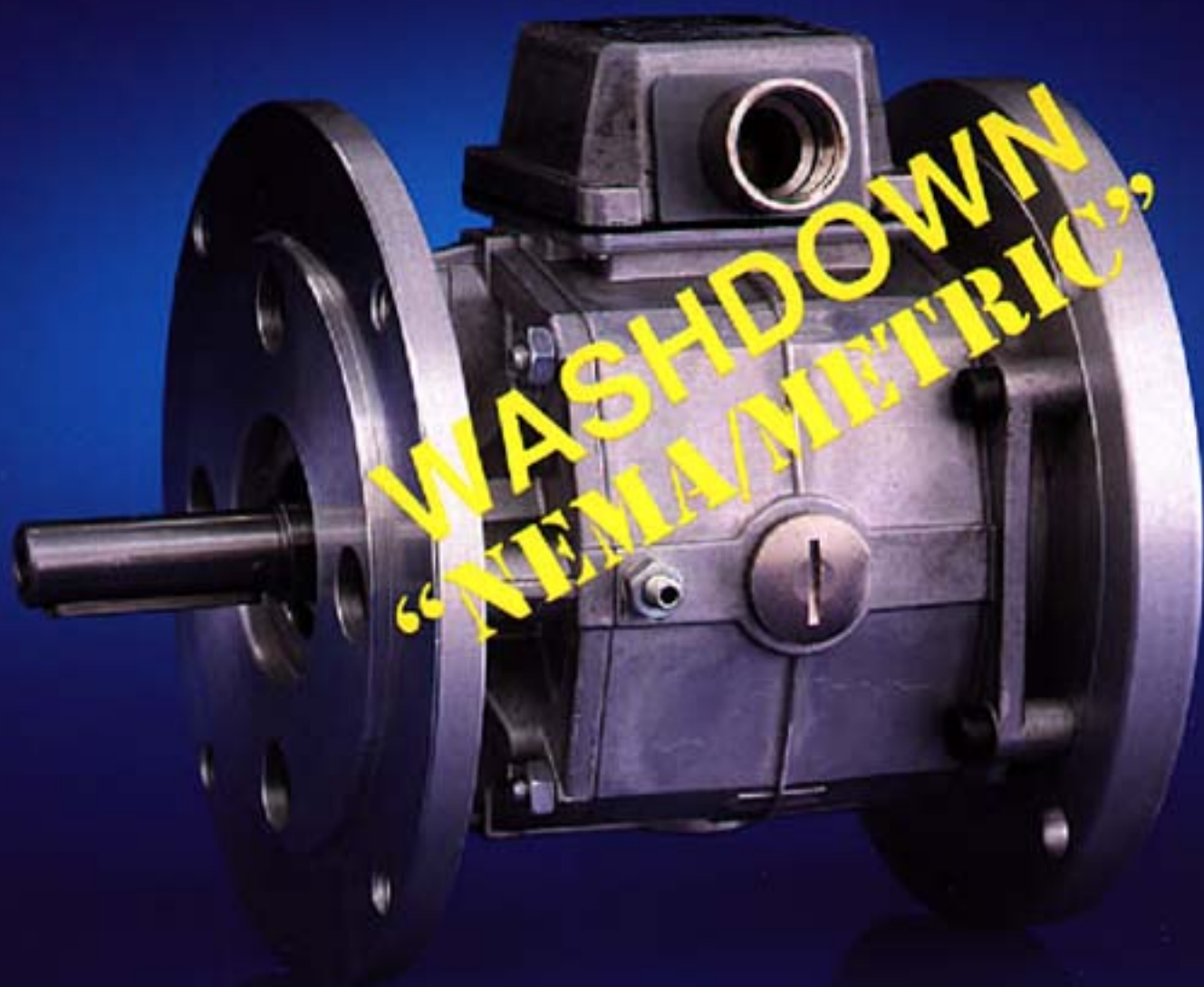


KEBCO

CLUTCH/BRAKE MODULES



**WASHDOWN
"NEMA METRIC"**

COMBIBOX^{T.M.}



The KEBCO Commitment

To provide the highest quality motion control products for power transmission applications using the most complete, cost effective solution possible.

"GUARANTEED ENGINEERING PERFORMANCE"

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Introduction

The patented KEBCO design provides a high quality clutch/brake unit available to industrial and commercial OEM's and end users. KEBCO engineers have the application experience to offer the options your particular need demands.

Standard Features

Features

- Single working armature
- Armature mounted directly to output shaft
- Mount in any orientation
- Metric and English dimensions standard
- Torque range from 5 to 370 lb-ft
- Completely enclosed design
- Coil voltages from 6 to 95VDC
- Asbestos-free friction material
- External wear adjustment
- Completely factory assembled and adjusted

Benefits

- No overlap of clutch and brake during engagement
- No backlash along with a high level of repeatability
- Vertical or horizontal mounting capable with standard Combibox design
- Ideal for international markets
- Flexibility to meet your application requirements
- No contamination from working environment
- Clutch/brakes and rectifiers to accommodate all possible AC and DC voltage inputs
- Lining dust is not a health hazard.
- Air gap easily adjusted with patented system providing 2-3 times longer lifetime than comparable models
- Facilitates fast and easy installation "out of the box"

Optional Features

Features

- Washdown and/or oiltight
- FDA approved epoxy paint
- Rectifiers and other electronic controls factory installed and adjusted
- "Drop in" mounting feet

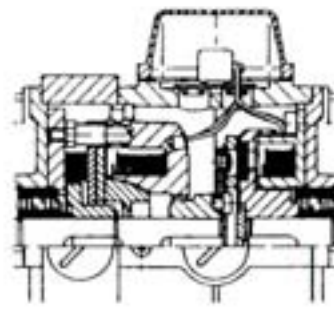
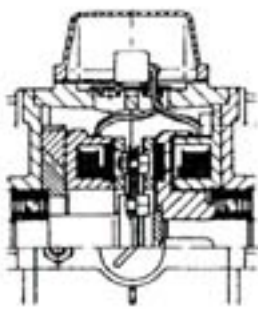
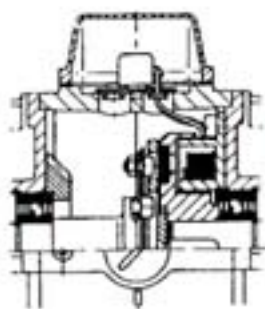
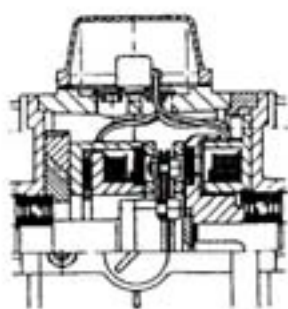
Benefits

- Perfect for food service industry and demanding environments
- Available for special applications
- Encapsulated full and half wave bridge rectifiers for AC or DC side switching. Built in voltage peak protection and arc suppression protects your contacts and switches
- Foot mount available for other manufactures' bolt pattern

Operation

KEBCO Combibox clutch and brake armatures are rigidly riveted together forming a single working unit. This single armature is connected to the hub through a set of flat springs which are bolted directly to the output shaft,—**no backlash!** Activation of either the clutch or the brake is performed by applying (or removing in the case of permanent magnet brakes and spring set brakes) DC power to the coil. The armature is then pulled over to the corresponding friction surface,—**no overlap!** **Because of our special armature design, KEBCO clutch/brakes are capable of: higher cycle rates, improve repeatability, and longer lifetimes than our competitors.**

Sizing and Selection



Type 06

Electric clutch
Permanent magnet brake

Type 09

Electric clutch

Type 10

Electric clutch
Electric brake

Type 16

Electric clutch
Spring set brake

When selecting a KEBCO clutch/brake three parameters to consider are: the size (torque), the type (clutch only, clutch and brake, etc.) and the design (shaft mount, etc.) KEBCO part #'s reflect these parameters as follows:

XX

Size
Code

06-5 lb ft
07-11 lb ft
08-22 lb ft
09-48 lb ft
10-96 lb ft
11-185 lb ft
12-370 lb ft

YY

Type
Code

06-electric clutch/permanent magnet brake
09-electric clutch only
10-electric clutch/electric brake
16-electric clutch/spring set brake

