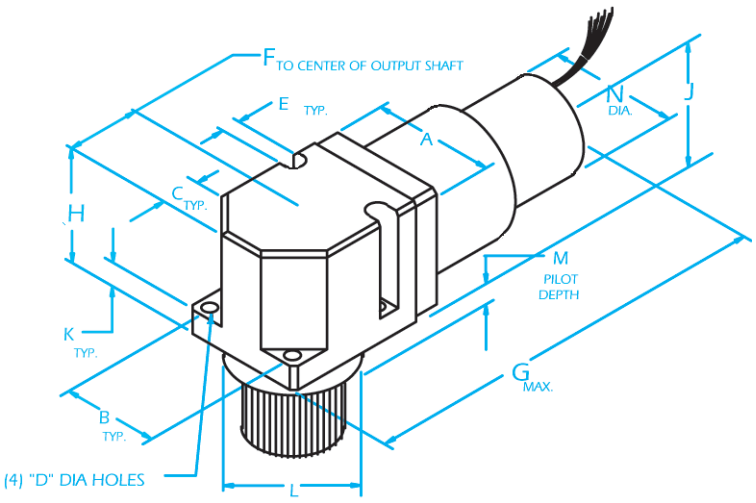
Notes:

1. These tabulations DO NOT reflect all of the possible Damper / Gearbox assembly possibilities. Higher gear ratios, damping rates, and torque capacities are available on request.
2. Rate gearhead performance by the first letter of the gearhead type tabulated.

GEARHEAD RATINGS

Gearhead Type	"A" Basic Size		Torque Capacity				Torsional Spring Constant	
			Continuous		Intermittent			
	Inches	mm	Lb-In	Nm	Lb-In	Nm	Lb-In/Rad	Nm/Rad
A	0.750	19.05	7.2	0.81	18	2.03	6.0 E+03	6.8 E+02
C	1.000	25.40	48	5.4	84	9.5	1.6 E+04	1.8 E+03
D	1.250	31.75	84	9.5	168	19	2.5 E+04	2.8 E+03
F	1.500	38.10	168	19	456	52	4.2 E+04	4.7 E+03
H	2.000	50.80	300	34	744	84	7.4 E+04	8.4 E+03
J	2.500	63.50	744	84	1500	170	1.8 E+05	2.0 E+04
M	3.000	76.20	1200	136	3000	340	6.0 E+05	6.8 E+04
N	4.000	101.60	3600	407	6900	780	3.6 E+06	4.1 E+05

