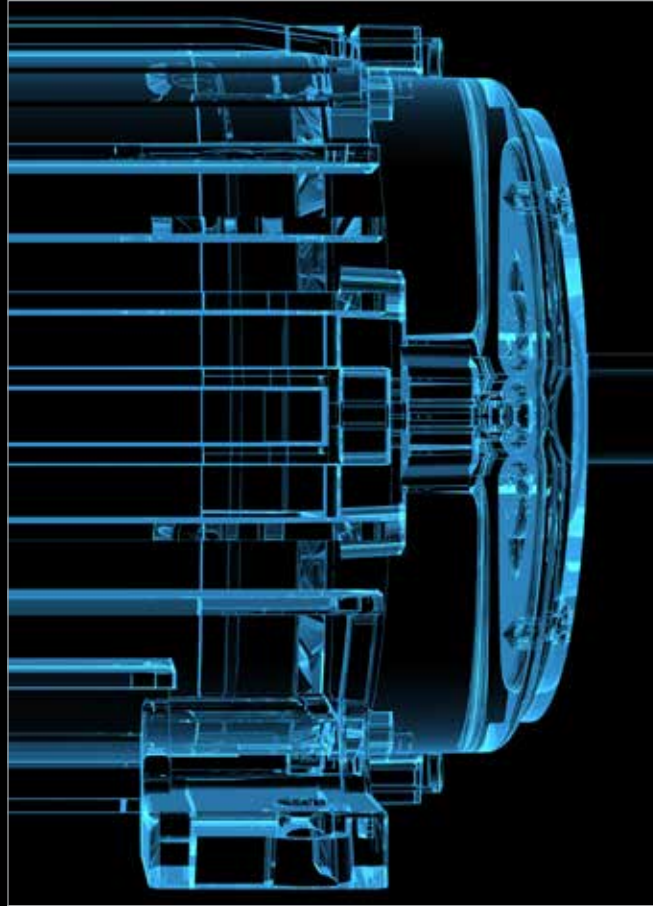


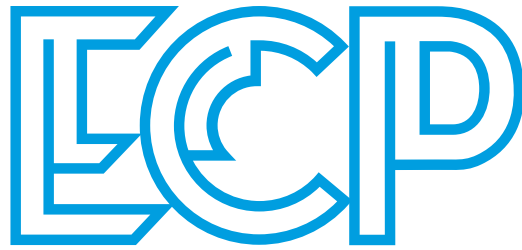
THE ERODEX GROUP



ENGINEERING CARBON PRODUCTS



**ECP**



## ENGINEERING CARBON PRODUCTS

ECP is the division of Erodex dedicated to the manufacture and supply of carbon brushes and related products for electric motors. Formed in 1965, and a part of Erodex since 1999, ECP has a great depth of experience, and now, with the Erodex policy for service and customer support, it has expanded to be a very considerable force in this sector.

This unique catalogue from ECP details our comprehensive range of ancillary products such as slip rings; brush holders; commutators; contacts and commutator maintenance products. The policy is to supply quality products, which perform consistently in key areas. Our technical team are available for on-site surveys, and world class technical support for any 'problem' motors.

A breakdown service is in place that means that carbon brushes can be manufactured on an emergency basis, without a price premium, and are ready for despatch or collection on the same day.



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■ Commutators.....page 9



■ Slipring Brush Holders.....page 10 - 16



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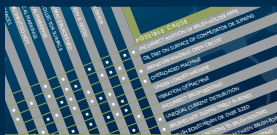
■ The Bearing Protector.....page 22



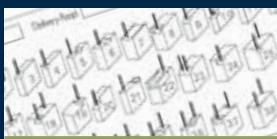
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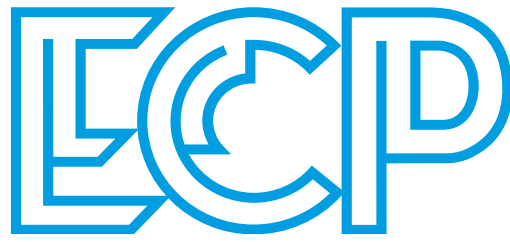
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## Carbon Brushes



**Engineering Carbon Products has built an enviable reputation for high quality brushes manufactured using world class materials, delivered when and wherever they are required. At ECP, it is our policy to exceed your expectations.**

- Two UK manufacturing sites
- Full technical support
- Emergency same-day service
- Free carbon brush site surveys

# Carbon Brushes

All of our Brushes are manufactured using material of the highest quality. We are happy to advise on grade selection and Brush design. Manufacturing survey sheets are available at the back of this catalogue that are designed to make the process accurate, simple and fast. Our survey sheets are also available for download from [www.engineeringcarbonproducts.com](http://www.engineeringcarbonproducts.com).

Currently supplied industries include:

- Plastic/Rubber Extrusion
- Paper/Packaging
- Printing
- Polythene Film
- Quarries/Aggregates
- Water Treatment
- Motor Repair/Industrial Maintenance
- Lift Repair
- Power Stations
- Steel Rolling Mills
- Uninterruptible Power Supplies
- Recycling
- Disabled Carriages



At Engineering Carbon Products, we are confident that we can offer quality products which perform in a consistent manner in key areas such as current distribution, wear rates, coefficient of friction, temperature, and voltage drop.

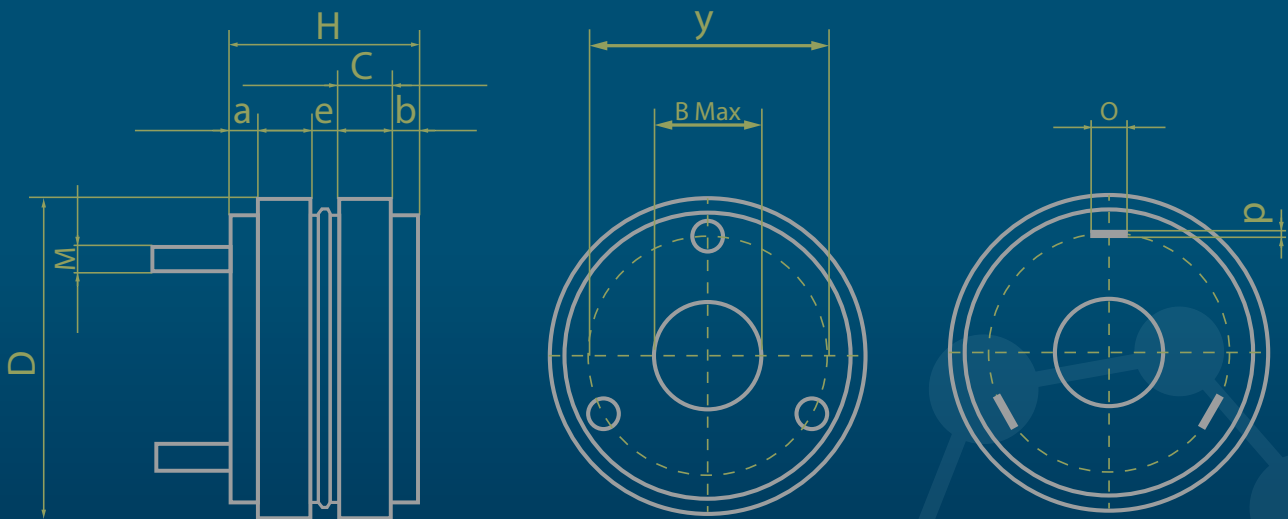
Tests have shown better and more consistent rates of wear than certain other grades currently available on the market.

# Sliprings



**ECP carries a wide range of standard moulded sliprings, but we are always happy to quote for different construction styles, materials or sizes. Technical assistance is also available if required.**

# Sliprings with 2 Rings

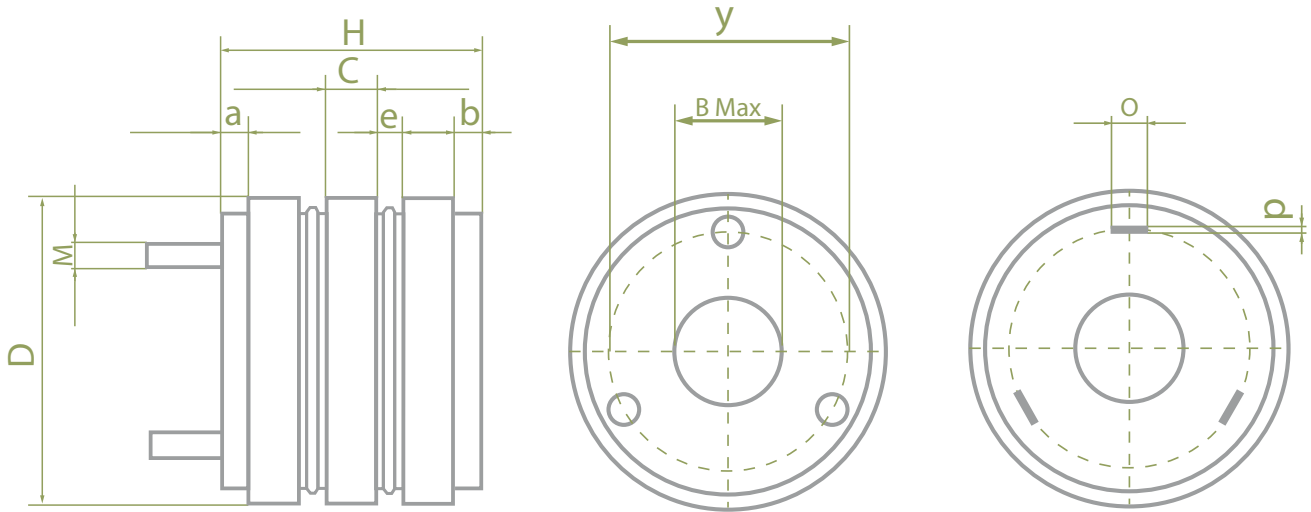


Dimensions in mm unless otherwise stated.

Part Number	D	C	B-Max	H	a	b	e	Y	M
2/20/5	20	5	8	17	1,5	1,5	4	13	1
2/27/8	27	8	12	20	1,5	1,5	1,1	19,5	1,5
2/40/7	40	7	22	29	5	5	5	31	2
2/45/10	45	10	23	27	2	2	3	28	4
2/50/8	50	8	28	30	4	4	6	35	3
2/52/10	52	10	28	30	1	2	7	40	4
2/52/14	52	14	27	41	3	3	7	38	5
2/60/12	60	12	29	45	7	7	7	40	5
2/70/8	70	8	36	27	4	4	3	50	5
2/70/12,5	70	12,5	38	42	5	5	7	51	5
2/80/10	80	10	44	40	6	6	8	60	6
2/80/15	80	15	49	47	6	6	5	60	5
2/90/12,5	90	12,5	51	42	5	5	7	67	6
2/100/12,5	100	12,5	64	44	6	6	7	78	6
2/120/12	120	12	64	44	5	5	10	90	8
2/130/10	130	10	77	40	5	5	10	100	5
2/140/10	140	10	85	46	8	8	10	112	8
2/140/12	140	12	85	50	8	8	10	112	8
2/150/12	150	12	82	62	8	8	22	114	10
2/160/16	160	16	100	58	8	8	10	128	3
2/180/15	180	15	110	56	8	8	10	140	12

- B-Max denotes the largest shaft diameter for each size of slipring
- Please let us know of any special fixing, keyway or sizing requirements
- Please state amps when ordering

# Sliprings with 3 Rings



Dimensions in mm unless otherwise stated.

Part Number	D	C	B-Max	H	a	b	e	Y	M
3/25/5	25	5	11	29	3	3	4	18,5	1,5
3/38/5	38	5	14	33	4	4	5	25	3
3/40/9	40	9	19	43	3	3	5	30	3
3/50/8	50	8	26	42	3	3	6	37	3
3/50/10	50	10	24	54	5	5	7	36	4
3/52/12,5	52	12,5	28	57,5	3	3	7	39	3
3/60/7	60	7	33	47	6	6	7	43	10 x I
3/60/10	60	10	36	52	5	5	6	45	10 x I
3/60/12	60	12	27	62	6	6	7	40	5
3/65/12	65	12	36	62	6	6	7	48	4
3/70/8	70	8	35	44	4	4	6	50	5
3/70/12,5	70	12,5	44	61,5	5	5	7	53	10 x I
3/80/10	80	10	47	52	4	4	7	60	5
3/80/12,5	80	12,5	46	61,5	5	5	7	59	5
3/90/12,5	90	12,5	54	61,5	5	5	7	68	6
3/90/14	90	14	54	84	9	9	12	68	6
3/90/15	90	15	62	79	8	8	9	71	10 x I
3/90/16	90	16	49	111	12,5	12,5	19	63,5	6
3/100/12,5	100	12,5	50	69,5	8	8	8	76	8
3/100/13	100	13	51	57	5	5	4	74	5
3/100/16	100	16	50	80	8	8	8	76	8
3/100/20	100	20	50	92	8	8	8	76	8