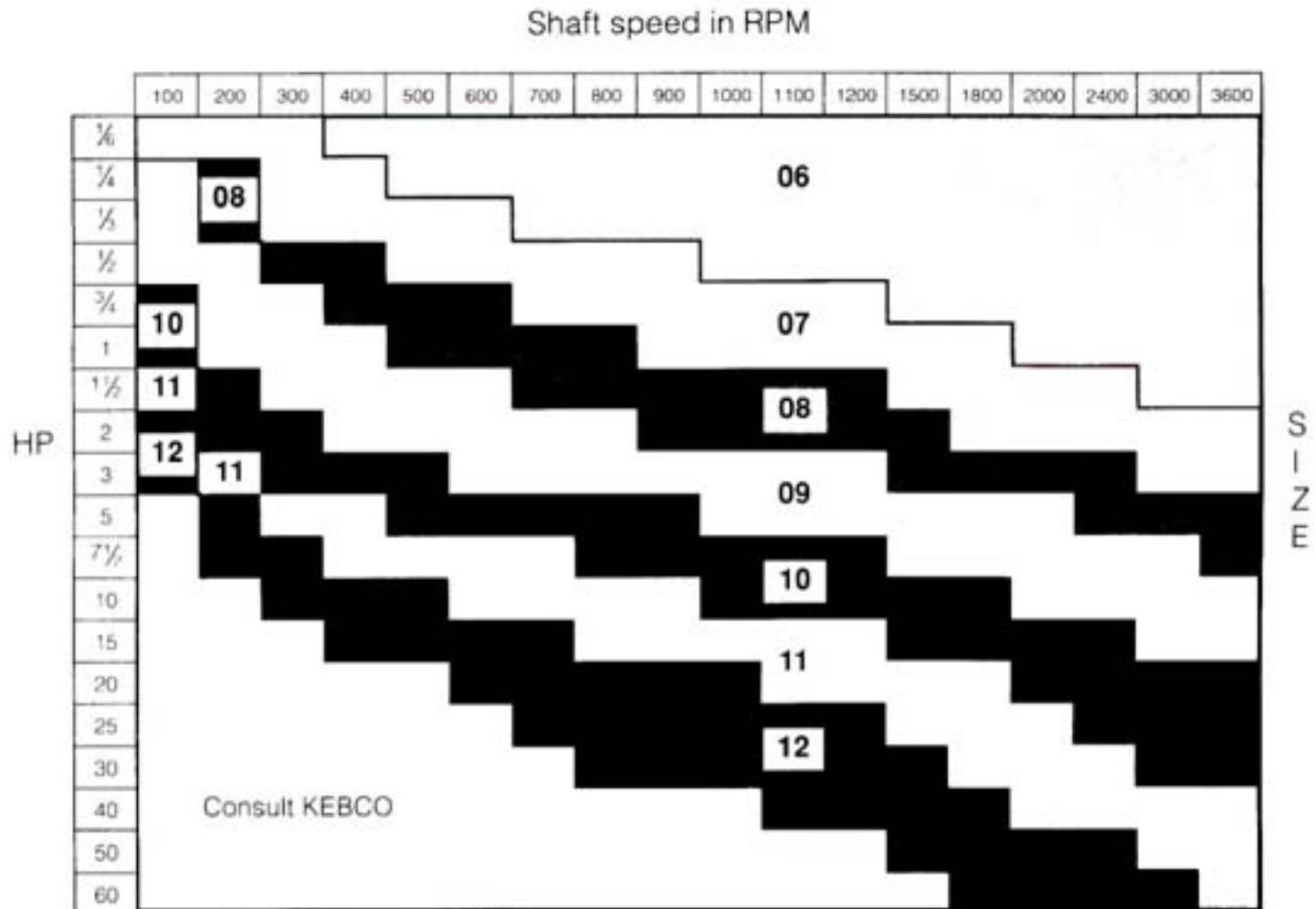
ZZ

Design
Code

360-shaft in/shaft out without feet
370-shaft in/shaft out with feet
440-female flange in/shaft out
670-female flange in/male flange out
etc.

The Size

Units may be sized according to the selection chart below* (see the applications engineering section on pages 15–17).



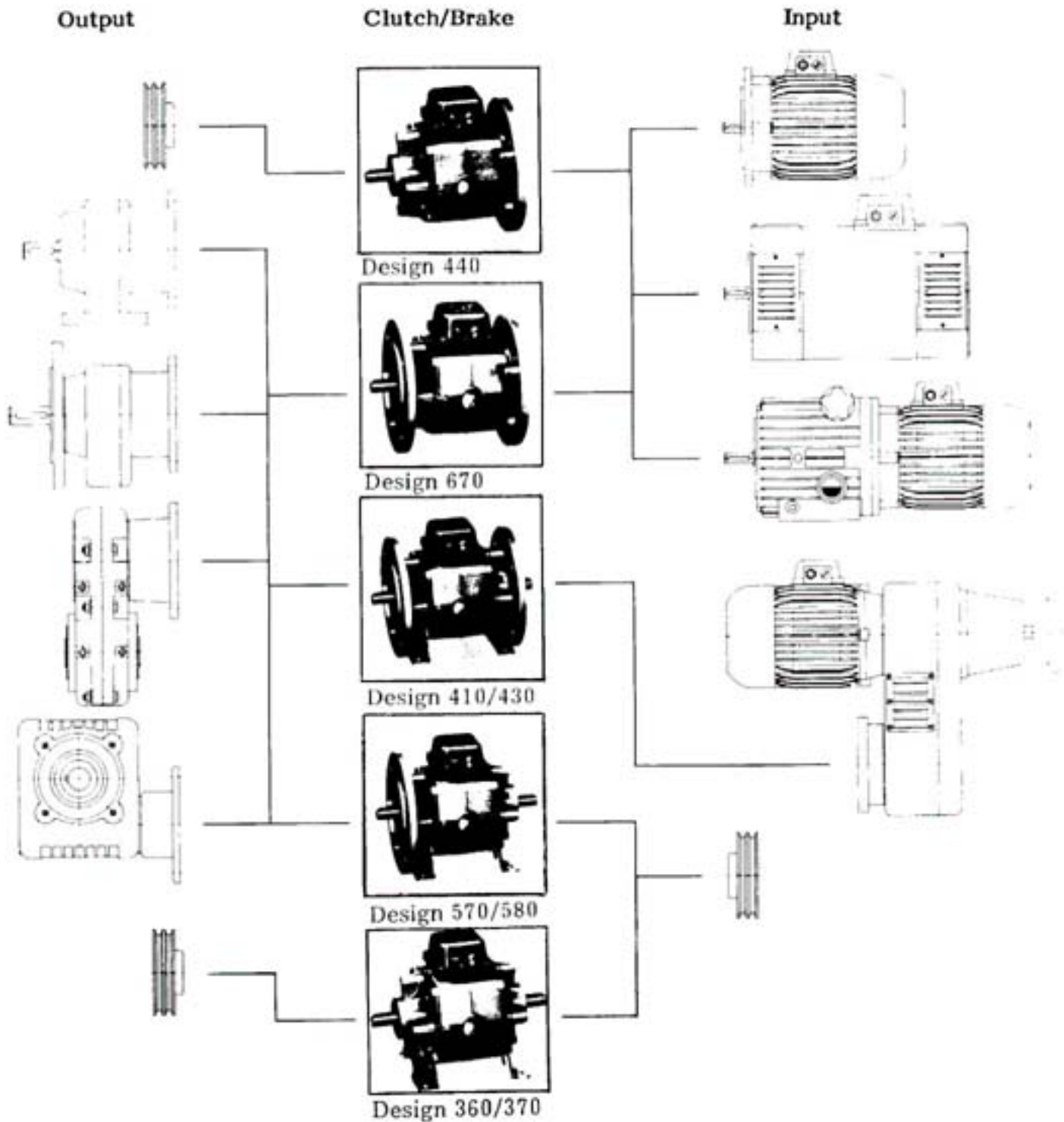
*Type 09 and 10 Only

Combibox Airgap

Size	Nominal Air Gap	Maximum Air Gap
06	0.008	0.024
07	0.012	0.035
08	0.014	0.040
09	0.014	0.040
10	0.016	0.047
11	0.016	0.047

How to select the right design.