Damper / Right Angle Gearhead Composite Dimensions and Performance



TYPE		MAXIMUM RATINGS			IMPERIAL DIMENSIONS (Inches)													WEIGHT
GEARHEAD	DAMPER	DAMPING	TORQUE	GEAR RATIO	A	B	C	D	E	F	G	H	J	K	L	M	N	OZ.
		Lb-In-sec/rad	Lb-In	-														
ARA	12	2.36 E+00	18	187	0.750	0.620	0.229	0.081	0.140	0.375	2.130	0.833	0.436	0.188	0.7350	0.250	0.750	4.3
CRAA	12	2.36 E+02	84	1870	1.000	0.828	0.300	0.110	0.194	0.500	3.050	1.170	0.594	0.250	0.9750	0.313	0.750	8.0
DRCA	12	2.68 E+02	168	1991	1.275	1.030	0.400	0.129	0.219	0.637	3.315	1.287	0.622	0.250	1.2500	0.313	0.750	14
CRA	16	4.26 E+01	84	187	1.000	0.828	0.300	0.110	0.194	0.500	2.680	1.170	0.594	0.250	0.9750	0.313	1.000	10
DRCA	16	4.83 E+03	168	1991	1.275	1.030	0.400	0.129	0.219	0.637	3.530	1.287	0.622	0.250	1.2500	0.313	1.000	16
FRDC	16	8.58 E+03	456	1911	1.525	1.250	0.440	0.149	0.272	0.763	3.950	1.540	0.790	0.375	1.5000	0.375	1.000	23
DRC	20	1.93 E+02	168	199	1.275	1.030	0.400	0.129	0.219	0.637	3.232	1.287	0.622	0.250	1.2500	0.313	1.250	17
FRDC	20	1.78 E+04	456	1911	1.525	1.250	0.440	0.149	0.272	0.763	4.260	1.540	0.790	0.375	1.5000	0.375	1.250	25
HRDC	20	1.78 E+04	744	1911	2.000	1.670	0.585	0.177	0.316	1.000	4.629	2.062	1.062	0.375	1.9750	0.475	1.250	40
FRD	24	1.83 E+02	456	191	1.525	1.250	0.440	0.149	0.272	0.763	3.855	1.540	0.790	0.375	1.5000	0.375	1.500	28
HRDC	24	3.88 E+04	744	1911	2.000	1.670	0.585	0.177	0.316	1.000	4.292	2.062	1.062	0.375	1.9750	0.475	1.500	43
JRFD	24	2.02 E+04	1500	1387	2.500	2.060	0.750	0.206	0.430	1.250	5.700	2.562	1.312	0.500	2.4750	0.562	1.500	72
HRD	32	1.86 E+03	744	191	2.000	1.670	0.585	0.177	0.316	1.000	4.572	2.062	1.062	0.375	1.9750	0.475	2.000	52
JRFD	32	8.93 E+04	1500	1323	2.500	2.060	0.750	0.206	0.430	1.250	6.061	2.562	1.312	0.500	2.4750	0.562	2.000	85
MRFD	32	6.70 E+04	3000	1146	3.500	2.750	1.250	0.266	0.600	1.750	6.950	3.313	1.813	0.625	3.2500	0.625	2.000	160
JRF	40	1.61 E+03	1500	124	2.500	2.060	0.750	0.206	0.430	1.250	5.610	2.562	1.312	0.500	2.4750	0.562	2.500	95
JRFD	40	1.84 E+05	1500	1323	2.500	2.060	0.750	0.206	0.430	1.250	6.240	2.562	1.312	0.500	2.4750	0.562	2.500	110
MRFD	40	1.38 E+05	3000	1146	3.500	2.750	1.250	0.266	0.600	1.750	7.230	3.313	1.813	0.625	3.2500	0.625	2.500	210
MRF	48	2.92 E+03	3000	107	3.500	2.750	1.250	0.266	0.600	1.750	6.910	3.313	1.813	0.625	3.2500	0.625	3.000	225
MRFD	48	3.35 E+05	3000	1146	3.500	2.750	1.250	0.266	0.600	1.750	7.530	3.313	1.813	0.625	3.2500	0.625	3.000	250

Notes:

1. These tabulations DO NOT reflect all of the possible Damper / Gearbox assembly possibilities. Higher gear ratios, damping rates, and torque capacities are available on request.
2. "J" dimension is from the mounting surface to the centerline of the damper body diameter.
3. Rate gearhead performance by the first letter of the gearhead type tabulated.