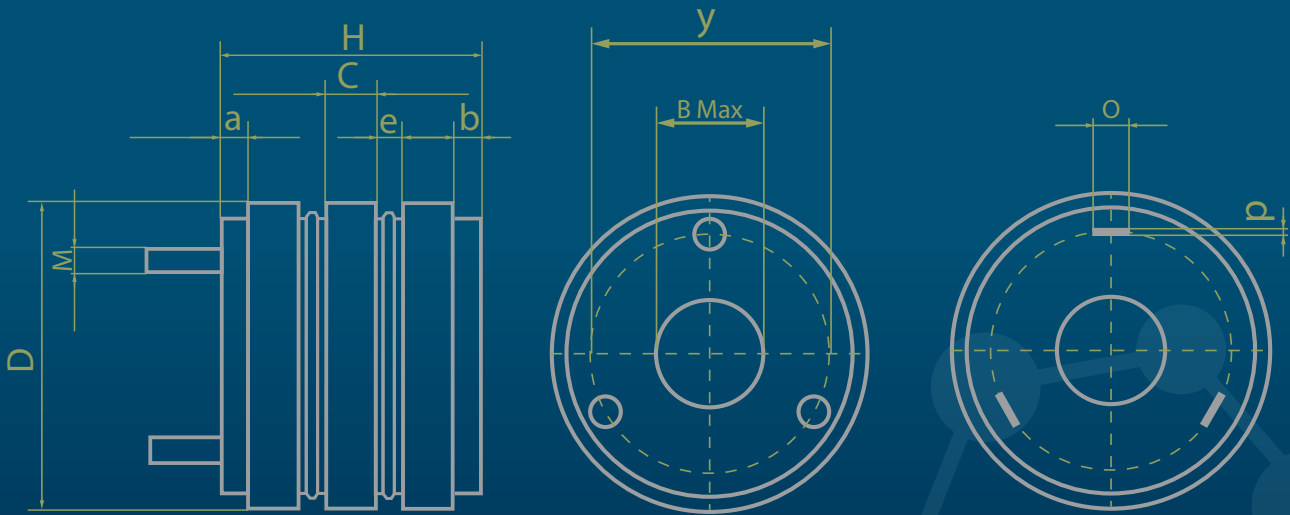
■ B-Max denotes the largest shaft diameter for each size of slipring

■ Please let us know of any special fixing, keyway or sizing requirements

■ Please state amps when ordering



# Sliprings with 3 Rings

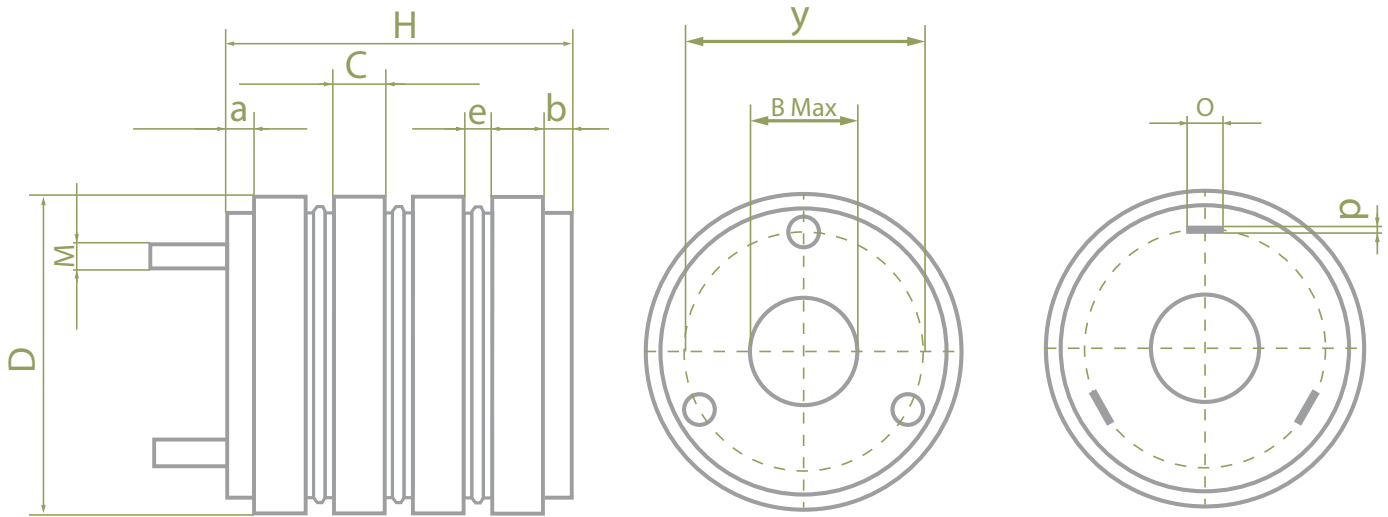


Dimensions in mm unless otherwise stated.

Part Number	D	C	B-Max	H	a	b	e	Y	M
3/112/16	112	16	60	84	8	8	10	86	8
3/120/16	120	16	69	84	8	8	10	94	16 x 3
3/120/20	120	20	64	96	10	10	8	92	10
3/125/16	125	16	84	84	9	9	9	105	16 x 3
3/130/14	130	14	74	86	8	8	14	102	8
3/130/16	130	16	76	86	8	8	11	102	8
3/140/16	140	16	76	104	8	8	20	106	8
3/140/20	140	20	81	118	14	14	15	112	8
3/140/25	140	25	81	111	8	8	10	112	8
3/150/16	150	16	85	92	10	10	12	118	10
3/150/18	150	18	78	102	10	10	14	110	10
3/150/20	150	20	85	104	10	10	12	118	10
3/160/20	160	20	97	108	9	9	15	130	10
3/160/25	160	25	97	115	10	10	10	130	10
3/180/20	180	20	110	112	10	10	16	146	12
3/190/23	190	23	108	131	15	15	16	156	12
3/200/25	200	25	115	235	40	40	40	150	12
3/220/32	220	32	130	148	10	10	16	174	16
3/300/27	300	27	194	129	10	10	14	238	16

- B-Max denotes the largest shaft diameter for each size of slipring
- Please let us know of any special fixing, keyway or sizing requirements
- Please state amps when ordering

# Sliprings with 4 Rings



Dimensions in mm unless otherwise stated.

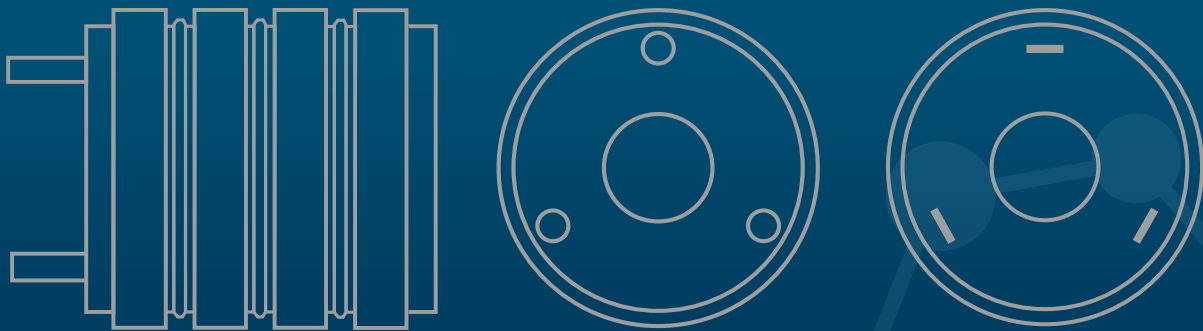
Part Number	D	C	B-Max	H	a	b	e	Y	M
4/30/7	30	7	12	51	4	4	5	22	2
4/52/10	52	10	30	63	1	1	7	40	4
4/60/10	60	10	30	73	6	6	7	43	5
4/70/12	70	12	34	78	6	6	6	48	6
4/80/12,5	80	12,5	47	80	6	6	6	60	5
4/90/14	90	14	54	108	8	8	12	68	6
4/100/12,5	100	12,5	50	84	5	5	8	76	8
4/120/15	120	15	68	106	8	8	10	94	8
4/130/12,5	130	12,5	70	84	5	5	8	102	8
4/140/20	140	20	76	135	8	8	13	108	10
4/150/16	150	16	90	113	8	8	11	120	8
4/190/20	190	20	105	114	8	8	6	142	12
4/220/16	220	16	130	123	10	10	13	170	12



- B-Max denotes the largest shaft diameter for each size of slipring
- Please let us know of any special fixing, keyway or sizing requirements
- Please state amps when ordering

# Sliprings

## Bespoke and Unlisted Sizes

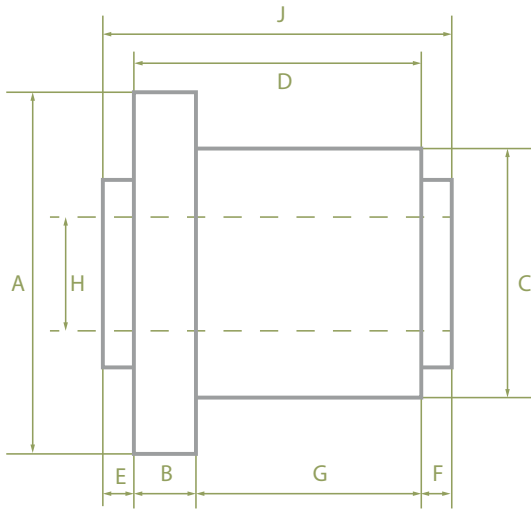


ECP hold a large selection of sliprings in stock and ready for despatch, as a result, it's not always possible to list every size we are currently holding. If you don't see your required size in this catalogue, please contact a member of our technical team and we can advise accordingly. There are occasions where bespoke or non-stock sizes are required. For these circumstances, ECP are able to supply sliprings to your exact requirements. Please complete the survey form in the forms section of this catalogue and send it to use via email or fax.

- Many sizes in stock
- Sliprings to your exact requirements
- Fast delivery
- Expert technical staff
- All to ECP's high quality standards



# C o m m u t a t o r s



**Commutators form the heart of any DC motor and ECP aim to assist when it comes to replacing with New.** ECP carries a large range of commutators in stock. However we are always happy to source different sizes, construction styles or one off specials - whatever your requirements. Simply fill in our survey form on the page shown below and send it to us by either email or fax where we'll be more than happy to quote you accordingly.



# Slipring Brush Holders



**ECP offer a huge range of slipring brush holders, many from stock.**

- Slipring brush holders for both high and low current applications
- Range of designs to accommodate fast or slow moving sliprings
- Other designs available on request

# DL Series Slipring Brush Holder



Dimensions in mm unless otherwise stated.

Type		Brush Dimensions				Bore		C	M	Style
		t	a	r	A	B	Max	Max		
43 DL 21	B 7-8	4	3	10	21	7	8	7	M2	G
63 DL 23	B 7-8	6	3	15	23	7	8	7	M3	G
84 DL 30	B 10	8	4	15	30	10	-	8	M4	G/W
84 DL 43	B 10	8	4	15	43	10	-	8	M4	G/W
85 DL 27	B 7-9	8	5	15	27	7	9	9	M3	G
85 DL 32	B 10	8	5	15	32	10	-	9	M4	G/W
85 DL 43	B 10	8	5	15	43	10	-	9	M4	G/W
105 DL 37	B 10	10	5	16	37	10	-	9	M4	G/W
1064 DL 37	B 10	10	6,4	16	37	10	-	11	M4	G/W
12564 DL 40	B 10	12,5	6,4	20	40	10	-	11	M4	G/W
1258 DL 47	B 10-13	12,5	8	20	47	10	13	12	M5	G/W
168 DL 46	B 10-13	16	8	20	46	10	13	12	M5	G/W
168 DL 50	B 10-13	16	8	20	50	10	13	12	M5	G/W
168 DL 62	B 13-16	16	8	25	62	13	16	12	M5	G/W
1610 DL 50	B 10-16	16	10	25	50	10	16	14	M5	G/W
1610 DL 62	B 13-16	16	10	25	62	13	16	14	M5	G/W
208 DL 50	B 13-16	20	8	25	50	13	16	12	M5	G/W
208 DL 60	B 13-16	20	8	25	60	13	16	12	M5	G/W
2010 DL 50	B 10-13	20	10	25	50	10	13	14	M5	G/W
2010 DL 56	B 13-16	20	10	25	56	13	16	14	M5	G/W
2010 DL 60	B 13-16	20	10	25	60	13	16	14	M5	G/W
2010 DL 70	B 16-20	20	10	30	70	16	20	14	M5	G/W
258 DL 60	B 13-16	25	8	25	60	13	16	12	M5	G/W
2510 DL 60	B 13-16	25	10	25	60	13	16	14	M6	G/W
2510 DL 70	B 16-20	25	10	30	70	16	20	14	M6	W
25125 DL 60	B 13-16	25	12,5	25	60	13	16	17	M6	G/W
25125 DL 70	B 16-20	25	12,5	30	70	16	20	17	M6	W
25125 DL 80	B 16-20	25	12,5	30	80	16	20	17	M6	W
25125 DL 90	B 16-20	25	12,5	30	90	16	20	17	M6	W
2516 DL 85	B 16-20	25	16	30	85	16	20	22	M8	W
3210 DL 67	B 13-16	32	10	32	67	13	16	15	M6	W
3210 DL 80	B 13-20	32	10	32	80	13	20	15	M6	G/W
32125 DL 70	B 16-20	32	12,5	32	70	16	20	17	M6	W
32125 DL 80	B 16-20	32	12,5	32	80	16	20	17	M6	W
32125 DL 90	B 16-20	32	12,5	32	90	16	20	17	M6	W
32125 DL 100	B 16-20	32	12,5	32	100	16	20	17	M6	W
3216 DL 85	B 16-20	32	16	32	85	16	20	22	M8	W
3216 DL 100	B 16-20	32	16	32	100	16	20	22	M8	W
40125 DL 95	B 16-20	40	12,5	40	95	16	20	17	M8	W
4020 DL 100	B 16-20	40	20	40	100	16	20	26	M10	W
4020 DL 125	B 25	40	20	40	125	25	-	26	M10	W
4020 DL 140	B 25	40	20	40	140	25	-	26	M10	W

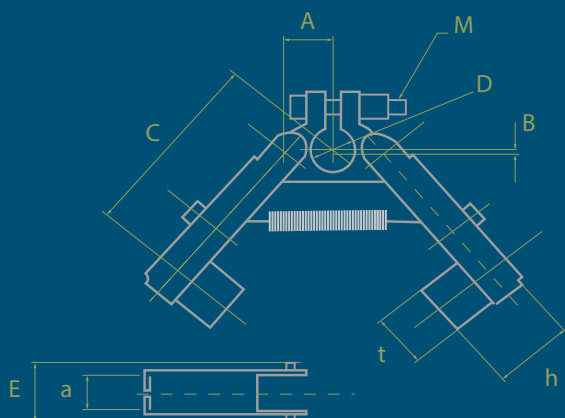
CONSTRUCTION Brass with copper foil connections, spring:- plated spring steel. All parts steel

plated. Double spring versions and brushes are available upon request.