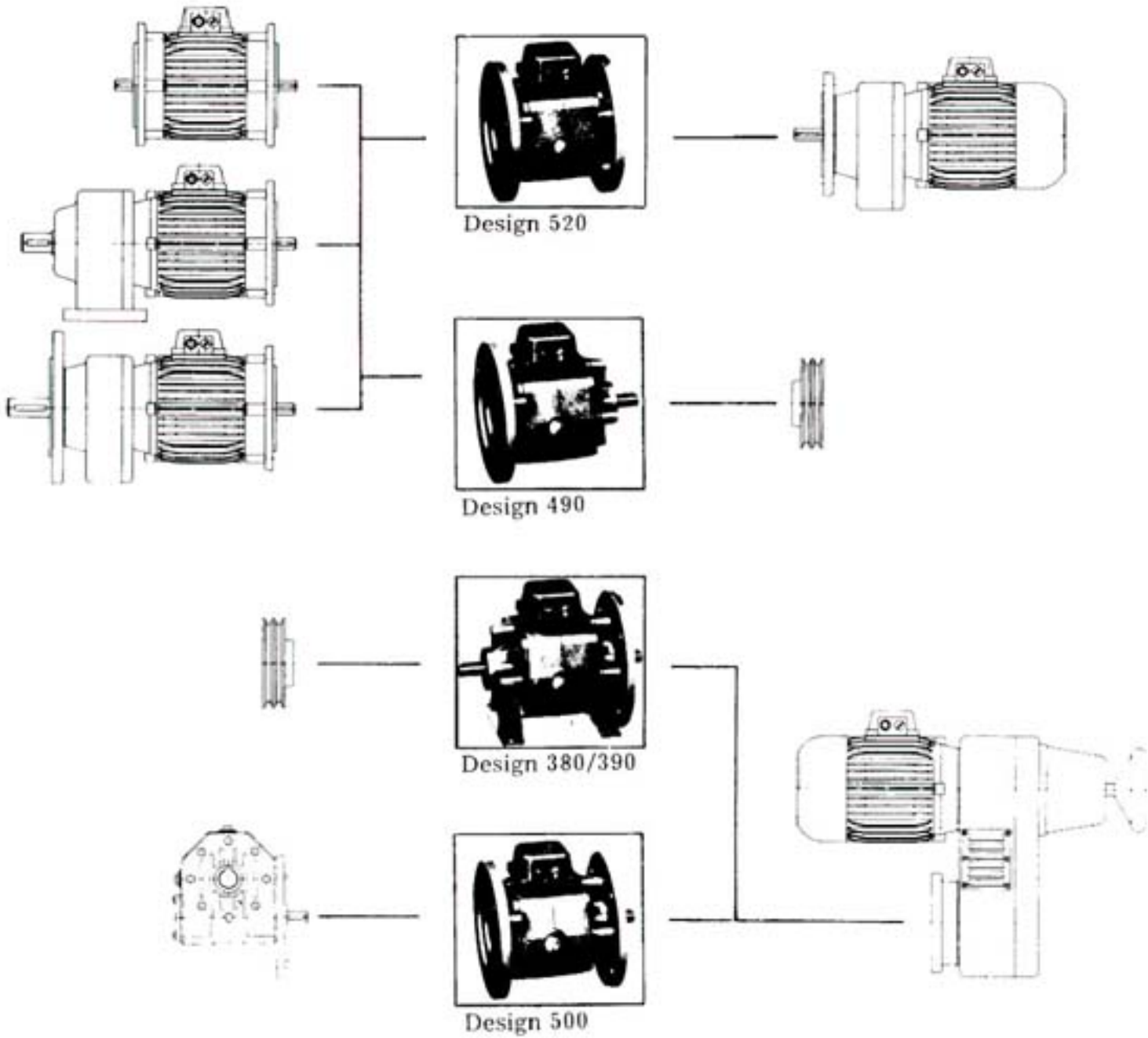
Determine the input and output requirements for your application. The following chart provides typical input and output selections (ex: Nema C input-shaft output). Special shaft and flanges are also available including I.E.C.



Output

Clutch/Brake

Input



Plus:



Design 620/630

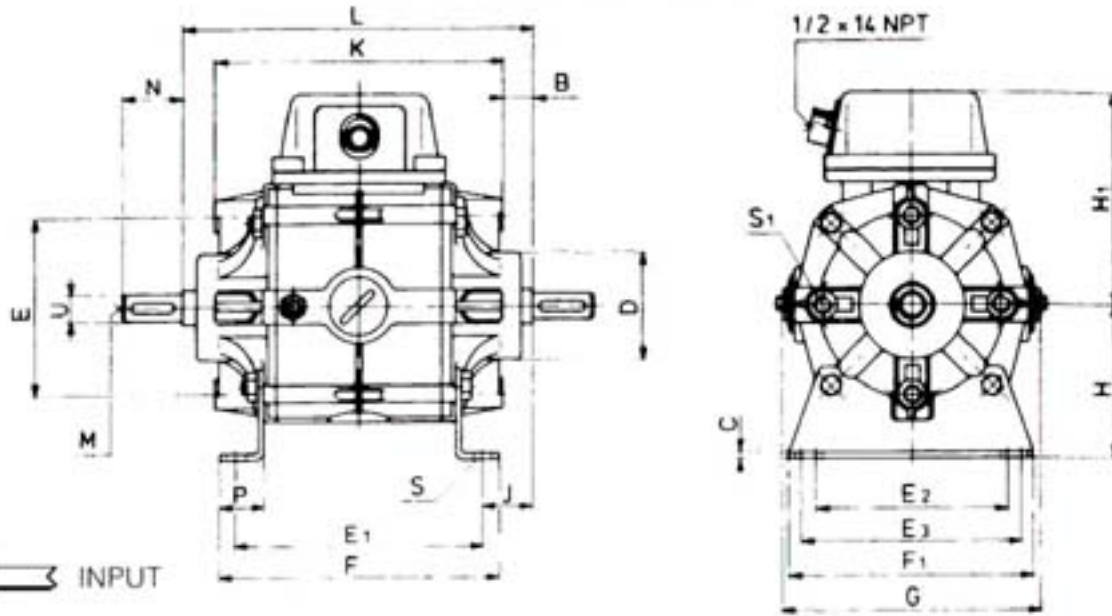


Design 640/660



Design 680/690

Dimensional Data



Electric Clutch/Electric Brake - Type 10 and Housed Electric Clutch Only - Type 09

Model 10.360 (without feet); Model 10.370 (with feet)

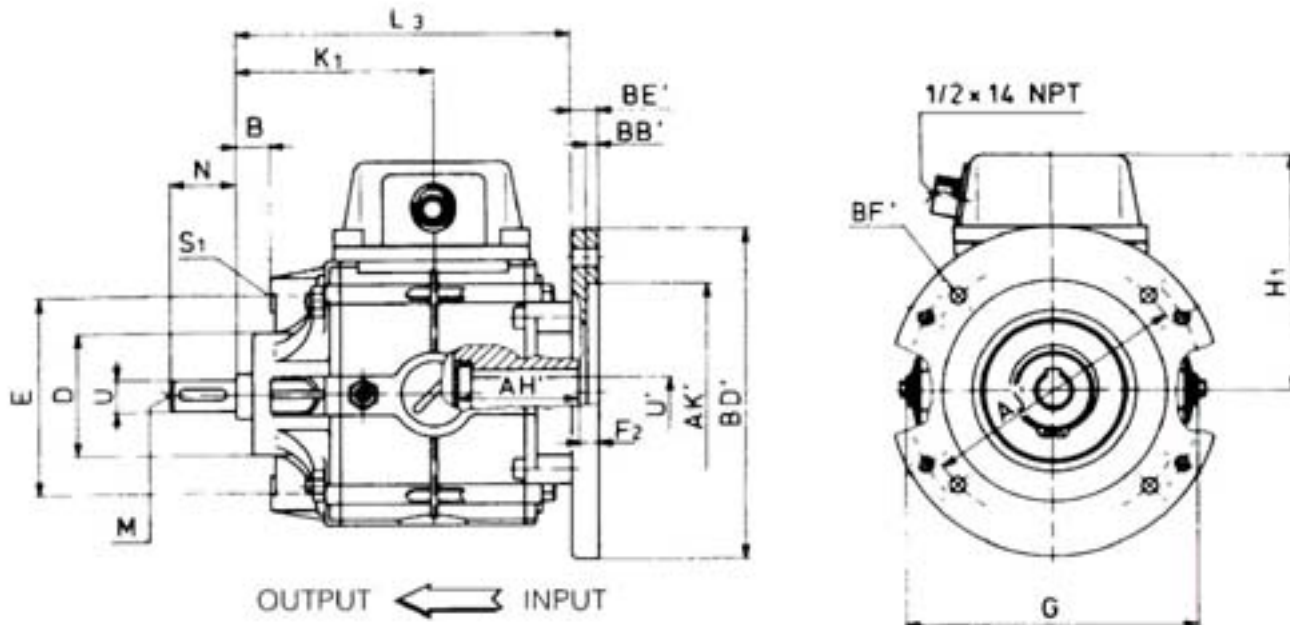
Size	Torque lb. ft.	Watts		B	C	D	E	E ₁	E ₂	E ₃	F	F ₁	G	H	H ₁	J	K	L	M	P	S	S ₁	Weight Lbs.
		Clutch	Brake																				
06	5	15	12	514	11	1.732 1.731	7.83	3.94	3.15	3.35	4.53	3.94	4.06	2.48	3.43	84	4.60	5.63	M4	71	275	M6	5.7
07	11	20	16	514	12	1.969 1.967	3.54	4.53	4.13	4.33	5.43	5.12	4.92	2.80	3.70	1.01	5.52	6.54	M5	98	354	M8	7.7
08	22	28	21	594	16	2.441 2.439	4.41	5.31	5.17	5.51	6.30	6.30	6.22	3.54	4.25	1.33	6.77	7.96	M8	1.10	354	M8	16.5
09	48	35	28	707	20	2.913 2.912	5.39	6.10	5.91	6.30	7.09	7.09	7.28	3.94	5.08	1.51	7.72	8.13	M10	1.18	430	M10	28.6
10	96	50	38	866	24	3.740 3.738	6.89	7.28	7.28	7.68	8.46	8.78	9.30	5.20	6.06	2.15	9.64	11.47	M12	1.50	510	M12	55.0
11	185	68	50	Consult Kebraco																			

Size	Input		Output		KEY
	U	N	U	N	
06	5000 4995	1.5	5000 4995	1.50	1/8 x 1/8
07	6250 6245	1.90	6250 6245	1.90	3/16 x 3/8
08	8750 8745	2.00	8750 8745	2.00	3/16 x 3/8
09	11250 11245	2.75	11250 11245	2.62	1/4 x 1/4
10	13750 13744	3.50	13750 13744	3.19	5/16 x 5/16
11	1625 16244	3.75	1625 16244	3.75	3/8 x 3/8

All dimensions given in inches

NOTE:
Larger sizes and other NEMA-adaptions are available.
Standard coil voltages are 6,12,24,48, or 95 volts DC.
Other voltages available on request.