TYPE		MAXIMUM RATINGS			SYSTEM INTERNATIONAL - (mm)													WEIGHT
GEARHEAD	DAMPER	DAMPING	TORQUE	GEAR RATIO	A	B	C	D	E	F	G	H	J	K	L	M	N	kg
		Nm-sec/rad	Nm	-														
ARA	12	2.67 E-01	2.0	187	19.05	15.75	5.82	2.06	3.56	9.35	54.10	21.16	11.07	4.78	18.669	6.35	19.05	0.122
CRAA	12	2.67 E+01	9.5	1870	25.4	21.03	7.62	2.79	4.93	12.70	77.47	29.72	15.09	6.35	24.765	7.95	19.05	0.227
DRCA	12	3.03 E+01	19	1991	32.39	26.16	10.16	3.28	5.56	16.18	84.20	32.69	16.81	6.35	31.750	7.95	19.05	0.398
CRA	16	4.81 E+00	9.5	187	25.4	21.03	7.62	2.79	4.93	12.70	68.07	29.72	15.09	6.35	24.765	7.95	25.40	0.284
DRCA	16	5.46 E+02	19	1991	32.39	26.16	10.16	3.28	5.56	16.18	89.66	32.69	16.81	6.35	31.750	7.95	25.40	0.454
FRDC	16	9.69 E+02	52	1911	38.73	31.75	11.18	3.78	6.91	19.38	100.3	39.12	20.07	9.53	38.100	9.53	25.4	0.653
DRC	20	2.18 E+01	19	199	32.39	26.16	10.16	3.28	5.56	16.18	82.09	32.69	16.81	6.35	31.750	7.95	31.75	0.483
FRDC	20	2.01 E+03	52	1911	38.73	31.75	11.18	3.78	6.91	19.38	108.2	39.12	20.07	9.53	38.100	9.53	31.75	0.710
HRDC	20	2.01 E+03	84	1911	50.80	42.42	14.86	4.50	8.03	25.40	117.6	52.37	26.97	9.53	50.165	12.07	31.75	1.14
FRD	24	2.07 E+01	52	191	38.73	31.75	11.18	3.78	6.91	19.38	97.92	39.12	20.07	9.53	38.100	9.53	38.10	0.795
HRDC	24	4.38 E+03	84	1911	50.80	42.42	14.86	4.50	8.03	25.40	109.0	52.37	26.97	9.53	50.165	12.07	38.10	1.22
JRFD	24	2.28 E+03	170	1387	63.50	52.32	19.05	5.23	10.92	31.75	144.8	65.07	33.32	12.70	62.865	14.27	38.10	2.05
HRD	32	2.10 E+02	84	191	50.80	42.42	14.86	4.50	8.03	25.40	116.1	52.37	26.97	9.53	50.165	12.07	50.80	1.48
JRFD	32	1.01 E+04	170	1323	63.50	52.32	19.05	5.23	10.92	31.75	154.0	65.07	33.32	12.70	62.865	14.27	50.80	2.41
MRFD	32	7.57 E+03	340	1146	88.9	69.85	31.75	6.75	15.24	44.45	176.5	84.15	46.05	15.88	82.55	15.88	50.80	4.54
JRF	40	1.82 E+02	170	124	63.50	52.32	19.05	5.23	10.92	31.75	142.5	65.07	33.32	12.70	62.865	14.27	63.50	2.70
JRFD	40	2.08 E+04	170	1323	63.50	52.32	19.05	5.23	10.92	31.75	158.5	65.07	33.32	12.70	62.865	14.27	63.50	3.13
MRFD	40	1.56 E+04	340	1146	88.9	69.85	31.75	6.75	15.24	44.45	183.6	84.15	46.05	15.88	82.55	15.88	63.50	5.96
MRF	48	3.30 E+02	340	107	88.9	69.85	31.75	6.75	15.24	44.45	175.5	84.15	46.05	15.88	82.55	15.88	76.20	6.40
MRFD	48	3.78 E+04	340	1146	88.9	69.85	31.75	6.75	15.24	44.45	191.3	84.15	46.05	15.88	82.55	15.88	76.20	7.10

Notes:

1. These tabulations DO NOT reflect all of the possible Damper / Gearbox assembly possibilities. Higher gear ratios, damping rates, and torque capacities are available on request.
2. "J" dimension is from the mounting surface to the centerline of the damper body diameter.
3. Rate gearhead performance by the first letter of the gearhead type tabulated

RIGHT ANGLE GEARHEAD RATINGS

Gearhead Type	"A" Basic Size		Torque Capacity				Torsional Spring Constant	
			Continuous		Intermittent			
	Inches	mm	Lb-In	Nm	Lb-In	Nm	Lb-In/Rad	Nm/Rad
AR_	0.750	19.05	7.2	0.81	18	2.03	6.0 E+03	6.8 E+02
CR_	1.000	25.40	48	5.4	84	9.5	1.6 E+04	1.8 E+03
DR_	1.275	32.39	84	9.5	168	19	2.5 E+04	2.8 E+03
FR_	1.525	38.73	168	19	456	52	4.2 E+04	4.7 E+03
HR_	2.000	50.80	300	34	744	84	7.4 E+04	8.4 E+03
JR_	2.500	63.50	744	84	1500	170	1.8 E+05	2.0 E+04
MR_	3.500	88.90	1200	136	3000	340	6.0 E+05	6.8 E+04