Please refer to the survey sheets to enquire about other sizes.



## DD Series Slipring Brush Holder



Dimensions in mm unless otherwise stated.

Type	Brush Dimensions						Bore		E		M
	a	t	h	A	B	C	D	Max	Max		
DD40/80/33	4	8	15	9,5	-	33	9,5	10	7,6	M4	
DD40/120/37	4	12	15	10	-	37	9,5	10	6,6	6BA	
DD40/120/48	4	12	15	10	-	48	9,5	10	6,6	6BA	
DD63/80/39	6,3	8	16	10	-	39	9,5	10	10,5	M4	
DD63/125/37	6,3	12,5	16	10	-	37	9,5	10	10,5	M4	
DD63/80/50	6,3	8	16	10	-	50	9,5	10	10,5	M4	
DD63/125/48	6,3	12,5	16	10	-	48	9,5	10	10,5	M4	
DD80/160/56	8	16	20	12	1,6	56	12	13	12,8	M5	
DD80/200/54	8	20	20	12	1,6	54	12	13	12,8	M5	
DD80/160/63	8	16	20	12	1,6	63	12	13	12,8	M5	
DD80/200/61	8	20	20	12	1,6	61	12	13	12,8	M5	

These units are very adaptable and lend themselves to many varied applications. Current ratings are available upon request.

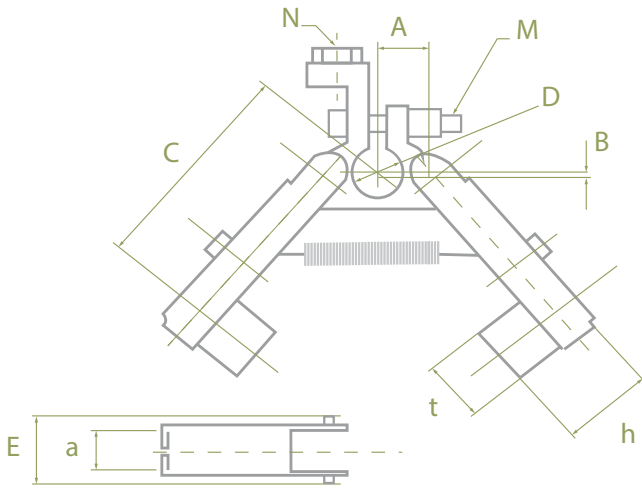
Dimension 'C' = Approximate distance between centre of clamping hole and centre line of brush when brush holder is in working position.



CONSTRUCTION Brass with copper foil connections, spring:- plated spring steel. All parts steel plated. Double spring versions and brushes are available upon request. Please refer to the survey sheets to enquire about other sizes.



# DDA Series Slipring Brush Holder



Dimensions in mm unless otherwise stated.

Type	Brush Dimensions			Bore				E		M	N
	a	t	h	A	B	C	D	Max	Max		
DDA100/250/70	10	25	32	12,5	5	70,5	12,7	13	16	M6	M6 X 8
DDA127/222/64	12,7	22,2	30	15	5	64	16	19	17,5	M6	M6 X 8
DDA127/254/83	12,7	25,4	28	15	5	83	16	19	17,5	M6	M6 X 8
DDA160/320/76	16	32	32	15	5	76	16	19	21	M6	M8 X 10

These units lend themselves to many varied applications and are therefore very adaptable. Current ratings are available upon request.

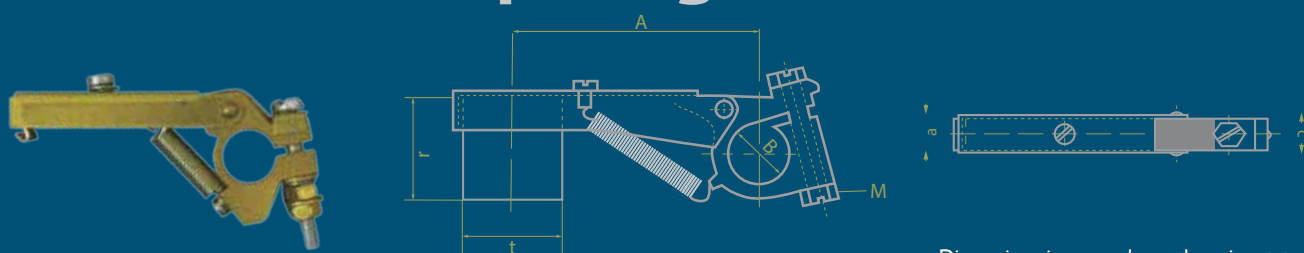
Dimension 'C' = Approximate distance between centre of clamping hole and centre line of brush when brush holder is in working position.



CONSTRUCTION Brass with copper foil connections, spring:- plated spring steel.All parts steel plated. Note: DDA160/320/76 - braided connections. Double spring versions and brushes are available upon request. Please refer to the survey sheets to enquire about other sizes.



# SL Series Slipping Brush Holder

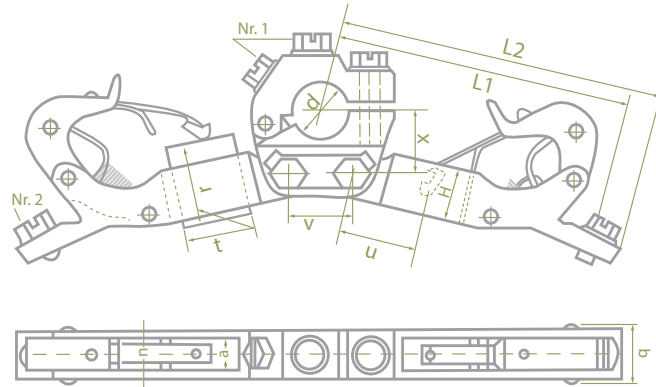


Dimensions in mm unless otherwise stated.

Type	Brush Dimensions				Bore		C	M	
	t	a	r	A	B	Max	Max		
43 SL 21	B 7-8	4	3	10	21	7	8	7	M2
63 SL 23	B 7-8	6	3	15	23	7	8	7	M3
84 SL 30	B 10	8	4	15	30	10	-	8	M4
84 SL 43	B 10	8	4	15	43	10	-	8	M4
85 SL 27	B 7-9	8	5	15	27	7	9	9	M3
85 SL 32	B 10	8	5	15	32	10	-	9	M4
85 SL 43	B 10	8	5	15	43	10	-	9	M4
105 SL 37	B 10	10	5	16	37	10	-	9	M4
1064 SL 37	B 10	10	6,4	16	37	10	-	11	M4
12564 SL 40	B 10	12,5	6,4	20	40	10	-	11	M4
1258 SL 47	B 10-13	12,5	8	20	47	10	13	12	M5
168 SL 46	B 10-13	16	8	20	46	10	13	12	M5
168 SL 50	B 10-13	16	8	20	50	10	13	12	M5
168 SL 62	B 13-16	16	8	25	62	13	16	12	M5
1610 SL 50	B 10-16	16	10	25	50	10	16	14	M5
1610 SL 62	B 13-16	16	10	25	62	13	16	14	M5
208 SL 44	B 10-13	20	8	25	44	10	13	12	M5
208 SL 50	B 13-16	20	8	25	50	13	16	12	M5
208 SL 60	B 13-16	20	8	25	60	13	16	12	M5
2010 SL 50	B 10-13	20	10	25	50	10	13	14	M5
2010 SL 56	B 13-16	20	10	25	56	13	16	14	M5
2010 SL 60	B 13-16	20	10	25	60	13	16	14	M5
2010 SL 70	B 16-20	20	10	30	70	16	20	14	M5
258 SL 60	B 13-16	25	8	25	60	13	16	12	M5
2510 SL 60	B 13-16	25	10	25	60	13	16	14	M6
2510 SL 70	B 16-20	25	10	30	70	16	20	14	M6
25125 SL 60	B 13-16	25	12,5	25	60	13	16	17	M6
25125 SL 70	B 16-20	25	12,5	30	70	16	20	17	M6
25125 SL 80	B 16-20	25	12,5	30	80	16	20	17	M6
25125 SL 90	B 16-20	25	12,5	30	90	16	20	17	M6
2516 SL 85	B 16-20	25	16	30	85	16	20	22	M8
3210 SL 67	B 13-16	32	10	32	67	13	16	15	M6
3210 SL 80	B 13-20	32	10	32	80	13	20	15	M6
32125 SL 70	B 16-20	32	12,5	32	70	16	20	17	M6
32125 SL 80	B 16-20	32	12,5	32	80	16	20	17	M6
32125 SL 90	B 16-20	32	12,5	32	90	16	20	17	M6
32125 SL 100	B 16-20	32	12,5	32	100	16	20	17	M6
3216 SL 85	B 16-20	32	16	32	85	16	20	22	M8
3216 SL 100	B 16-20	32	16	32	100	16	20	22	M8
40125 SL 95	B 16-20	40	12,5	40	95	16	20	17	M8
4020 SL 100	B 16-20	40	20	40	100	16	20	26	M10
4020 SL 125	B 25	40	20	40	125	25	-	26	M10
4020 SL 140	B 25	40	20	40	140	25	-	26	M10

CONSTRUCTION Brass with copper foil connections, spring:- plated spring steel. All parts steel plated. Note: DDA160/320/76 - braided connections. Double spring versions and brushes are available upon request. Please refer to the survey sheets to enquire about other sizes.

# Double Clamping Slipring Brush Holder



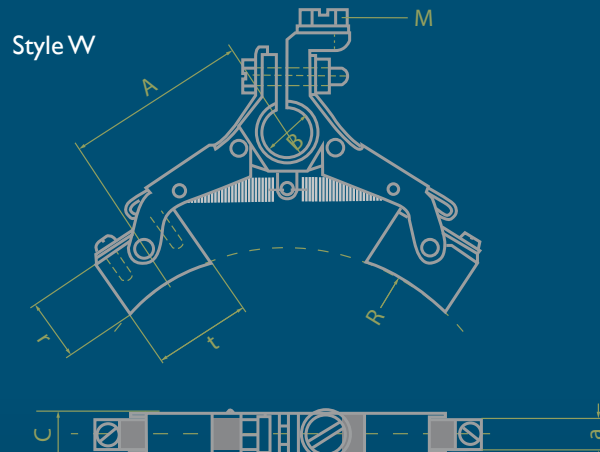
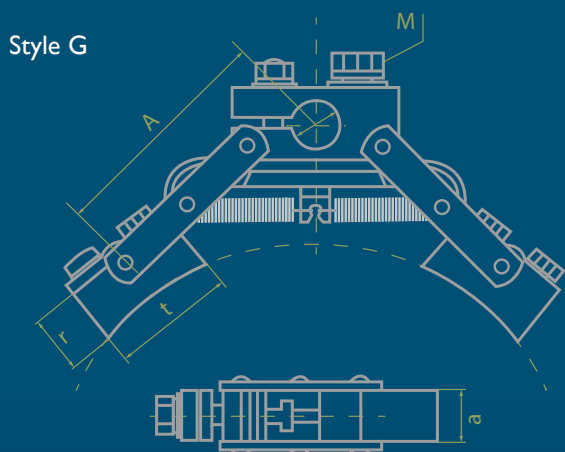
Dimensions in mm unless otherwise stated.

Type	Brush Dimensions			L1	L2	Bore								Bolt	
	t	a	r			d	H	N	q	u	v	w	x	1	2
20641	16	8	20	55	62	16-20	16	6	14	16	18	5	17	M5	M6
20642	20	8	25	80	92	16-20	16	6	15	22	18	8	17	M5	M6
20643	20	10	32	77	84	16-20	18	6	16	22	18	8	17	M5	M6
20644	25	10	32	86	95	16-20	18	6	17	26	23	8	19,5	M6	M8
20645	25	12,5	32	90	101	20-25	20	8	20	26	23	9	19,5	M6	M8
20646	25	16	40	90	101	20-25	20	10	24	26	23	9	19,5	M6	M8
20647	32	12,5	40	101	111	20-25	20	10	21	32	25	10	27,5	M8	M10
20648	32	16	40	101	111	20-28	20	10	24	32	25	10	27,5	M8	M10
20649	32	20	40	101	111	20-28	20	10	26	32	25	10	27,5	M8	M10
20650	32	25	50	101	111	20-28	25	10	31	32	25	10	27,5	M8	M10
20651	40	16	50	114	125	20-28	25	10	23	36	25	12	27,5	M8	M10
20652	40	20	50	114	125	20-28	25	10	27	36	25	12	27,5	M8	M10
20653	40	25	50	114	125	25-32	25	10	31	36	33	12	30	M8	M10
20654	40	32	50	114	125	25-32	25	10	37	36	33	12	30	M8	M10
20655	50	25	50	125	140	25-32	25	10	31	44	33	10	30	M8	M10

■ All double clamping brush holders can be made with one or two connectors or without.