Competitive mounting footprints available



**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

Model 10.440

Size	Torque lb. ft.	Watts		B	D	E	F ₂	G	H ₁	K ₁	L ₃	M	S ₁	Weight Lbs.
		Clutch	Brake											
06	5	15	12	514	1.732 1.731	2.83	220	4.06	3.43	2.81	4.80	M4	M6	6.2
07	11	20	16	514	1.969 1.967	3.54	220	4.92	3.70	3.27	5.40	M5	M8	8.4
08	22	28	21	594	2.441 2.439	4.41	220	6.22	4.25	4.00	6.58	M8	M8	17.6
09	48	35	28	707	2.913 2.912	5.39	260	7.28	5.08	4.56	7.60	M10	M10	28.6
10	96	50	38	866	3.740 3.738	6.89	417	9.30	6.06	5.79	9.15	M12	M12	50.6

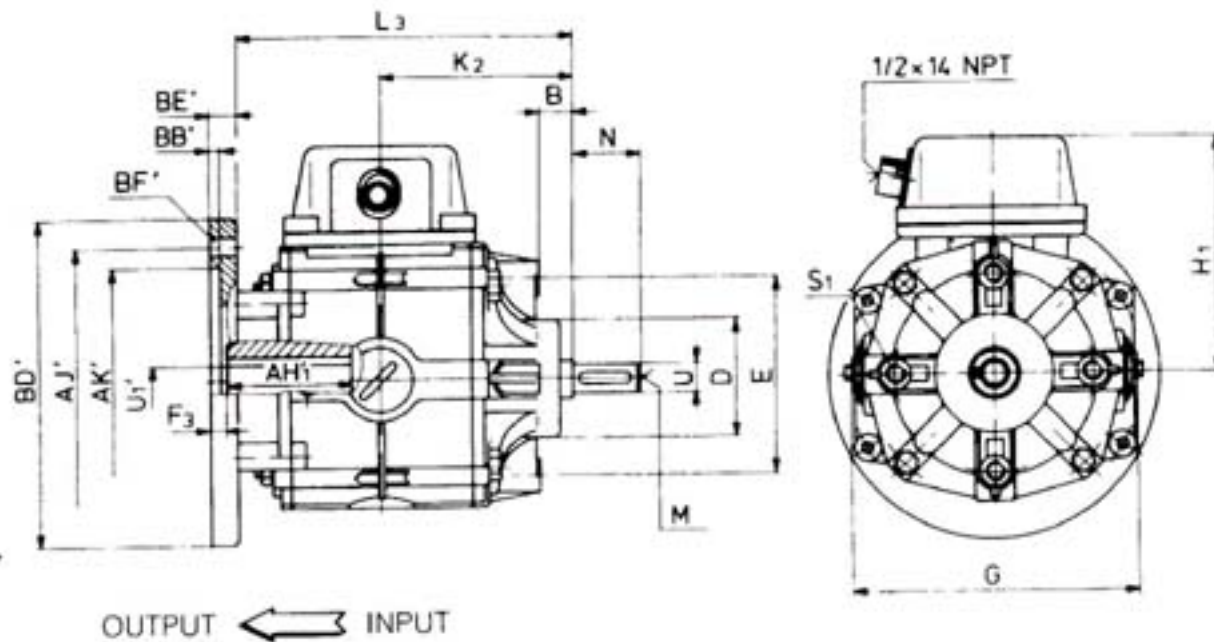
Size	Nema	Input Flange					Input		Output		Key	U' Max.	
		BD'	AK'	BE'	AJ'	BB'	BF'	U'	AH'	U			N
06	56C	6.5	4.503 4.501	574	5.875	18	406	6260 6252	2.05	6250 6245	1.90	3/16 x 3/16	6260 6252
07	56C	6.5	4.503 4.501	574	5.875	18	406	6260 6252	2.05	6250 6245	1.90	3/16 x 3/16	8761 8753
08	145TC	7.2	4.503 4.501	652	5.875	18	406	8761 8753	2.50	8750 8745	2.00	3/16 x 3/16	11261 11253
09	182TC	9.0	8.503 8.501	771	7.250	22	531	11261 11253	2.91	11250 11245	2.62	1/4 x 1/4	13763 13754
10	215TC	10.5	8.503 8.501	1086	7.250	22	531	13763 13754	3.38	13750 13744	3.19	5/16 x 5/16	16263 16254

NOTE:

Larger sizes (185 lb. ft., 370 lb. ft.) and other NEMA-adaptions are available.

Standard coil voltages are 6, 12, 24, 48, or 95 volts DC. Other voltages available on request.

All dimensions given in inches



**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

Model 10.490

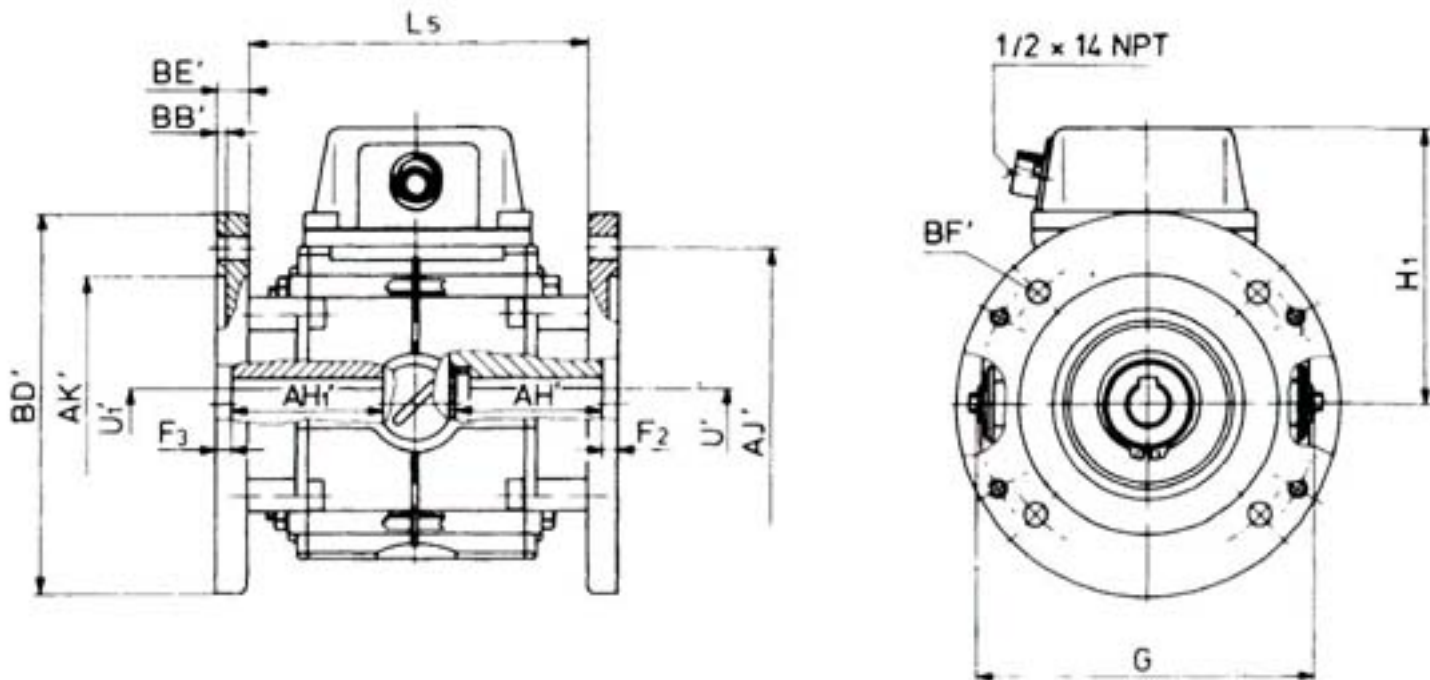
Size	Torque lb. ft.	Watts Clutch	Watts Brake	B	D	E	F ₃	G	H ₁	K ₂	L ₃	M	S ₁	Weight Lbs.
06	5	15	12	514	1.732 1.731	2.83	22	4.06	3.43	2.81	4.80	M4	M6	6.2
07	11	20	16	514	1.969 1.967	3.54	22	4.92	3.70	3.27	5.40	M5	M8	8.4
08	22	28	21	594	2.441 2.439	4.41	22	6.22	4.25	4.00	6.58	M8	M8	17.6
09	48	35	28	707	2.913 2.912	5.39	26	7.28	5.08	4.56	7.60	M10	M10	26.6
10	96	50	38	866	3.740 3.738	6.89	42	9.30	6.06	5.79	9.15	M12	M12	50.6

Size	Nema	Output Flange					Input		Output		Key	U ₁ Max.	
		BD'	AK'	BE'	AJ'	BB'	BF'	U	N	U ₁			AH ₁
06	56C	6.5	4.503 4.501	574	5.875	18	406	6250 6245	1.90	6260 6252	2.40	3/16 x 3/16	6260 6252
07	56C	6.5	4.503 4.501	574	5.875	18	406	6250 6245	1.90	6260 6252	2.40	3/16 x 3/16	6761 6753
08	145TC	7.2	4.503 4.501	652	5.875	18	406	8750 8745	2.00	8761 8753	2.95	3/16 x 3/16	11261 11253
09	182TC	9.0	8.503 8.501	771	7.250	22	531	11250 11245	2.75	11261 11253	3.38	1/4 x 1/4	13763 13754
10	215TC	10.5	8.503 8.501	1086	7.250	22	531	13750 13744	3.50	13763 13754	4.01	5/16 x 5/16	16263 16254

NOTE:

Larger sizes (185 lb. ft., 370 lb. ft.) and other NEMA-adaptions are available. Standard coil voltages are 6, 12, 24, 48, or 95 volts DC. Other voltages available on request.