ECD Nomenclature and Damper Equations

NOMENCLATURE AND DAMPING EQUATIONS			
Symbol	**Description**	**Units**	**Comment or Equation**
B_D	Damping Rate of the High Speed Damper	Lb-In-sec/rad [Nm-sec/rad]	Tabulated on page 3
B_{Dt}	Damping Rate of High Speed Damper at Temperature (t) other than +25˚ C	Lb-In-sec/rad [Nm-sec/rad]	$B_{Dt} = B_D (1-0.004(t-25))$
B_G	Damping Rate of the Gearbox Reflected to the High Speed Damper	Lb-In-sec/rad [Nm-sec/rad]	Typically: $B_G = B_{Dt} * 0.25$
B_T	Total Damping Rate Reflected to the High Speed Damper	Lb-In-sec/rad [Nm-sec/rad]	$B_T = B_D + B_G$
B_L	Damping Rate of Damper - Gearbox Assembly Reflected to the Low Speed Input	Lb-In-sec/rad [Nm-sec/rad]	$B_L = B_T * N^2$
DB_L	Dynamic Damping Rate at the Load (Instantaneous damping rate at any point)	Lb-In-sec/rad [Nm-sec/rad]	$DB_L = T_L / \omega_L$
F_D	Coulomb (or static) Friction of High Speed Damper	Lb-In [Nm]	Tabulated on page 3
F_G	Coulomb Friction of Gearbox, Reflected to the High Speed Damper	Lb-In [Nm]	Typically 0.01 Lb-In [1.12 E-03 Nm]
F_T	Total Coulomb Friction, Reflected to the High Speed Damper	Lb-In [Nm]	$F_T = F_D + F_G$
F_L	Coulomb Friction of the Damper - Gearbox Assembly, Reflected to the Low Speed Input	Lb-In [Nm]	$F_L = F_T * N$
N	Gearbox Ratio (Given ω_L and T_L, find N for a given damper)	-	$N = ((1/(2B_T*\omega_L))*(-F_T^2+4B_T*\omega_L*T_L)^{0.5})$
T_L	Torque Input at Load	Lb-In [Nm]	$T_L = (B_L * \omega_L) + F_L$
ω_L	Load Angular Velocity	rad/sec	$\omega_L = (T_L - F_L) / B_L$

Notes:

1. Unless otherwise stated, the above equations reflect nominal performance at +25˚ C.
2. Gearhead B_G and F_G may vary with frame size and ratio, however, these estimates reflect reasonable nominal values.
3. Consult CDA InterCorp's engineering department for further information.

FAX COVER SHEET				
To:	**Company:**	CDA InterCorp	**Phone No:**	954-698-6000
	Attention:	Application Engineering	**Fax No:**	954-698-6011
	Date:		**Reference:**	
FROM:	**Company:**		**Phone No.:**	
	Name:		**FAX No.:**	
	Mail Stop:		**e-mail:**	
Subject:	Request for Information			

Fill in known data and fax this sheet directly to CDA InterCorp for an immediate response. Be sure to include preferred units.

Parameter	Symbol	Value	Units
Nominal Operating Torque	T_L		
Nominal Operating Velocity	ω_L		
Dynamic Damping Rate	DB_L		
Maximum Torque Rating	T_{MAX}		
Operating Temperature Range	t	Max: Min:	
Brief Description and other comments			

CDA InterCorp Products

Motor Modules:
- Brushless Permanent Magnet Motors
- AC Induction Motors
- Stepper Motors
- Square Wave Driven AC Motors
- Damped Rotary Switches
- Housed Limited Angle Torquers
- Synchronous Motors

Eddy Current Dampers:
- Rotary
- Linear
- In Line or Right Angle
- Damping "enable" option

Gearing Modules:

Rotary:
- High Torque Planetary
- Right Angle Gearing
- High Accuracy Zero Backlash Gearing
- Precision Indexing Drive Gearing

Linear:
- Ball Screw Actuation
- ACME Lead Screw Actuation
- In-line, Right-angle, or U-drive

Brakes:
- DC Friction Brakes
- Permanent Magnet Detent Brakes
- DC Hysteresis Brakes

Transducers:

Position Transducers:
- Brushless Resolvers
  - Single Speed
  - Multiple Speed
  - Tandem or Cluster Redundant
  - With or without Gearing
  - *OnAxis* Resolvers
- RVDT's
  - Tandem or Cluster Redundancy
  - With or without Gearing
  - *OnAxis* RVDT

Velocity Transducers:
- AC Tachometers
  - Damping Tachs
  - Rate Tachs
- Permanent Magnet Alternators
  - Single Speed
  - Multiple Speed
  - With or without Gearing

Acceleration Transducers:
- Brushless DC Rotary Accelerometers
- DC Excited Rotary Accelerometers

CDA InterCorp can combine these standard modules into multi-function integrated actuators and assemblies. Call CDA InterCorp directly for application engineering assistance, or to request a complete set of application data brochures.

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