# DLG Series Slipring Brush Holder



Dimensions in mm unless otherwise stated.

Type		Brush Dimensions				Bore			M	Amps Max
		t	a	r	A	B	C			
224 DLG	40 B 10	22	4	18	40	10	8-10	7,5	M4	25
1664 DLG	40 B 10	16	6,4	13	40	8	8-10	11,5	M4	25
2264 DLG	40 B 10	22	6,4	13	40	8	8-10	11,5	M4	30
258 DLG	60 B 12	25	8	20	60	13	12-16	13,5	M5	60
3210 DLG	60 B 16	32	10	20	60	16	15-17	15,5	M8	150
3216 DLG	65 B 16	32	16	20	65	16	15-17	22	M8	180
4514 DLG	80 B 16	45	14	25	80	16	16-20	23	M10	220
4516 DLG	80 B 17	45	16	25	80	17	16-20	27	M12	265
4516 DLG	95 B 17	45	16	25	95	17	16-20	27	M12	265
5020 DLG	95 B 18	50	20	25	95	18	16-20	30	M12	350
6025 DLG	105 B 17	60	25	25	105	17	17-20	36	M12	500



Designed for use in slow moving AC power transmission applications. Brushes have pivoting facility so that they are self-aligning for larger slip ring diameters. Current is transmitted by woven copper braids.



**CONSTRUCTION** Brass with copper foil connections, spring-plated spring steel. All parts steel plated. Double spring versions and brushes are available upon request. Please refer to the survey sheets to enquire about other sizes.

# Brush Holders



ECP aim to assist wherever we can with brush holder enquiries, whether they be for use on sliprings, commutators or shaft earthing, as linear collectors, or simply for rail lubrication holders.

Whilst ECP do aim to carry a select range of holders from stock, if we don't have exactly what you need or the correct quantity, we will endeavour offer an alternative solution or advise when stock will become available.

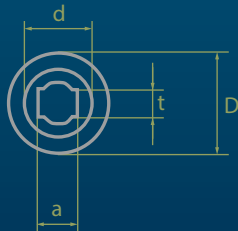
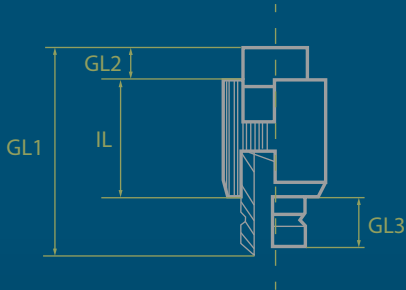
For those 'impossible-to-find' holders, ECP can advise upon the possibility of bespoke manufacture. In the first instance please email us some photos to us along with the exact quantity of holders that you require. We'll then call you to discuss the options available and anticipated lead times for manufacture.

# Cartridge Brush Holder



ECP offer a range of both stock and 'made-to-order' cartridge type brush holders, many of which are produced to order, due to the vast array of holders in circulation.

**Ordering is relatively straight forward with us, just requiring the following details:**



- 'd' – the diameter of the brass body
- 'D' – the outer diameter of the insulation material
- 'GL1' – overall length of holder
- 'GL2' – depth of threaded section
- 'GL3' – depth from end of holder to start of the insulation material
- 'IL' – length of the insulation material
- QUANTITY of holders required
- PHOTOS – please email some supporting images to assist with quotations
- SAMPLE – maybe required for manufacture and does help to ensure the finished parts match the original spec. as closely as possible

Email or fax - once you have all of the above information to hand, please email or fax it through to us where we will be more than happy to prepare a quotation for you.



Dimensions in mm unless otherwise stated.

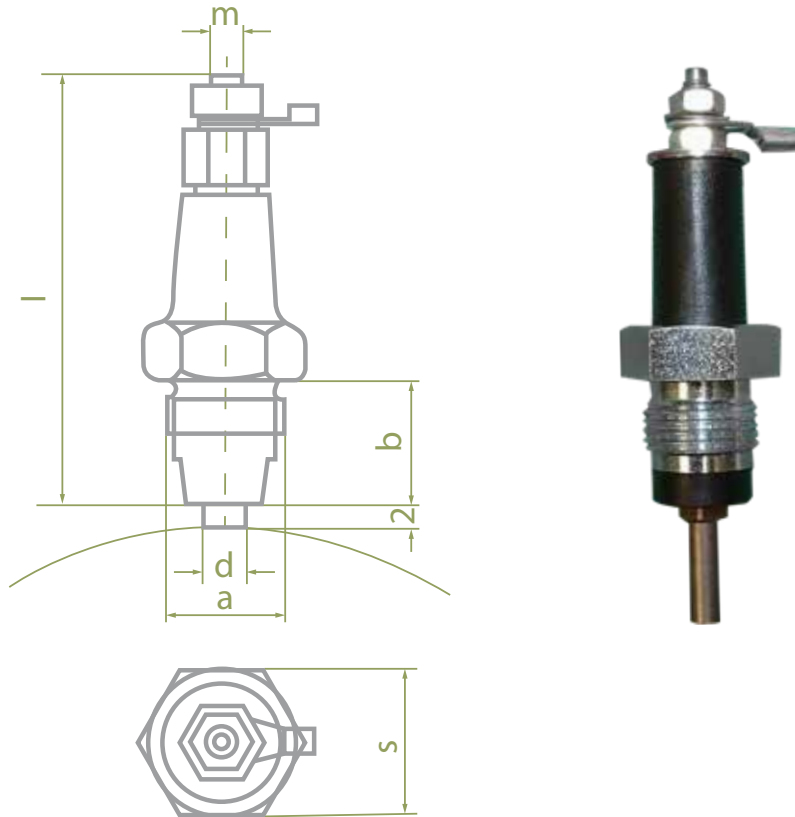
Type	t	a	d	Others
KH 34	3	4	7	
KH 364	3	6,4	9	
KH 44	4	4	8	
KH 45	4	4	8	
KH 48	4	8	12	
KH 55	5	5	9	
KH 56	5	6	9	
KH 564	5	6,4	10	
KH 58	5	8	12	
KH 510	5	10	14	
KH 66	6	6	10	
KH 68	6	8	12	
KH 69	6	9	13	
KH 613	6	13	14,6 / 12	
KH 616	6	16	21	
KH 648	6,4	8	12	
KH 6410	6,4	10	14	
KH 64125	6,4	12,5	16	
KH 64125	6,4	12,5	13,7 / 7,5	
KH 88	8	8	13	
KH 810	8	10	16	
KH 812	8	12	16	
KH 8125	8	12,5	14,5 / 10	
KH 10125	10	12,5	18	

Required Dimensions



■ Manufactured from insulating paper, thermo plastic and brass

# Cartridge Type Clutch Brush Holder



Tubular brush holders with the appropriate brush can be used for oil and dry running operations. For oil operation, an additional blind brush should be provided before or after the live brush for rotational speeds of more than 15m/s. With erratic run, heavy vibrations and exceeding of the maximum current rate, it is recommended to arrange two brushes (offset 60° – 90°) per slipring and to connect the electrically.

For clutches with one slipring, the positive terminal has to be connected to the slipring and the negative terminal to the frame.

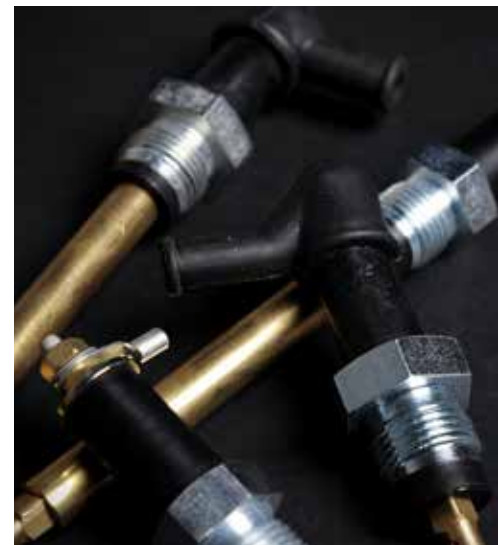
Dimensions in mm unless otherwise stated.

Tubular Brush Holder	d	a	b	l	m	s	Brushes Included	
KB 14/4	4	M14 X 1,5	15	54	M4	17	BN4	TR4
KB 16/6')	6	M16 X 1,5	20	65	M5	19	BN6	TR6
KB 18/6')	6	M18 X 1,5	19	65	M5	22	BN6	TR6

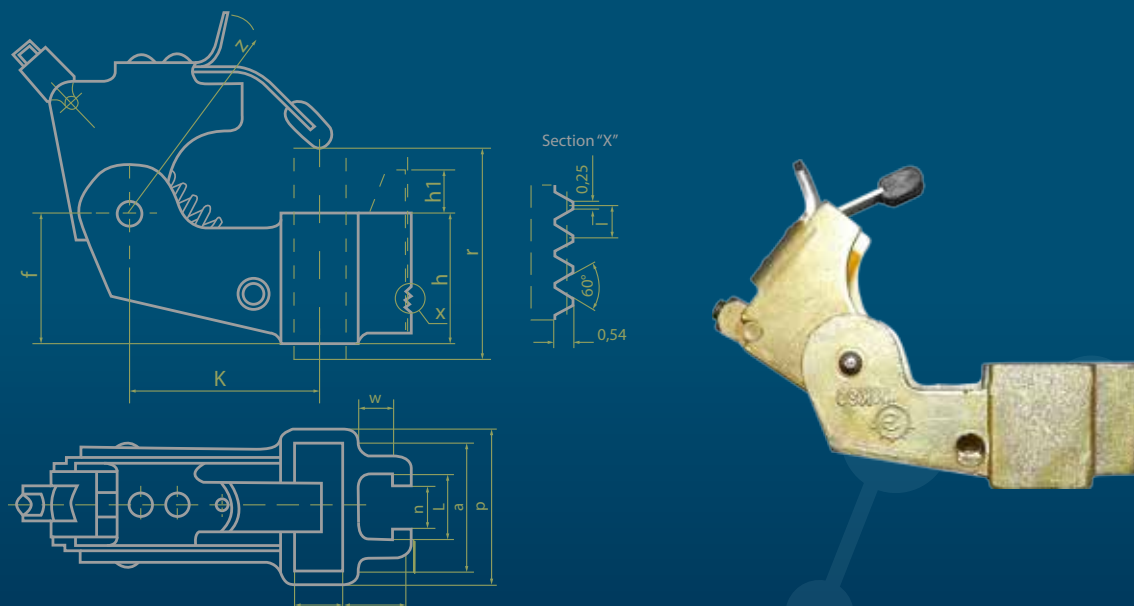
■ Tubular brush holders with longer brush guide tube and the appropriate brushes available on request

Brushes for oil operation	d mm	max current A	max speed m/sec	contact force N
BN4	4	3	20	10
BN6	6	6	20	20

Brushes for oil operation	d mm	max current A	max speed m/sec	contact force N
TR4	4	2	40	2,5
TR6	6	4	40	3,5



# Single Brush Holder



Dimensions in mm unless otherwise stated.

Type	Dimensions												
	t	a	r	h	h <sub>1</sub>	c	l	n	k	f	w	z <sub>ok</sub>	p <sub>ok</sub>
506000	6,3	20	32	20	-	10	10,2	6,3	28	20	5	37	24
507100	6,3	32	40	25	7	10	10,2	6,3	33	25	5	41,5	36
506100	8	20	32	20	-	10	10,2	6,3	29	20	5	37	24
506200	10	20	32	20	-	10	10,2	6,3	30	20	5	37	24
506700	10	25	40	25	-	10	10,2	6,3	35	25	5	41,5	29
506300	12,5	20	32	20	-	10	10,2	6,3	31	20	5	37	24
506800	12,5	25	40	25	-	10	10,2	6,3	36	20	5	44	30
507400	12,5	32	40	25	7	10	10,2	6,3	36	20	5	44	37
506900	16	25	40	25	-	12,5	13,5	8,5	38	20	7,5	44	30
507500	16	32	40	25	-	12,5	13,5	8,5	38	20	7,5	44	37
507000	20	25	40	25	7	12,5	13,5	8,5	40	20	7,5	44	30
507600	20	32	40	25	-	12,5	13,5	8,5	40	20	7,5	44	37
507700	25	32	40	25	7	12,5	13,5	8,5	44	20	7,5	46,5	37

## Single Brush Holders

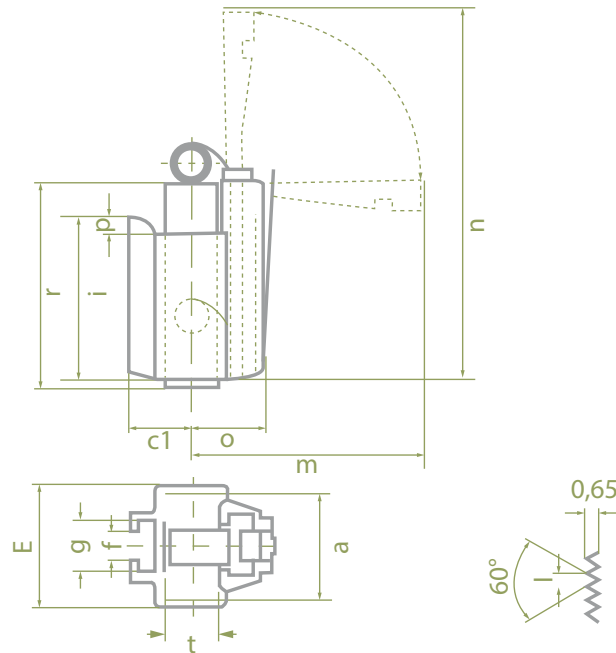
ECP offer a range of brush holders which have the benefit of providing a more consistent spring pressure to the brush throughout its life cycle. This not only overcomes the variation in pressure found with the more traditional type springs, which tends to reduce as the brush wears but also improves the overall wear life by maintaining a constant pressure within the brushes required design parameters.