All dimensions given in inches



OUTPUT ← INPUT

**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

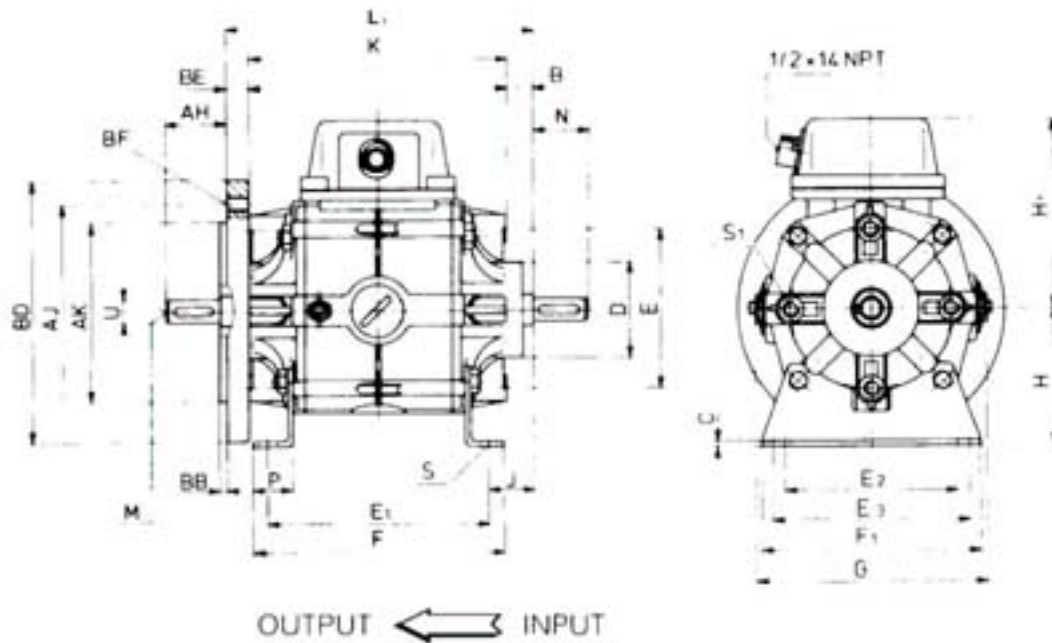
Model 10.520

Size	Torque lb. ft.	Watts		F ₂	F ₃	G	H ₁	L ₅	Weight Lbs.
		Clutch	Brake						
06	5	15	12	22	22	4.06	3.43	3.98	6.8
07	11	20	16	22	22	4.92	3.70	4.25	9.7
08	22	28	21	22	22	6.22	4.25	5.20	18.5
09	48	35	28	26	26	7.28	5.08	6.02	30.8
10	96	50	38	42	42	9.30	6.06	6.89	49.5

Size	Nema	Input/Output Flange						Input		Output		Key	U ₁ Max. U ₁ Max.
		BD'	AK'	BE'	AJ'	BB'	BF'	U	AH'	U ₁	AH ₁		
06	56C	6.5	4.503 4.501	.574	5.875	.18	.406	6260 6252	2.05	6260 6252	2.40	3/16 x 3/16	6260 6252
07	56C	6.5	4.503 4.501	.574	5.875	.18	.406	6260 6252	2.05	6260 6252	2.40	3/16 x 3/16	.8761 8753
08	145TC	7.2	4.503 4.501	.652	5.875	.18	.406	8761 8753	2.50	8761 8753	2.95	3/16 x 3/16	1.1261 1.1253
09	182TC	9.0	8.503 8.501	.771	7.250	.22	.531	1.1261 1.1253	2.91	1.1261 1.1253	3.38	1/4 x 1/4	1.3763 1.3754
10	215TC	10.5	8.503 8.501	1.086	7.250	.22	.531	1.3763 1.3754	3.38	1.3763 1.3754	4.01	5/16 x 5/16	1.6263 1.6254

NOTE:
Larger sizes
(185 lb. ft., 370 lb. ft.)
and other NEMA-adaptions are
available.
Standard coil voltages are
6, 12, 24, 48, or 95 volts DC.
Other voltages available on
request.

All dimensions given in inches



**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

Model 10.570 (without feet); Model 10.580 (with feet)

Size	Torque lb. ft.	Watts		B	C	D	E	E ₁	E ₂	E ₃	F	F ₁	G	H	H ₁	J	K	L ₁	M	P	S	S ₁	Weight Lbs.
		Clutch	Brake																				
06	5	15	12	514	114	1.732 1.731	2.83	3.94	3.15	3.35	4.53	3.94	4.06	2.48	3.43	84	4.60	5.51	M4	.71	275	M6	6.4
07	11	20	16	514	120	1.969 1.967	3.54	4.53	4.13	4.33	5.43	5.12	4.92	2.80	3.70	1.01	5.52	6.43	M5	.98	354	M8	8.8
08	22	28	21	594	160	2.441 2.439	4.41	5.31	5.12	5.51	6.30	6.30	6.22	3.54	4.25	1.33	6.77	7.84	M8	1.10	354	M8	18.0
09	48	35	28	707	200	2.913 2.912	5.39	6.10	5.91	6.30	7.09	7.09	7.28	3.94	5.08	1.51	7.72	8.85	M10	1.18	430	M10	30.8
10	96	50	38	866	240	3.740 3.738	6.89	7.28	7.28	7.68	8.46	8.78	9.30	5.20	6.06	2.15	9.84	11.29	M12	1.50	510	M12	52.8

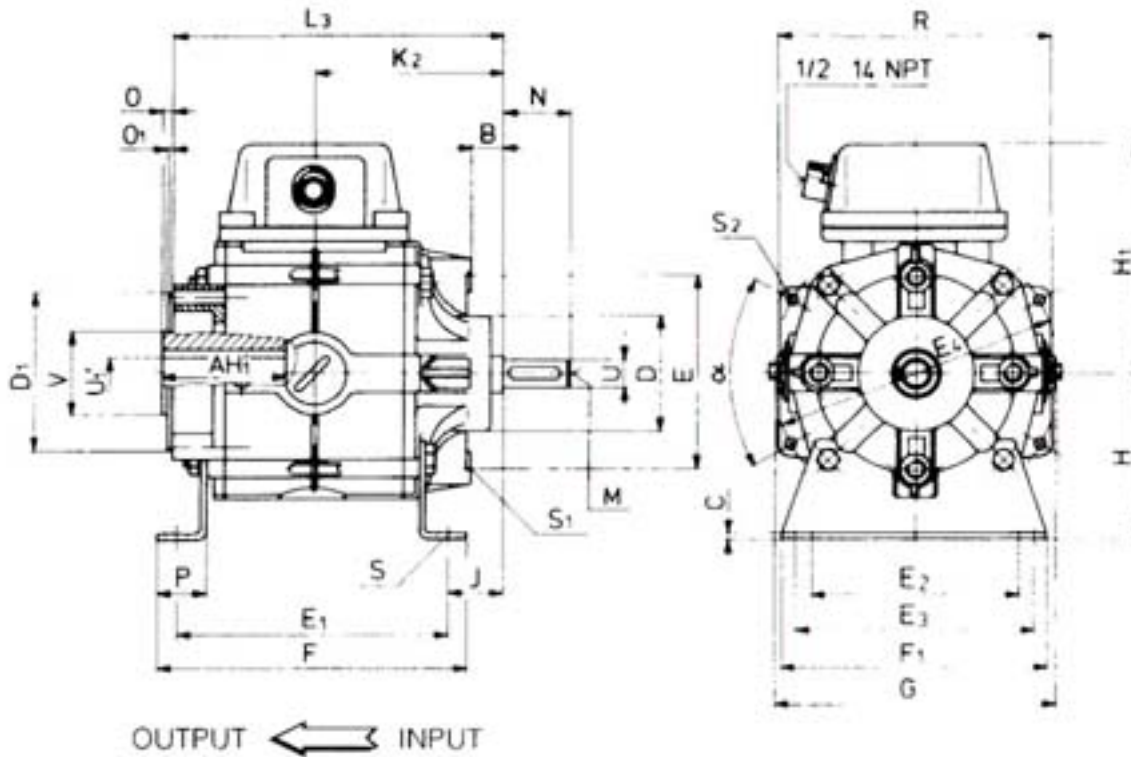
Size	Nema	Output Flange					Input		Output		Key	
		BD	AK	BE	AJ	BB	BF	U	N	U		AH
06	56C	6.5	4.500 4.497	394	5.875	12	3/8-16 UNC	6250 6245	1.90	6250 6245	2.02	3/16 x 3/16
07	56C	6.5	4.500 4.497	394	5.875	12	3/8-16 UNC	6250 6245	1.90	6250 6245	2.02	3/16 x 3/16
08	145TC	6.5	4.500 4.497	474	5.875	12	3/8-16 UNC	8750 8745	2.00	8750 8745	2.12	3/16 x 3/16
09	182TC	9.0	8.500 8.497	551	7.250	28	3/8-16 UNC	1.1250 1.1245	2.75	1.1250 1.1245	2.90	1/4 x 1/4
10	215TC	9.0	8.500 8.497	708	7.250	28	3/8-16 UNC	1.3750 1.3744	3.50	1.3750 1.3744	3.47	5/16 x 5/16

NOTE:

Larger sizes
(185 lb. ft., 370 lb. ft.)
and other NEMA-adaptions are
available.

Standard coil voltages are
6, 12, 24, 48, or 95 volts DC.
Other voltages available on
request.

All dimensions given in inches



**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

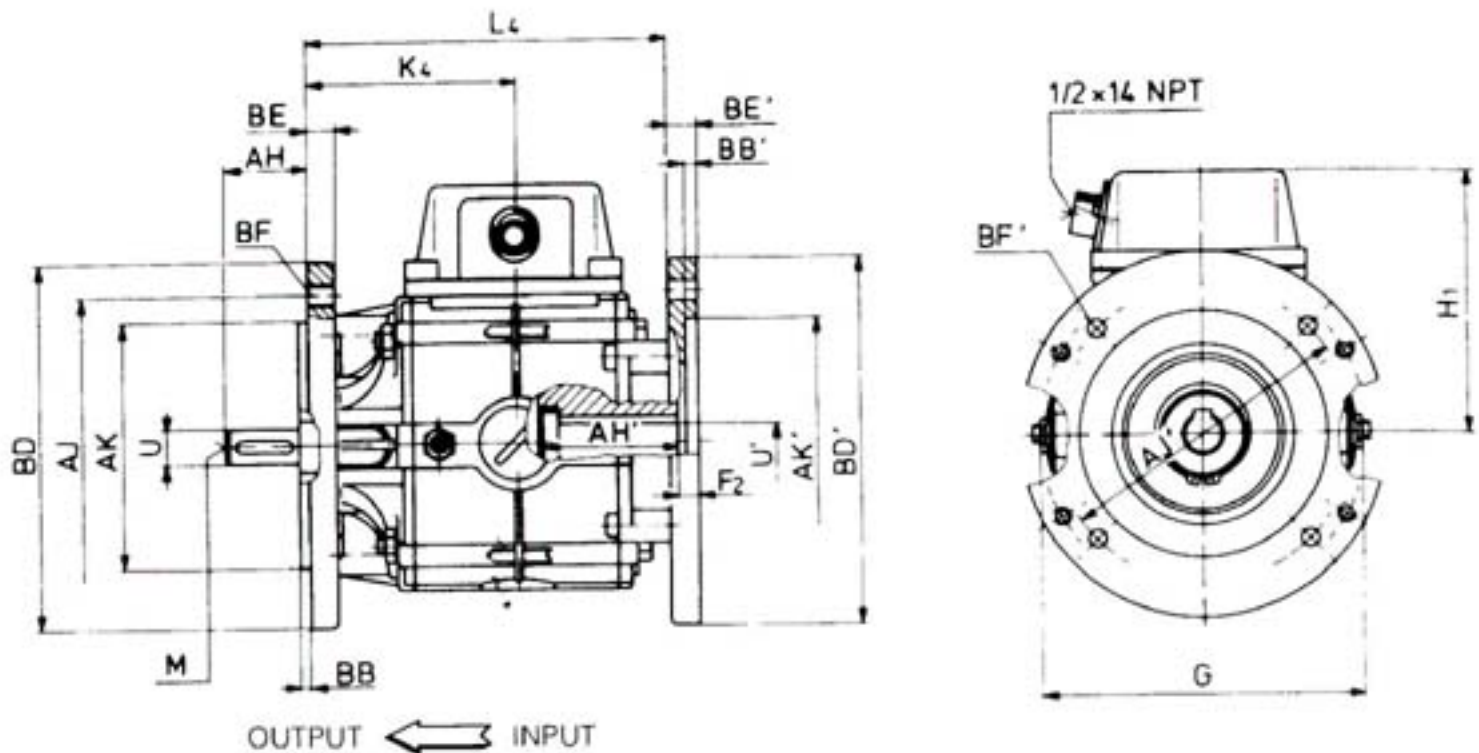
Model 10.620 (without feet); Model 10.630 (with feet)

Size	Torque lb. ft.	Watts Clutch	Watts Brake	B	C	D	D ₁	E	E ₁	E ₂	E ₃	E ₄	F	F ₁	G	H	H ₁	J	K ₂	L ₃	M	D	D ₁	P	R	S	S ₁	S ₂	V	Ø	Weight lbs.
06	5	15	12	514	114	1.732 1.731	2.367 2.360	2.83	3.94	3.15	3.35	4.25	4.53	3.94	4.05	2.48	3.43	.84	2.81	4.83	M4	354	157	71	4.09	275	M6	217	1.18	60"	5.2
07	11	26	16	514	120	1.969 1.967	2.756 2.754	3.54	4.52	4.13	4.33	5.04	5.43	5.12	4.92	2.80	3.70	1.01	3.77	5.39	M5	354	157	98	4.84	354	M8	256	1.38	60"	8.6
08	22	28	21	594	160	2.441 2.439	3.150 3.148	4.41	5.31	5.12	5.51	6.50	6.70	6.30	6.22	3.54	4.25	1.33	4.00	6.58	M8	433	157	110	6.10	354	M8	335	1.77	64"	16.9
09	48	25	28	707	200	2.913 2.912	3.740 3.738	5.29	6.10	5.91	6.30	7.48	7.09	7.05	7.28	3.94	5.08	1.51	4.56	7.60	M10	510	157	118	7.00	430	M10	335	1.97	62"	27.5
10	95	50	38	868	236	3.740 3.738	4.231 4.229	6.89	7.78	7.28	7.68	9.53	8.46	8.78	9.30	5.29	6.06	2.15	5.79	9.25	M12	670	200	150	9.00	510	M12	410	2.75	60"	49.5

Size	Input		Output		Key	U ₁ Max.
	U	N	U ₁	HF ₁		
06	5000	1.50	5010	2.24	5/8 x 3/8	6260
	4926		5002			6252
07	6250	1.90	6260	2.40	5/8 x 3/8	8761
	6245		6252			8753
08	8750	2.00	8761	2.95	5/8 x 3/8	11261
	8745		8753			11253
09	11250	2.75	11261	3.38	5/8 x 3/4	13763
	11245		11253			13754
10	13750	3.50	13763	4.01	5/8 x 5/8	16263
	13744		13754			16254

NOTE:
Larger sizes
(185 lb. ft., 370 lb. ft.)
and other NEMA-adaptions are
available.
Standard coil voltages are
6,12,24,48, or 95 volts DC.
Other voltages available on
request.

All dimensions given in inches



**Electric Clutch/Electric Brake - Type 10 and
Housed Electric Clutch Only - Type 09**

Model 10.670

Size	Torque lb. ft.	Watts		F ₂	G	H ₁	K ₄	L ₄	M	Weight Lbs.	
		Clutch	Brake								
06	5	15	12	220	4.06	3.43	2.69	4.69	M4	6.8	
07	11	20	16	220	4.92	3.70	3.15	5.28	M5	9.5	
08	22	28	21	220	6.22	4.25	3.87	6.46	M8	19.1	
09	48	35	28	260	7.28	5.08	4.29	7.32	M10	31.9	
10	96	50	38	417	9.30	6.06	5.50	8.97	M12	55.0	
11	185	68	50	Consult KebcO							

NOTE:
Larger sizes
and other NEMA-adaptions are
available.
Standard coil voltages are
6, 12, 24, 48, or 95 volts DC.
Other voltages available on
request.