Whilst ECP aim to hold a limited stock of key maintenance components, the vast array of available designs does prevent us from listing all of these in one catalogue.

If you don't see what you need then please email us some photos, complete the relevant survey sheet or even draw a basic dimensioned sketch and we'll be more than happy to take a look for you.

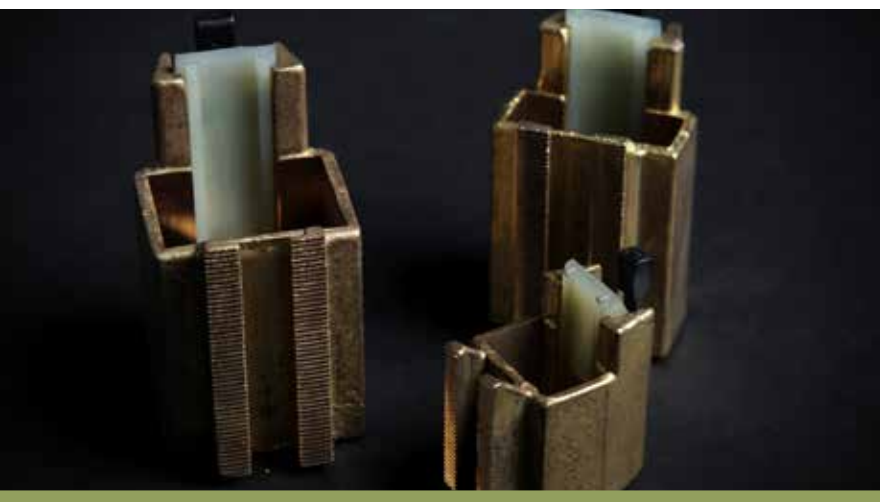


# Constant Force Spring Brush Holder



Dimensions in mm unless otherwise stated.

Type	t	a	r	Cl	E	f	g	i	m	n	o	p
RTR820	8	20	40	14	24	M6	10,5	32	44	71	17	4
RTR1020	10	20	40	15	24	M6	10,5	32	45	71	18	4
RTR1220	12,5	20	40	16,3	24	M6	10,5	32	46	71	19	4
RTR1225	12,5	25	50	16,3	30	M6	10,5	40	57	90	21	5
RTR1625	16	25	50	18	30	M6	10,5	40	59	90	23	5
RTR1032	10	32	64	15,5	37	M8	14,5	50	66	110	20	5
RTR1232	12,5	32	64	16,8	37	M8	14,5	50	67	112	21	5
RTR1632	16	32	64	18,5	37	M8	14,5	50	69	114	23	5
RTR2032	20	32	64	20,5	37	M8	14,5	50	71	116	25	5
RTR2532	25	32	64	23	37	M8	14,5	50	73	116	28	5
RTR2540	25	40	64	23	45	M8	14,5	50	73	116	30	5



■ For all peripheral speeds

■ Brush boxes are brass die cast

We are happy to source special sizes, whatever your requirement, (Please refer to the relevant survey form for more details). In cases where only the clip and spring need replacing, these can sometimes be replaced separately.



# The Bearing Protector

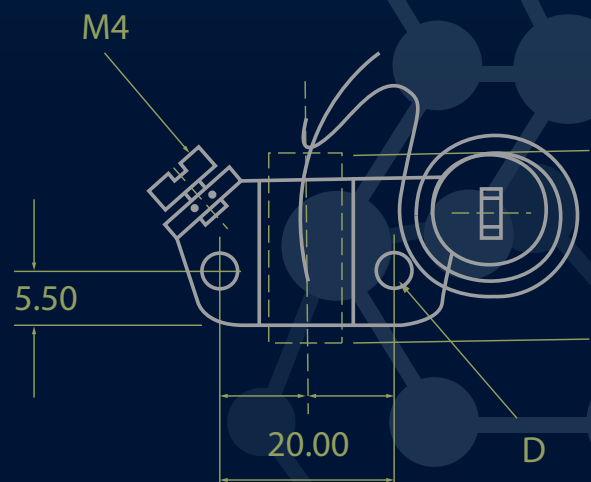


ECP offer low cost Bearing Protection Units, comprising of a compact-sized brush holder & a high content 'silver-graphite' carbon brush.

One, two or multiple units can be used in combination to ensure that any spurious electrical currents are safely discharged to earth and not via the bearings. Spurious leakage currents, if inadequately earthed, will lead to prematurely bearing failure as a result of electrical erosion or pitting of the running faces/bearings.

For a relatively small cost, ECP Bearing Protector Units can help avoid those unnecessary and expensive motor repairs and especially when the cost of 'lost production' is factored-in.

- Complete with an 'RS70' Silver Graphite Brush – 6,4mm x 10 x 23mm long
- The maximum space required for fitting is 55mm x 35mm x 20mm
- The mounting holes are pre-threaded to accept M4 screws



# A n c i l l a r y   P r o d u c t s



**Engineering Carbon Products holds a comprehensive range of ancillary products in stock, across two dedicated UK sites. All stock items are available for immediate despatch and other products can be supplied with short lead times from our well established suppliers.**

- Comprehensive range of stock
- Immediate despatch
- Technical advice available
- Tailored solutions to your requirements



### **Constant Force Spring Clips**

ECP offer a range of both stock and 'made-to-order' constant force spring clips.

#### **Typical forms are as follows;**

- 'U' – type (sugar tong style)
- 'V' – type
- 'L' – type

### **Constant Force Spring 'REFURBS'**

ECP also offer a constant force spring 'REFURB' service for the replacement of damaged or broken spring coils whilst reusing the existing back plate or carrier.

The 'REFURB' route is the next quickest option to take where completely brand new springs clips are not readily available.

As long as the stainless steel carrier or back plates are still usable, we can then remove the old coils and replace with new.

If you are unsure of the coils condition then please send in the whole batch and we'll advise how many need to be refurbished – it's generally best practice to replace all to guarantee future reliability.

### **Terminal Blocks**

ECP offer a limited range of replacement motor terminal blocks and can be supplied with or without the links, nuts & washers. These spares are typically manufactured from glass reinforced polyester compound to enhance strength. A sample terminal block, photos or a dimensioned sketch maybe requested to ensure we quote/ship the correct item to you.

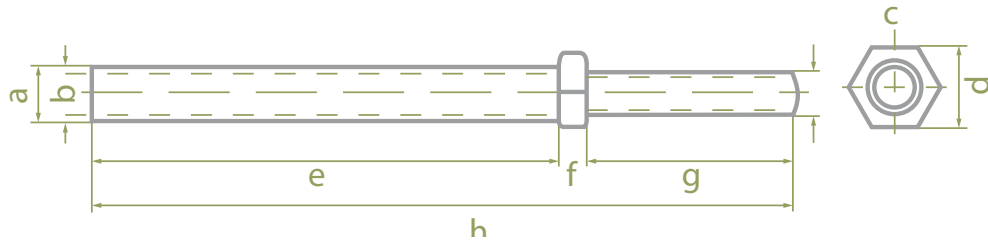


### **Clamps**

ECP offer a select range of brush holder mounting clamps which enable the brush holder not only to be clamped onto the insulated mounting post but also to be adjusted to the correct height above the commutator.

If required, ECP can facilitate bespoke manufacture to your specific requirements – we may request for a sample clamp, photos or a dimensioned sketch to ensure we quote & supply to your complete satisfaction.

# Spindles



Dimensions in mm unless otherwise stated.

Type	a	b	c	d	e	f	g	h
SP01	10	8	M8	14	32	3	10	45
SP02	10	8	M8	14	45	3	14	62
SP03	10	8	M8	14	70	3	14	87
SP04	10	8	M8	14	90	5	40	135
SP05	12	8	M8	14	100	5	40	145
SP06	13	8	M8	14	100	5	45	150
SP07	14	10	M10	17	100	8	37	145
SP08	15	10	M10	17	110	8	37	155
SP09	16	10	M10	17	110	8	47	165
SP10	18	12	M12	22	120	8	47	175
SP11	20	12	M12	22	140	8	47	195
SP12	22	12	M12	22	140	10	50	200
SP13	23	12	M12	22	140	10	55	205
SP14	25	12	M12	22	140	10	55	205

■ Manufactured from insulating laminated paper and mild steel threaded rod



# Brush Seater Holders

Non-conductive (Brush Seaters sold separately)



I.D. Dimension	Catalogue Number
1/4" x 1/4"	BRHDX13
1/2" x 1/4"	BRHDX12
3/8" x 3/8"	BRHDX15
1/2" x 1/2"	BRHDX09
5/8" x 1/2"	BRHDX28
3/4" x 1/2"	BRHDX08
3/4" x 5/8"	BRHDX07
1" x 1/2"	BRHDX06
1" x 1"	BRHDX16

The Brush Seater Holder adds an element of safety when seating brushes while the motor is running. The non-decreasing length of the holder helps keep fingers away from rotating equipment and possible shock is reduced because the holder is non-conductive. This sheath also provides additional support to the relatively fragile seater material.

- 10" & 15" lengths available (At Additional Cost)  
(To order longer lengths: Add "10" or "15" to above part numbers)



See Brush Seaters - Page 29

# Garnet Commutator Paper

Garnet Commutator Paper is non-conductive and is used for pre-shaping new copper and carbon brushes and for cleaning and burnishing commutator surfaces. To pre-shape brushes, commutator paper of sufficient width to contact all brushes is secured, abrasive side out, to the full commutator circumference with masking tape. With the new brushes in place, the commutator is rotated by hand until the brushes have taken on the radius of the commutator. Eighty grit paper does the primary shaping and should be followed by 220 grit for a fine finish. Surface burnishing of the commutator should be done with 150 grit followed by 220 grit paper.

Width	Length	Catalogue Number		
		80 grit	150 grit	220 grit
1"	25 Yards	COMP01X080	COMP01X150	COMP01X220
2"	25 Yards	COMP02X080	COMP02X150	COMP02X220
3"	25 Yards	COMP03X080	COMP03X150	COMP03X220
4"	25 Yards	COMP04X080	COMP04X150	COMP04X220
6"	25 Yards	COMP06X080	COMP06X150	COMP06X220
8"	25 Yards	COMP08X080	COMP08X150	COMP08X220
12"	25 Yards	COMP12X080	COMP12X150	COMP12X220



■ Non-Conductive

# Commutator Dressing and Finishing Stones



### Lathe Type with Handle

This is supplied with a wooden block handle, which allows the entire stone to be used when clamped in a lathe or portable grinder. Specify catalogue number and grade when ordering.

■ See page 47 for grades

Description	Catalogue Number
1" x 1½" x 5" Stone, with 1½" Wood Block	COMMX602
1" x 2" x 5" Stone, with 3" Wood Block	COMMX604
1½" x 2½" x 5" Stone, with 3" Wood Block	COMMX614
2" x 2" x 5" Stone, with 3" Wood Block	COMMX616
1" x 1½" x 8" Stone, with 1½" Wood Block	COMMX634
1½" x 2½" x 8" Stone, with 3" Wood Block	COMMX648
2" x 2" x 8" Stone, with 3" Wood Block	COMMX650

### Pocket Combination Stones

A versatile two grade stone for use on small motors and generators. Specify catalogue number and both grades when ordering.

■ See page 47 for grades



### Commutator Brush Saver

This uniquely shaped plastic handle with resurfacing stones at each end, (one polishing grade, while the other is a finishing grade) is designed for smoothing commutators on many small motors and generators. This non-conductive tool allows the user access into any motor frame, in order to resurface the commutator to a smooth finish. This extends brush life and improves commutation.

■ 5/16 x 7/8 Cutting Face

■ Catalogue Number COMMX007

# Commutator Dressing and Finishing Stones



### Small Motor Combination Stone

This handy two grade stone is excellent for use on fractional horsepower motors. Specify catalogue number and both grades when ordering.

■ See page 47 for grades

Description	Catalogue Number
$\frac{3}{4}'' \times \frac{1}{2}'' \times \frac{3}{8}''$	COMMX950
$1 \frac{1}{8}'' \times \frac{1}{2}'' \times \frac{5}{16}''$	COMMX952
$1 \frac{1}{4}'' \times \frac{3}{4}'' \times \frac{1}{2}''$	COMMX955

### Pencil Type / Plain-Lathe Type

These are unmounted stones (no handles). The smaller sizes are used for small motors and generators. The larger sizes are clamped in a lathe or portable grinder. Specify catalogue number and grade when ordering.

■ See page 47 for Grades

Description	Pieces Per Box	Catalogue Number
$\frac{3}{4}'' \times \frac{3}{4}'' \times 3''$	2	COMMXLS804
$\frac{1}{4}'' \times \frac{1}{2}'' \times 4''$	6	COMMXLS802
$\frac{1}{4}'' \times \frac{3}{8}'' \times 6''$	6	COMMXLS800
$\frac{1}{4}'' \times \frac{1}{2}'' \times 6''$	6	COMMXLS805
$\frac{1}{8}'' \times \frac{3}{8}'' \times 6''$	6	COMMXLS801
$\frac{3}{8}'' \times \frac{3}{8}'' \times 6''$	6	COMMXLS810
$\frac{3}{8}'' \times \frac{1}{2}'' \times 6''$	4	COMMXLS815
$\frac{1}{2}'' \times \frac{1}{2}'' \times 6''$	4	COMMXLS820
$\frac{3}{8}'' \times \frac{5}{8}'' \times 6''$	4	COMMXLS825
$\frac{1}{2}'' \times \frac{5}{8}'' \times 6''$	4	COMMXLS830
$\frac{5}{8}'' \times \frac{5}{8}'' \times 6''$	2	COMMXLS835
$\frac{3}{4}'' \times \frac{3}{4}'' \times 6''$	1	COMMXLS840
$1'' \times 1'' \times 6''$	1	COMMXLS845
$1'' \times 1'' \times 6\frac{1}{2}''$	1	COMMXLS846
$1'' \times 1\frac{1}{2}'' \times 6\frac{1}{2}''$	1	COMMXLS847
$\frac{1}{4}'' \times \frac{5}{16}'' \times 8''$	6	COMMXLS803
$\frac{5}{16}'' \times \frac{3}{4}'' \times 8''$	6	COMMXLS809
$1'' \times 2'' \times 8''$	1	COMMXLS850
$2'' \times 2'' \times 8''$	1	COMMXLS855
$1'' \times 1\frac{1}{2}'' \times 11''$	1	COMMXLS860

■ Priced per piece





# Brush Seating and Cleaning Stones



Commutators and slip ring brushes of any material can be easily and accurately seated with Diamond D Brush Seaters.

Just hold the Brush Seater on the commutator close to the brush so the Brush Seater material will be carried under the brush.

At the same time, press on the brush to increase pressure.

Many commutators and slipring troubles are caused by poor contact with the brushes. This is particularly true when new brushes are installed along with old ones because if the new

brushes do not make good contact, the current is forced through the other brushes. This overloads the other brushes causes pitting of the brush faces, loosening of brush shunts, burning of brush holders, and many other evils that result from sparking and heating.

### Size Selection

For brush seating, choose a stone with a width equal to, or slightly greater than the width of the brush. For cleaning commutators, pick a stone about 3/4" the length of the commutator bar and as thick as will neatly fit between the brush riggings. For slip rings, select a stone about 1/2" wider than the ring.

### Grade Selection

#### Grade ES (Extra Soft)

Used for cleaning and seating brushes on all types of slip rings.

#### Grade FH (Fine Hard)

Recommended for small motor applications such as vacuum cleaners, fans and automotive generators.

#### Grade MS (Medium Soft)

Our most popular grade and is normally supplied for general purpose use.

#### Grade FS (Fine Soft)

Similar to Grade MS, except utilizing a finer grit abrasive.

#### Grade MH (Medium Hard)

Similar to grade MS except harder. It was specifically developed for use on undercut commutators where softer grades might wear too quickly.

Description	Pieces Per Box	Catalogue Number
4" x 1 1/2" x 2"	2	BRSRX03
4 3/4" x 2" x 1 1/4"	2	BRSRX01
4 3/4" x 1 1/2" x 1 1/4"	2	BRSRX02
4 3/4" x 1 1/4" x 3/4"	4	BRSRX04
4 3/4" x 1 3/8" x 5/8"	4	BRSRX05
4 3/4" x 1" x 1/2"	4	BRSRX06
4 3/4" x 3/4" x 5/8"	4	BRSRX07
4 3/4" x 3/4" x 1/2"	4	BRSRX08
4 3/4" x 1/2" x 1/2"	2	BRSRX09
4 3/4" x 1/2" x 5/8"	2	BRSRX10
4 3/4" x 5/8" x 1/2"	4	BRSRX28
4 3/4" x 3/4" x 1/4"	2	BRSRX11
4 3/4" x 1/2" x 1/4"	4	BRSRX12
4 3/4" x 1/4" x 1/4"	6	BRSRX13
4 3/4" x 1/4" x 1/8"	12	BRSRX14
4 3/4" x 3/8" x 3/8"	4	BRSRX15
4 3/4" x 1" x 1"	4	BRSRX16
4 3/4" x 2" x 1"	2	BRSRX17
4 3/4" x 3/8" x 1/4"	4	BRSRX18
2" x 1" x 1"	1	BRSRX19
2" x 2" x 2"	1	BRSRX23
3" x 2" x 2"	1	BRSRX24
3" x 2" x 4"	1	BRSRX25
6" x 3" x 2"	1	BRSRX21
5" x 2" x 2"	1	BRSRX22
8" x 1 1/2" x 1 1/2"	1	BRSRX27
8" x 3" x 2"	1	BRSRX20

■ Priced per piece

■ We can manufacture special sizes not shown. Please advise the size and grade for a prompt quotation





# K u t - K w i k U n d e r c u t t e r



For Use With	Model	RPM	H.P.	Length	Wt.	Catalogue #
H.S.S. Saws	KK32	4,000	.3	9½"	1½#	KTKW032
Tungsten Saws	KK50	5,300	.3	9½"	1½#	KTKW050
Diamond Wheels	KK180	20,000	.9	11½"	2½#	KTKW180

Kut-Kwik is a very small light-duty air-driven undercutter designed for reaching into limited spaces where other undercutters cannot be used. It is not meant for the heavier duty and more continuous service of our other portable undercutters.

There are now 3 versions of the Kut-Kwik Undercutter available to accommodate the various needs of our customers.

- Model KK32: 4,000 RPM version has gained increased popularity since it was introduced. It is still the most popular and practical unit for use with high speed steel saws and V-Cutters.

- Model KK50: 5,300 RPM version is recommended for use with tungsten carbide saws. It should be noted that because of the brittle nature of carbide, these saws are more susceptible to breakage and should only be used by more skilled operators. The higher price of carbide can normally be justified by the shorter time required to complete a job because of the higher operating speeds and less down-time required to replace cutters.

- Model KK180: 20,000 RPM version is intended for use with diamond coated undercutting wheels. Extremely fast undercutting is made possible by this high speed tool which will more than justify the higher priced diamond wheels. Again, this tool is only recommended for use by more skilled operators.

## Saws

High-Speed Steel	OD	ID	Catalogue Number
65-HS Saws	¾"	5/16"	HSMS65
75-HS Saws	7/8"	5/16"	HSMS75

Tungsten Carbide	OD	ID	Catalogue Number
65-TC Saws	¾"	5/16"	TUNS65
75-TC Saws	7/8"	5/16"	TUNS75

## Diamond Coated Undercutting Wheels

OD	ID	Thickness "	Catalogue #
¾"	5/16"	.020, .030, .040	DIAW3 (add thickness)
7/8"	5/16"	.020, .025, .030, .035, .040, .045, .050, .055, .060, .065	DIAW7 (add thickness)

- Minimum compressed air requirement for proper operation is 11 CFM @ 90 PSI

- Width of head, including saw retaining nut, only 1 3/16"

- Net Weight 1.2kg, Shipping Weight 2kg

- Three Models — 3 Saw Spindle Speeds (See table top of page)

- Compact

- Light-weight



# Mica - Miller

## Model K Mica-Miller

Three interchangeable heads make the Model K extremely versatile. Saws or "V" cutters from  $\frac{23}{32}$ " to  $1\frac{1}{4}$ " diameter can be used to undercut commutators of virtually any size. Full load saw spindle speeds are as follows:

- With "Small" Head.....3500 r.p.m
- With "Standard" Head.....2800 r.p.m
- With "Heavy-Duty" Head.....1850 r.p.m

The slot guide provided on the two smaller heads is positioned by two sensitive screw adjustments. It may be swung out of the way when changing saws. Many operators find the model K so easy to use they remove the guide entirely.

The model K Mica-Miller is an excellent all-around Undercutter for industrial plants or repair shops, as it can be used in the shop or taken to the job, and can be operated on AC from any lighting circuit.

- Cuts either "U" or "V" slots
- 1/5 h.p. Universal Motor
- Control switch in handle
- Overall length  $16\frac{1}{2}$ "
- Weighs only 3.7kg
- Used on all sizes of
- Commutators
- Well balanced
- Easy to guide



- With "Small" Head . . . . .3700/4300 r.p.m
- With "Standard" Head . . . . .2850/3450 r.p.m
- With "Heavy-Duty" Head . . 1700/2300 r.p.m

## Flex-Drive Mica-Miller

Flex-Drive Mica-Miller should be hung overhead by means of its suspension ring, thus lessening operator fatigue and flexible shaft strain. The flexible shaft (No. 16;  $\frac{3}{8}$ " dia., 5 ft. long) of the Flex-Drive Mica-Miller is strong yet very flexible and transmits full power smoothly, without chatter or vibration. The three interchangeable heads described above are available for this undercutter. The head mounts on a long slender drive shaft housing making the machine particularly valuable in close quarters as the head is the widest part of the undercutter. Full load saw spindle speeds can be seen to the right of the image.

### Flex-Drive Mica-Miller

Head Size	115 V., 60 Hz	230 V., 60 Hz
Small Head and $\frac{5}{16}$ " arbor	M-MU301A	M-MU301B
Standard Head and $\frac{5}{16}$ " or (7mm.) arbor	M-MU302A or (7M)	M-MU302B or (7M)
Heavy-Duty Head and $\frac{3}{8}$ " arbor	M-MU303A	M-MU303B

### Accessories

Head Size	230 V., 60 Hz
No. 16 Core (5 ft.) (replacement for flexible shaft)	MFLXD90
No. 16 Sheath (replacement for flexible shaft)	MFLXD61
Steel Carrying Case, No. 2; for Flex-Drive Mica-Miller	CASE102

- Extra Interchangeable Heads available

### Flex-Drive Mica-Miller with Flexible Shaft and Swivel Connection

Head Size	Connection	Catalogue #
Small Head and $\frac{5}{16}$ " arbor	$\frac{1}{2}$ " dia. Motor Connection	M-MU40112
	$\frac{5}{8}$ " dia. Motor Connection	M-MU40158
	10mm. dia. Motor Connection	M-MU40110MM
Standard Head and $\frac{5}{16}$ " or (7mm.) arbor	14mm. dia. Motor Connection	M-MU40114MM
	$\frac{1}{2}$ " dia. Motor Connection	M-MU40212 or (7M)
	$\frac{5}{8}$ " dia. Motor Connection	M-MU40258 or (7M)
Heavy-Duty Head and $\frac{3}{8}$ " arbor	10mm. dia. Motor Connection	M-MU40210MM or (7M)
	14mm. dia. Motor Connection	M-MU40214MM or (7M)
	$\frac{1}{2}$ " dia. Motor Connection	M-MU40312
	$\frac{5}{8}$ " dia. Motor Connection	M-MU40358
	10mm. dia. Motor Connection	M-MU40310MM
	14mm. dia. Motor Connection	M-MU40314MM

# Hand Tools



## Commutator Slotting Files

If you have only a few motors, undercut your mica with handy Commutator Slotting Files. They do the work rapidly, are easy to use and leave a 60° V-shaped slot. They are made in the two styles shown above.

Style	Catalogue Number
8", Double End, Curved	SLFL08
Single End, with handle	SLFL01

## Mini-Bar Mica Hand Saw

This hand-held undercutting saw is a handy way of accurately undercutting those small commutators where the use of a powered under-cutter is too awkward or cannot be justified. This tool uses replaceable blades which are ground to specific thicknesses so that the proper width undercut can be made. The blade is reversible so that it can be used for either a "Push" or a "Draw" cut. Replaceable blades are available in thicknesses of .015", .020", .026", .030", .035", .040", and .043".

Style	Catalogue Number
Mini-Bar Mica Hand Saw, complete with tool holder and one blade (specify thickness)	SLSC (Plus Thickness)
Replacement Blade (Specify Thickness)	SLSCB (Plus Thickness)



## Electrician's Knife

This is not an ordinary pocket knife. It is a quality tool guaranteed to satisfy the exacting demands of workmen accustomed to rugged and dependable performance.

- No. 1 Knife — Handmade from very highest quality steel. Hand ground. Screwdriver blade locks to prevent closing when in use
- 3<sup>3</sup>/<sub>4</sub>" long closed. 6<sup>1</sup>/<sub>2</sub>" long open. Net Weight 142g.
- Catalogue Number ELKN01

## Orange Sticks

Orange Sticks (called so because they were originally made from orange wood) can be used for forming, shaping and positioning fine magnet wire where fingers can't reach or work comfortably. Also used for opening and holding open, contacts on relays and the such. These hardwood, none conductive sticks have tapered ends for prying open contacts and can be trimmed and/or sharpened with a knife.

- Pack of 12
- Catalogue Number MARTOS



# Chamfering Tools



## Commutator Slot Shaver II

A new twist on an old design, this tool lightly chamfers commutator bar edges after undercutting. Pull it along the copper, shaving off the burs, then flip it over and do the edge of an adjacent bar. The holder is designed for comfort, important when many bars need to be chamfered by one person! Made of high speed steel, the inexpensive & easily replaceable 45° inserts are available in .020", .040", & .060" thicknesses.