All dimensions given in inches

Size	Nema	Input Flange						Output Flange						Input		Output		Key	U' Max.
		BD'	AK'	BE'	AJ'	BB'	BF'	BD	AK	BE	AJ	BB	BF	U'	AH'	U	AH		
06	56C	6.5	4.503 4.501	5.74	5.875	.18	.406	6.5	4.500 4.497	.394	5.875	.12	3/8-16	6260 6252	2.05	6250 6245	2.02	3/13 x 3/16	6260 6252
07	56C	6.5	4.503 4.501	5.74	5.875	.18	.406	6.5	4.500 4.497	.394	5.875	.12	3/8-16	6260 6252	2.05	6250 6245	2.02	3/13 x 3/16	6260 8753
08	145TC	7.2	4.503 4.501	6.52	5.875	.18	.406	6.5	4.500 4.497	.474	5.875	.12	3/8-16	8761 8753	2.50	8750 8745	2.12	3/13 x 3/16	1.1261 1.1253
09	182TC	9.0	8.503 8.501	7.71	7.250	.22	.531	9.0	8.500 8.497	.551	7.250	.28	3/8-16	1.1261 1.1253	2.91	1.1250 1.1245	2.90	1/4 x 1/4	1.3763 1.3754
10	215TC	10.5	8.503 8.501	1.086	7.250	.22	.531	9.0	8.500 8.497	.708	7.250	.28	3/8-16	1.3763 1.3754	3.38	1.3750 1.3744	3.47	5/16 x 5/16	1.6263 1.6254
11	254TC	13	8.503 8.501	1.77	7.250	.22	.531	9.5	8.500 8.497	.738	7.250	.28	1/2-13	1.6263 1.6254	3.75	1.6250 1.6244	3.75	3/8 x 3/8	2.0013 2.0004

Application Engineering

Size Selection

The selection of the KEBCO Combibox is made according to various considerations depending on the application.

The most important criteria are:

1. Torque
2. Braking Time
3. Heat
4. Service Life

The following terms are used in the calculation:

M_{r1}	= required torque	(Nm)
M_{201}	= rated torque of Combibox	(Nm)
M_d	= dynamic load torque	(Nm)
M_L	= static load torque	(Nm)
J	= moment of inertia	(Kgm ²)
F	= force	(N)
r	= lever arm	(m)
i	= reduction n_1/n_2	
α	= angular acceleration	(rad/s ²)
ω	= angular frequency	(rad/s)
n	= speed	(rpm)
P	= power	(watts)
t	= max. accel or decel time	(ms)
t_1	= switching time	(ms)
W_R	= friction per engagement	(J)
W_{Rmax}	= max. permissible friction per engagement	(J)
P_R	= friction work per second	(J/s)
P_{Rmax}	= max. permissible friction work per second	(J/s)
$W_{R0.1}$	= friction work until 0.1 mm wear is reached	(J)
S	= cycles per sec.	(cycles/sec)
$L_{0.1}$	= service life in cycles for 0.1mm wear	(cycles)
L_R	= service life in cycles until the Combibox is readjusted	(cycles)
X	= nominal air gap	(mm)
X_N	= max. air gap for readjustment	(mm)
K	= safety factor (KEBCO recommends a value of at least two)	

Tables

The average values mentioned in the tables have been determined by tests. They can fall below or exceed the average values depending on the operation condition.

The value $W_{R0.1}$ is mainly influenced by the temperature at the friction surfaces. This temperature can highly vary depending on the speed, the moment of inertia, and the cycle rate. Therefore these values are only approximate values.

Additional Technical Data in S.I. units

Type 09, 10 Combibox

Size	M_{20}		P_{20} [W]		X[mm]	X_N [mm]	n_{max} [rpm]
	[lb-ft]	[Nm]	Clutch	Brake			
06	5	7	15	12	0.20	0.6	3000
07	11	15	20	16	0.30	0.9	3000
08	22	30	28	21	0.35	1.05	3000
09	48	65	35	28	0.35	1.05	3000
10	96	130	50	38	0.40	1.20	3000
11	185	250	68	50	0.50	1.50	3000

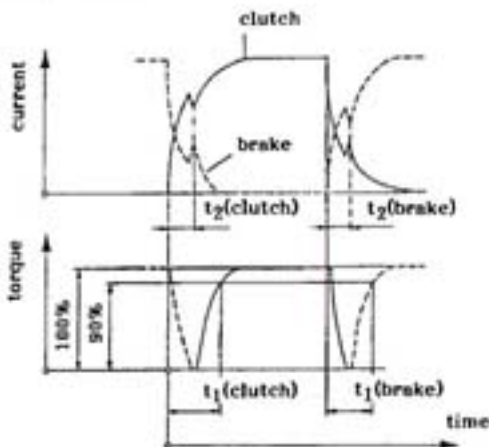
Size	J[kgm]		P_{Rmax} [J/s]		W_{Rmax}	$W_{R0.1}$ [J]
	Rotar	Armature	Clutch	Brake		
06	$1.07 \cdot 10^{-1}$	$0.84 \cdot 10^{-1}$	81	59	$1.9 \cdot 10^1$	$9.5 \cdot 10^1$
07	$2.98 \cdot 10^{-1}$	$2.62 \cdot 10^{-1}$	114	80	$3.1 \cdot 10^1$	$16.3 \cdot 10^1$
08	$7.78 \cdot 10^{-1}$	$8.59 \cdot 10^{-1}$	161	114	$4.8 \cdot 10^1$	$25.3 \cdot 10^1$
09	$23.29 \cdot 10^{-1}$	$23.08 \cdot 10^{-1}$	228	164	$7.5 \cdot 10^1$	$40.9 \cdot 10^1$
10	$67.4 \cdot 10^{-1}$	$91.07 \cdot 10^{-1}$	323	236	$12.5 \cdot 10^1$	$66.6 \cdot 10^1$
11	$220 \cdot 10^{-1}$	$330 \cdot 10^{-1}$	458	339	$20.0 \cdot 10^1$	$104 \cdot 10^1$

Switching Times

Size	Engagement Time (s)		Delay Time (s)		V _{DC} Voltage Drop (for nominal voltage)			
	Clutch	Brake	Clutch	Brake	t ₁ (clutch)	t ₁ (brake)	t ₂ (clutch)	t ₂ (brake)
06	50	45	18	18	18	18	8	10
07	90	50	28	20	40	25	10	15
08	100	70	38	25	45	30	15	20
09	200	150	45	50	80	70	25	30
10	250	180	75	55	120	80	35	40
11	280	210	90	65	160	110	45	50

All Values given in milliseconds

Switching Time



NOTE:

- t_2 (clutch) = Delay time – time required, before the armature makes contact with the friction lining of the clutch.
- t_2 (brake) = Delay time – time required, before the armature makes contact with the friction lining of the brake.
- t_1 (clutch) = Engagement time – time needed until clutch has 90% nominal torque.
- t_1 (brake) = Engagement time – time needed until brake has 90% nominal torque.

Conversion Factors

To Obtain	Multiply number of	By
Length		
mm	inches	25.4
meters	feet	3.28
Rotation		
rad/sec	RPM	$\frac{2\pi}{60}$
Torque		
NM	lb ft	1.36
lb ft	NM	0.738
lb in	lb ft	12
oz in	lb ft	192
Moment of Inertia		
Kgm ₂	lb ft ₂	0.042
lb ft ₂	Kgm ₂	23.7
lb ft ₂	slug ft ₂	32.2
lb in ₂ sec ₂	lb ft ₂	.0373
lb in ₂	lb ft ₂	144
Oz in ₂	lb ft ₂	2300
Power		
Watts	HP	746
HP	lb ft/min	33,000
HP	lb ft/sec	550

Service Lifetime

If the moment of inertia, the speed and the permissible cycle time of the machine are known, the torque of the Combibox can be determined.

If the masses to be cycled rotate at a speed other than that of the shaft cycled, by the Combibox, the moments of inertia must be related to this shaft.

Also the moment of inertia of the armature must be considered. A safety factor of at least 2 is standard.

1. Torque

1.1

Load torque (static load)

$$M_L = F \cdot r$$

1.2

Acceleration and braking torque (dynamic load)

$$M_a = J \cdot \alpha$$

$$M_a = 1.046 \cdot 10^7 \frac{n \cdot J}{t - t_1}$$

1.3

Required torque

$$M_N = M_a \pm M_L$$

$$M_N = 1.046 \cdot 10^7 \frac{n \cdot J}{t - t_1} \pm M_L$$

+M_L to clutch -M_L to brake

Exception:

Lowering and descending motion

-M_L to clutch +M_L to brake

If the moment of inertia is unknown and the drive power is fixed, the required torque is determined from:

$$M_N = 9.55 \cdot 10^3 \frac{P}{n}$$

1.4

Nominal torque of Combibox

$$M_{2N} = M_N \cdot K$$

Safety factor $K \geq 2$

2. Acceleration/Deceleration time

$$t = \left(\frac{J \cdot \omega}{M_{2N} \pm M_L} \right) \left(\frac{1}{1,000} \right) + t_1$$

$$t = 1.046 \cdot 10^7 \frac{J \cdot n}{M_{2N} \pm M_L} + t_1$$

-M_L to clutch +M_L to brake

Exceptions:

Lowering and descending motion

+M_L to clutch -M_L to brake

3. Heat

During each acceleration or braking period a certain amount of slip occurs which causes heat by friction.