HSS Insert Thickness	Catalogue #
Slot Shaver II, complete with .020" thick HSS Insert	SLSC2020
Slot Shaver II, complete with .040" thick HSS Insert	SLSC2040
Slot Shaver II, complete with .060" thick HSS Insert	SLSC2060

HSS Insert Thickness	Catalogue #
Insert Only, H.S.S., .020" thick; For Slot Shaver II	SLSC2B020
Insert Only, H.S.S., .040" thick; For Slot Shaver II	SLSC2B040
Insert Only, H.S.S., .060" thick; For Slot Shaver II	SLSC2B060

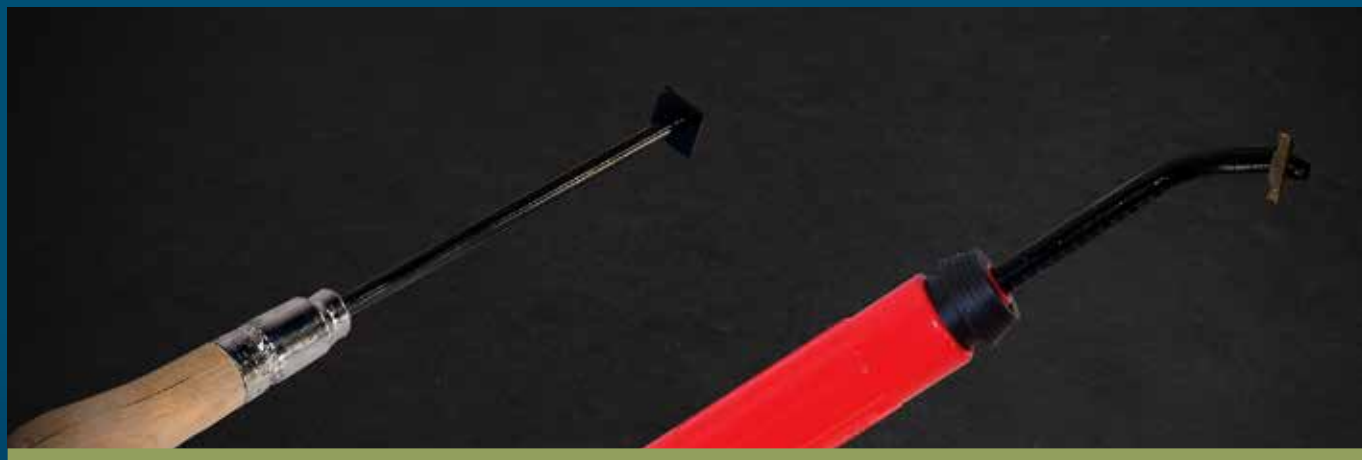
## Commutator Slot Shaver

The Commutator Slot Shaver is a simple little hand tool to lightly chamfer the edges of commutator bars after undercutting. Pull it along the copper, shaving off the burs - flip it over and do the other edge. Made of hardened high-speed steel; it can be quickly re-sharpened on a grinding wheel.

■ Catalogue Number SLSC73



# Chamfering Tools



### E-Z Chamfer 90°

Specially ground 4 cornered carbide insert, chamfers copper on both sides of commutator slots after undercutting. Flat sides of the insert can be used for scraping, deburring and chamfering corners on many parts. When insert is dull on all cutting edges, it is easily replaced.

	Catalogue #
E-Z Chamfer 90° complete with carbide insert	SLSC74
Replacement Carbide Insert only (90°)	SLSC745

- Four 90° Carbide Cutting Edges
- Useful on many deburring jobs

### E-Z Chamfer 60°

Special ground, 3 cornered insert, chamfers copper on both sides of commutator slots after undercutting. Tool is originally supplied with a H.S.S. insert. An optional Carbide replacement insert is available. The offset blade holder provides knuckle clearance when deburring. This holder can be retracted into the handle along with extra inserts, for easier storage when not in use. The insert is easily replaced when it becomes dull on all three corners.

	Catalogue #
Z Chamfer 60° complete with H.S.S. Insert	SLSC74PT
Replacement Carbide Insert only (60°)	SLSC745PT

- Three 60° Cutting Edges, for thin mica



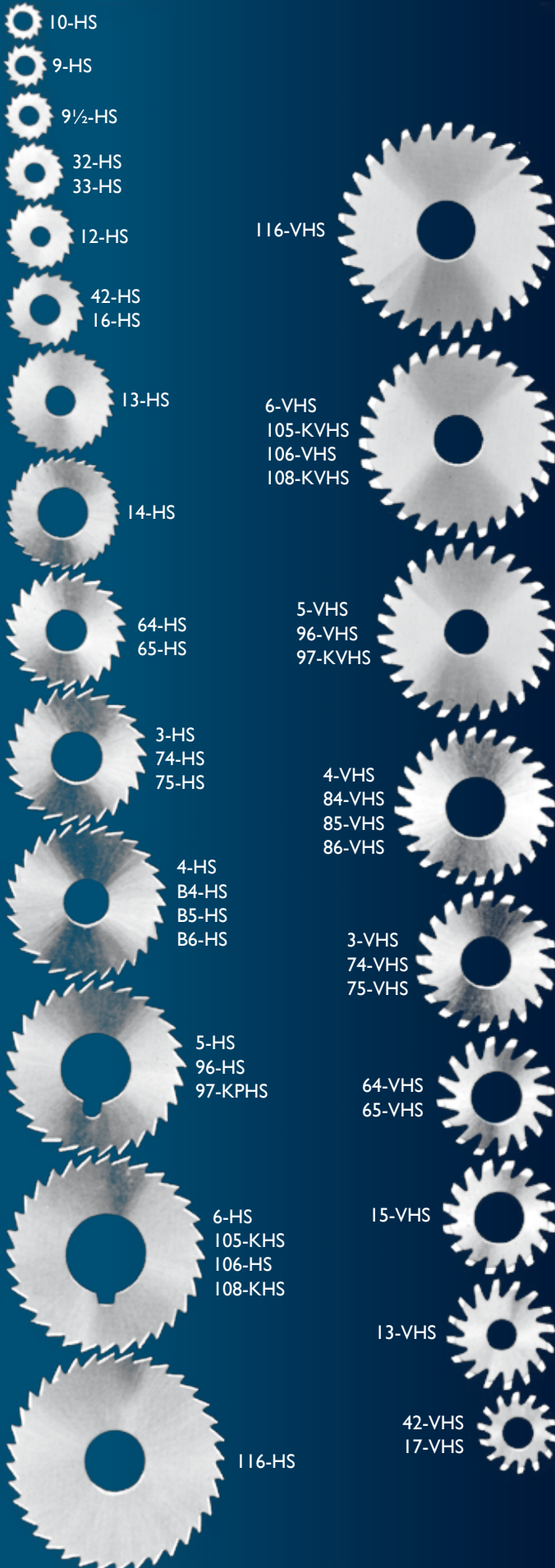
### Adjustable Slot Scraper

For removing fins of mica and burs of copper from the edges of commutator bars after undercutting with a U-shaped saw. Do not use for undercutting mica because any tool that rakes out the mica may injure the insulation by tearing out mica slivers and thus permitting dirt to work down into the insulation.

	Catalogue #
Slot Scrape	SLSC69
Extra Blade	SLSC694

- $\frac{3}{16}$ " High Speed Steel Adjustable Tool Bit
- Adjusts to any position
- Two Cutting Edges: 60° and 90° angles

## High Speed Steel



# Undercutting Saws

### GENERAL

Undercutting Saws and V-Cutters are available in High-Speed Steel or Tungsten-Carbide. Both types are carefully designed as to tooth form, hollow grind, hardness, etc., and are manufactured to close tolerances in our own plant. While used primarily for undercutting mica and slotting risers of commutators, our Undercutting Saws and V-cutters are also used for cutting steel, aluminium, plastics, and other materials not requiring set teeth. Undercutting differs from ordinary machining in that, instead of shearing, it is a combination of crushing, grinding, and conveying. Mica is very abrasive and varies in hardness, making necessary the very best design and production controls in the manufacture of undercutting saws.

### HIGH-SPEED STEEL SAWS and V-CUTTERS

These can be used on either portable or stationary equipment with spindle speeds of 1,500 to 5,000 r.p.m.

### SAWS ("U"-Slot)

Actual size illustrations at left; specifications below. Saws stocked in these thicknesses:

.015" .023" .028" .035" .043" .053" .060"  
 .018" .025" .030" .038" .045" .055" .063"  
 .020" .026" .032" .040" .050" .058" .065"

■ (Other thicknesses available at extra cost.)

Be sure to specify thicknesses.

Type	OD	Hole	Teeth	Catalogue #
10-HS	1/4"	3/8"	14	HSMS10
9-HS	3/32"	3/8"	14	HSMS9
9 1/2-HS	3/16"	3/8"	16	HSMS9.5
32-HS	3/8"	3/8"	18	HSMS32
33-HS	3/8"	3/16"	18	HSMS33
12-HS	7/16"	3/8"	18	HSMS12
42-HS	1/2"	3/8"	18	HSMS42
16-HS	1/2"	3/16"	18	HSMS16
13-HS	1 1/16"	3/16"	28	HSMS13
14-HS	2 3/32"	3/16"	32	HSMS14
64-HS	3/4"	1/4"	22	HSMS64
65-HS	3/4"	3/16"	22	HSMS65
74-HS	7/8"	1/4"	24	HSMS74
3-HS	7/8"	7/32"	24	HSMS3
75-HS	7/8"	3/16"	24	HSMS75
84-HS	1"	1/4"	28	HSMS84
4-HS	1"	7/32"	28	HSMS4
85-HS	1"	3/16"	28	HSMS85
86-HS	1"	3/8"	28	HSMS86
5-HS	1 1/8"	7/32"	28	HSMS5
96-HS	1 3/8"	3/8"	28	HSMS96
97-KHS	1 3/8"	7/16"	28	HSMS97K
6-HS	1 1/4"	7/32"	32	HSMS6
105-KHS	1 1/4"	3/16"	32	HSMS105K
106-HS	1 1/4"	3/8"	32	HSMS106
108-KHS	1 1/4"	1/2"	32	HSMS108K
116-HS	1 3/8"	3/8"	36	HSMS116

### V-CUTTERS ("V"-Slot)

Actual size illustrations at left; specifications below. These cutters are all .045" thick and stocked with 40°, 50°, and 60° angles between cutting edges. 40° V-cutters are for thin mica, 50° for medium mica, 60° for thick mica.

Be sure to specify angle 40°, 50°, or 60°.

Type	OD	Hole	Teeth	Catalogue #
42-VHS	1/2"	3/8"	12	HSMSV42
17-VHS	1/2"	3/16"	12	HSMSV17
13-VHS	1 1/16"	3/16"	14	HSMSV13
15-VHS	2 3/32"	3/16"	14	HSMSV15
64-VHS	3/4"	1/4"	14	HSMSV64
65-VHS	3/4"	3/16"	14	HSMSV65
74-VHS	7/8"	1/4"	18	HSMSV74
3-VHS	7/8"	7/32"	18	HSMSV3
75-VHS	7/8"	3/16"	18	HSMSV75
84-VHS	1"	1/4"	22	HSMSV84
4-VHS	1"	7/32"	22	HSMSV4
85-VHS	1"	3/16"	22	HSMSV85
86-VHS	1"	3/8"	22	HSMSV86
5-VHS	1 1/8"	7/32"	24	HSMSV5
96-VHS	1 3/8"	3/8"	24	HSMSV96
97-VHS	1 3/8"	7/16"	24	HSMSV97K
6-VHS	1 1/4"	7/32"	24	HSMSV6
105-KVHS	1 1/4"	3/16"	24	HSMSV105K
106-VHS	1 1/4"	3/8"	24	HSMSV106
108-KVHS	1 1/4"	1/2"	24	HSMSV108K
116-VHS	1 3/8"	3/8"	26	HSMSV116

■ Metric Sizes 25mm. OD x 7mm ID Saws, along with other metric sizes upon request

## Undercutting Saws

### TUNGSTEN-CARBIDE SAWS and V-CUTTERS

The teeth of both saws and V-cutters have a slight land to give strength to the cutting edge. Saws are hollow-ground for clearance, V-cutters have ample radial relief. When Carbide Saws are used on other equipment than our undercutters, steel supporting washers are recommended to reduce breakage. Spindle speeds may vary from 3,000 to 12,000 r.p.m., depending on Saw O.D. Carbide Saw Blades are harder than High Speed Steel Saws, therefore more brittle and should not be subjected to applications where shock may shorten the service life. Use on rigid stationary equipment. See Undercutters for products that use these saws: Close-Cut, Kut-Kwik, Utility, Bench-Type Model HV-3, Lathe-Type and Super Lathe-Type, Heavy-Duty Bench-Type Model H-9, Industrial Model HA-2, and Model UL Lathe Mounted Automatic.

#### SAWS ("U"-Slot)

Actual size illustrations; specifications below. Thickness ranges as follows:

114" - 9116" O.D. from .010" to .045" thick

518" - 1-318" O.D. from .010" to .065" thick

Be sure to specify thicknesses.

Type	OD	Hole	Teeth	Catalogue #
10-TC	1/4"	3/8"	12	TUNSI0
9 1/2-TC	5/16"	3/8"	14	TUNSI9.5
32-TC	3/8"	3/8"	14	TUNSI32
33-TC	3/8"	3/16"	14	TUNSI33
12-TC	7/16"	3/8"	14	TUNSI12
42-TC	1/2"	3/8"	14	TUNSI42
16-TC	1/2"	3/16"	14	TUNSI16
18-TC	3/16"	1/4"	16	TUNSI18
54-TC	3/8"	1/4"	16	TUNSI54
64-TC	3/4"	1/4"	18	TUNSI64
65-TC	3/4"	5/16"	18	TUNSI65
75-TC	7/8"	5/16"	20	TUNSI75
4-TC	1"	7/32"	20	TUNSI4
84-TC	1"	1/4"	20	TUNSI84
85-TC	1"	5/16"	20	TUNSI85
86-TC	1"	3/8"	20	TUNSI86
95-TC	1 1/8"	5/16"	22	TUNSI95
96-TC	1 3/8"	3/8"	22	TUNSI96
105-TC	1 1/4"	5/16"	24	TUNSI105
106-TC	1 1/4"	3/8"	24	TUNSI106
108-TC	1 1/4"	1/2"	24	TUNSI108
116-TC	1 3/8"	3/8"	24	TUNSI116

#### COMPOUND-LAND SAWS

The compound-land feature, sketched at right, is available on tungsten-carbide "U"-slot saws 9/16" OD and up (#18-TC thru #116-TC) at a 30% premium in price. Because of this feature, each tooth cuts only 50% of full slot width, resulting in better chip clearance, cooler operation and production increases of up to 60% over the square-toothed Saw. To order, add "CL" to Catalogue Number. Minimum thickness .015".