3.1

Friction per cycle

$$W_R = \frac{1}{2} J \cdot \omega^2 \frac{M_{2N}}{M_{2N} \pm M_L}$$

$$W_R = \frac{J \cdot n^2}{182.5} \frac{M_{2N}}{M_{2N} \pm M_L}$$

-M_L to clutch +M_L to brake

Exceptions:

Lowering and descending motion

+M_L to clutch -M_L to brake

The friction work per engagement should not exceed the permissible value W_{Rmax}
 $W_R < W_{Rmax}$

3.2

Friction work per second

If the number of cycles per sec. "S" is known, the friction work per sec. can be calculated:

$$P_R = W_R \cdot S$$

This value should not exceed the permissible value P_{Rmax}

$$P_R < P_{Rmax}$$

4. Service life

4.1

Service life in cycles for 0.1 mm wear

The service life, expressed in cycles can be calculated with the aid of the friction work $W_{R0.1}$

$$L_{0.1} = \frac{W_{R0.1}}{2W_R}$$

4.2

Service life in cycles until readjustment

With the variable X_n the service life before readjustment is required can be calculated.

$$L_n = \frac{X_n - X}{0.1} \cdot L_{0.1}$$

The variable X_n is a recommended value. According to the application it must be checked when the readjustment has to be made. Typically the brake can be adjusted 2 or 3 times. See KEBCO for details.

Use S.I. units in all calculations

Electronic Accessories

All KEBCO clutch/brake products are DC operated. Consequently, rectification of AC input power or use of a DC power supply is needed. KEBCO supplies a wide range of electronic switches from standard rectifiers to PWM Rapid Switches for high cycle rate applications. (Please see our Electronics catalog for further information.)

Rectifiers

Basic types:

01.91.010-0019 for 120/95 Volts AC/DC

02.91.010-0019 for 230/95 Volts AC/DC

Useful for DC side switching and include electronic arc suppression protection.

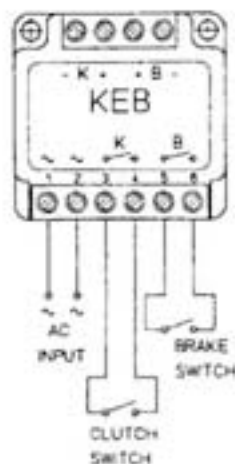


Figure 1

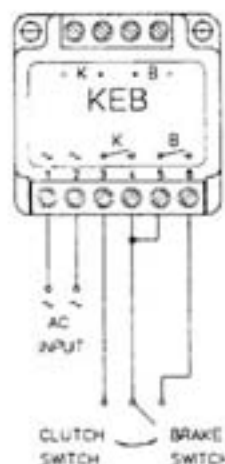


Figure 2

Electronic Switches

KEBCO Rapid Switch 33.94 (available for clutch/brake sizes 06,07, and 08 - 12V coils) The 33.94 is a current over excitation control designed specifically for use with KEBCO electromagnetic DC clutch/brakes. By using advanced PWM techniques extreme precision is attained.

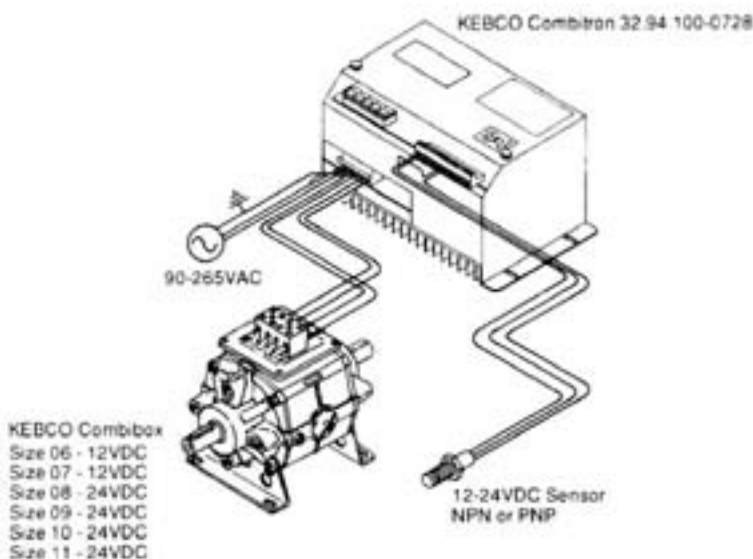
KEBCO Rapid Switch 32.94 (clutch/brake sizes 06, 07 - 12V; 08, 09, 10,11 -24V coils) The 32.94 is a complete microprocessor based PWM current over excitation control which was designed for use with KEBCO clutch/brakes. When maximum cycle rates and repeatability are necessary, select the 32.94.

Torque Controls

05.91.010-0009 single torque control

05.91.010-0009 dual torque control

Useful for soft stopping applications, the 05.91 series of controls converts 120VAC to a variable 30 to 95V DC. Soft starting is best achieved with a KEBCO Inverter Drive, please see our inverter catalogs for further details.



KEBCO Combibox
Size 06 - 12VDC
Size 07 - 12VDC
Size 08 - 24VDC
Size 09 - 24VDC
Size 10 - 24VDC
Size 11 - 24VDC

OPEN LOOP AC MOTOR CONTROL for START-STOP INDEXING

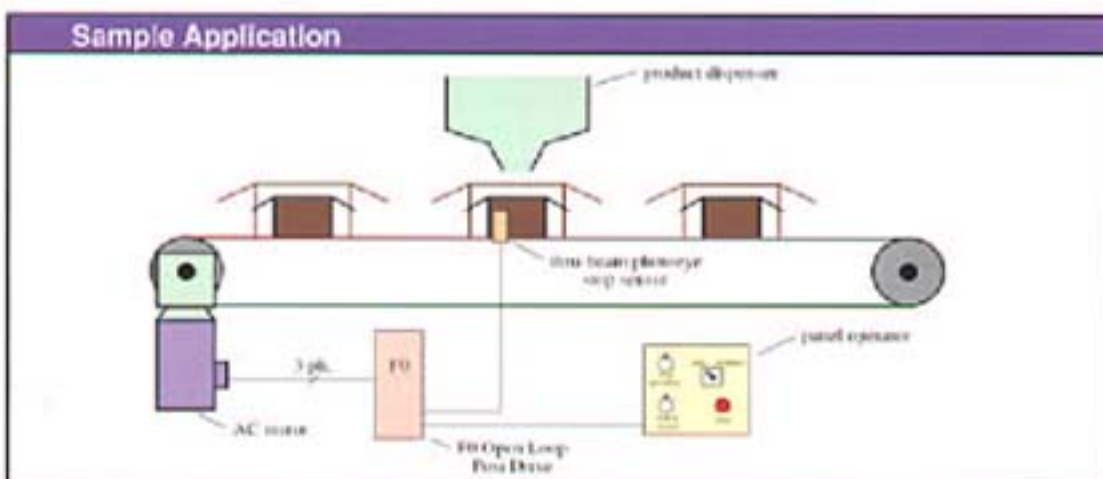


A HIGH PERFORMANCE, COST EFFECTIVE ALTERNATIVE TO:

- Servos
- Cam Indexers
- DC Drives
- Clutch/Brakes
- Brake Motors

FO FEATURES:

- achieves stopping position without closed loop
- adjustable set speed (via 0..10VDC, ± 10 VDC, digital) without affecting stopping position
- adjustable stopping position scaled via a 0-10VDC signal
- capable of high start/stop scaled rates (up to 120/ min!)
- maintains tight, repeatable accuracy
- programmable soft start and stop, reversible
- uses standard, 3 phase AC motors
- low cost, rugged, reliable and flexible



PROVEN APPLICATIONS INCLUDE:

- Packaging - cartoners, casepackers, fillers, baggers, sealers
- Automation - pick and place, in-line & rotary, robots
- Material Handling - indexing and feed conveyors



KEBCO COMBIVERT

High quality general purpose frequency inverters. Excellent for indexing systems, complex profile requirements, and high dynamic applications.

Rating: 0.5... 260 HP
 Connection: 1/3-phase
 230V, 460V



KEBCO COMBIDRIVE

High performance closed loop frequency inverter with either an angular synchronization control or an absolute/incremental positioning control built right into the drive.

Rating: 2 HP... 100 HP
 Connection: 230 V 460 V



KEBCO COMBIDYN

AC-Servo amp/motor packages with peak torques of 5 x nominal.

Torque: 0.16... 41.9 Nm
 Speed: 1000/1500/
 2000/2500/3000
 4000/6000 rpm



KEBCO COMBIVIS

Quickly program one or multiple KEBCO inverters with a PC-based software program. Supports live-time communication along with upload/download and scope-mode functions.

KEBCO COMBICOM

Communication equipment for networking KEBCO inverters to industrial bus systems, PC's, and PLC's



KEBCO COMBIGEAR

Compact, high performance integral gearmotors. Helical gearing available in inline, parallel shaft mount, and right angle shaft mount configurations. Gearmotors can be supplied with any combination of spring set brake, encoder, or force cooling fan.

Rating: 1/6... 100HP



KEBCO COMBISTOP

Fail safe brakes

KEBCO COMBINORM

Electromagnetic clutches and brakes

KEBCO COMBIPERM

Permanent magnetic clutches and brakes

KEBCO COMBIBOX

Clutch-Brake-Modules

KEBCO COMBITRON

Rectifiers and Controls