#### V-CUTTERS ("V"-Slot)

Actual size illustrations; specifications below. Thickness ranges as follows:

1/2" OD from .030" to .045" thick

3/4" - 1 3/8" OD from .030" to .065" thick

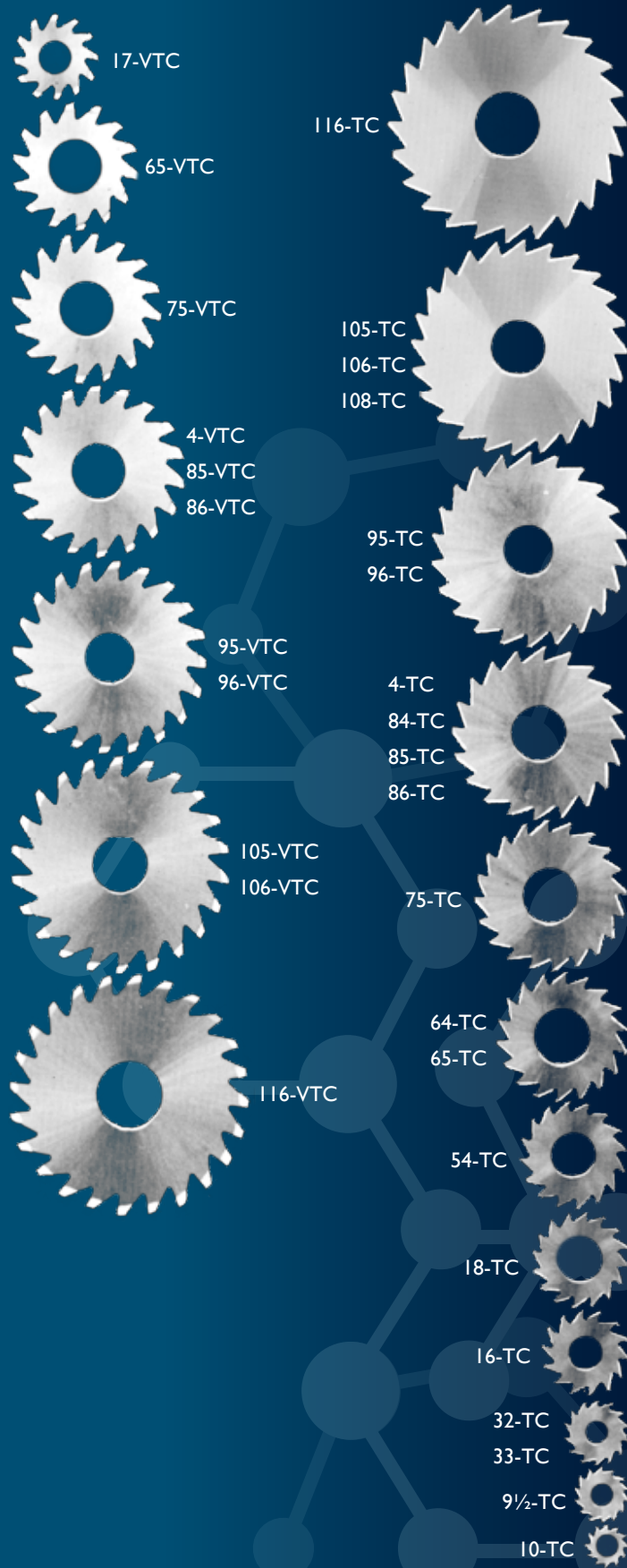
Angles between cutting edges can be 40°, 50°, and 60°. 40° V-cutters are for thin mica, 50° for medium mica, 60° for thick mica.

Be sure to specify thicknesses and angle, 40°, 50° or 60°.

Type	OD	Hole	Teeth	Catalogue #
42-VTC	1/2"	3/8"	12	TUNSV42
17-VTC	1/2"	3/16"	12	TUNSV17
65-VTC	3/4"	5/16"	14	TUNSV65
75-VTC	7/8"	5/16"	16	TUNSV75
4-VTC	1"	7/32"	18	TUNSV4
85-VTC	1"	5/16"	18	TUNSV85
86-VTC	1"	3/8"	18	TUNSV86
95-VTC	1 1/8"	5/16"	20	TUNSV95
96-VTC	1 3/8"	3/8"	20	TUNSV96
105-VTC	1 1/4"	5/16"	22	TUNSV105
106-VTC	1 1/4"	3/8"	22	TUNSV106
116-VTC	1 3/8"	3/8"	22	TUNSV116

■ SPECIALS — Your enquiries are invited for sizes not listed on the H.S.S. or Tungsten-Carbide Saw Pages

### Tungsten-Carbide



# Growlers

## General Information

When an alternating current is passed through a Growler, it sets up a magnetic flux in the iron of the armature or stator spanned by the jaws of the Growler. As this flux passes through any coil, it induces a potential. A current will flow if the coil is short-circuited. When current flows, it sets up a magnetic field around the shorted coil which can be detected with an iron feeler. (The increased load on the Growler sometimes changes the tone of the hum; hence the name "Growler".). Open coils can also be found; see discussion below.



Type B-1 has adjustable jaws 2½" long. Armature capacity: 1" to 18" diameter. There are no obstructions at the ends of the jaws, thus allowing small armatures with fans, bearings, etc., to fit properly.

- Model B-1 has Adjustable Jaws with Face Length of 2½"
- At Left: Type B-1 Adjustable Bench Growler

## Foot-Switch

A Foot-Switch with an 8 ft. line cord, and a female connection is available for use with any of the Growlers. Large armatures cannot be easily rotated without shutting off the Growler current. This is conveniently done with the Foot-Switch, while the hands are left free to turn the armature.

- Type F and Type I-X both have built-in feeler. Type F has fixed position feeler, Type I-X feeler is adjustable
- Type F and I-X Growler

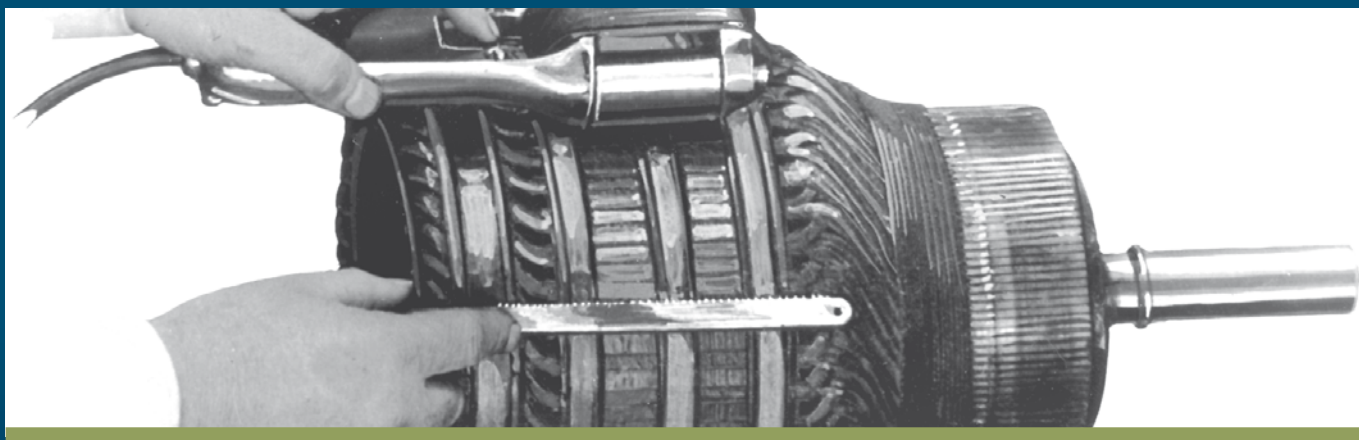
Types F and I-X are similar in appearance, with built-in feeler as pictured, except the feeler on Model I-X is adjustable, which gives it a wider range of applications. Both have fixed jaws 2" long, and a thumb-switch. Both can be used in stators as small as 2⅜" inside diameter, and on armatures from 2½" diameter up. The built-in feeler makes testing a one hand operation, and is especially desirable in small stators where there isn't room for a separate feeler. The adjustable feeler on the I-X is more satisfactory where a variety of large and small armatures and stators are involved.

Type	Length Face	Range for Armatures Dia	Range for Stators Dia	Catalogue Number	
				115V 50/60 Hz.	230V 50/60 Hz.
U-2	4"	1" & up	5¾" & up	GRLRU2A	GRLRU2B
B-1	2½"	1" - 18"	-	GRLRB1A	GRLRB1B
F	2"	2½"-12"	2⅜"-12"	GRLRFA	GRLRFB
I-X	2"	2½"-12"	2⅜"-12"	GRLR1XA	GRLR1XB
Foot Switch	2"	-	-	JGRLFSA	GRLR19





# Growlers



## How Growlers Are Used

The most common way of using a Growler is the “feeler method” in which the Growler spans a slot containing a coil, and a “feeler” of iron, such as a hack-saw blade is held about  $\frac{1}{4}$ ” above the slot containing the other side of the same coil. If the coil is shorted, the feeler will be pulled down to the slot where it will stick and vibrate. The action is very positive and is recognized instantly. The feeler can also be used on the same side of the coil that is spanned by the Growler, either a separate feeler or the convenient built-in feeler of Types F and I-X.

## Open Circuits

Open circuits can be detected by shorting adjacent commutator bars with a screw driver, or any other piece of metal. Good coils will spark as the bars are shorted. No sparks indicate the coil is open, test field coils by shorting lead wires. Another way is to use a continuity tester, these can also be used for detecting grounds.



Type U-2 Growler has adjustable jaws 4” long, and may be used on armatures over 1”, and on stators over  $5\frac{3}{4}$ ” inside diameter.

■ Type U-2 Universal Adjustable Growler may be used as both an external Growler for armatures and an Internal Growler for stators

■ Adjustable Jaws. Face Length 4”



Mechanical Carbon Products

# M e c h a n i c a l   C a r b o n P r o d u c t s



Vacuum Pump Vanes, Carbon  
Bushes, Bearings, seals...

**Vacuum Pump Vanes**

ECP offer a wide range of 'made-to-order' carbon vanes in our premium grade 'DURABLADE', with its resilient wear properties and ability to cope with frequent start / stop pump cycles.

To order / request a quotation; please send in a sample to us or photocopy of the appropriate survey sheet from this catalogue, complete and email or fax it back to us. Alternatively, visit our website and download our 'Spares Catalogue', then print off the page and send the completed sheet back to us.

**Carbon Bearings/Bushes**

ECP offer 'made-to-order' carbon bearings/bushes for all your needs, whether they are for one-off repairs or for high quantity batch runs.

We select the most suitable grade of carbon to utilise, based on your actual application.

To order / request a quotation; please either send in a sample to us or take a few photos of the part to highlight both general and specific machining details. Email these to us along with the following supporting information:-

- OUTSIDE DIAMETER
- INSIDE DIAMETER
- LENGTH
- QUANTITY
- ACTUAL SHAFT DIAMETER
- Any supporting drawings or sketches
- Any detail as to the application i.e. oven fan or submersible pump
- Will the bearing/bush be immersed in any fluids during normal operation?

**Carbon Seals**

ECP offer a broad range of high quality mechanical carbons for use on shaft sealing applications. We 'make-to-order' to satisfy all your needs and our grades are selected & impregnated accordingly to suit each application.

To order / request a quotation; please either send in a sample to us or take a few photos of the part(s) to highlight both general and specific machining details. Email these to us along with the following supporting information:-

- OUTSIDE DIAMETER
- INSIDE DIAMETER
- LENGTH
- QUANTITY
- ACTUAL SHAFT DIAMETER
- Any supporting drawings or sketches
- Application – i.e. petrol pump, syrup dosing pump
- What fluids/liquid will be in direct contact with the seals?



# T r o u b l e   S h o o t i n g



**Engineering Carbon Products can provide expert assistance, advise and solutions.**

- Self diagnosis charts to help identify the cause of your issue
- Expert advise and solutions
- 1-2 day order processing
- Emergency same day despatch

# Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE												
SPARKING AT THE TRAILING EDGES													■ INCORRECT POSITION OF BRUSH HOLDER ARMS
GREEN PIN POINT SPARKING													■ OIL DIRT ON SURFACE OF COMMUTATOR OR SLIPRING
EXCESSIVE SPARKING AROUND THE COMMUTATOR													■ ARMATURE WINDING OPEN CIRCUIT
BRUSH CHATTER AND / OR DUSTING													■ OVERLOADED MACHINE
RAPID BRUSH WEAR WHILE COMMUTATION IS GOOD													■ UNDER LOADED MACHINE
UNEQUAL BRUSH WEAR													■ VIBRATION OF MACHINE
EXCESSIVE COMMUTATOR WEAR - SURFACE BLACKENED													■ INCORRECT BRUSH BEDDING
SERRATION AND GROOVING OF COLLECTOR SURFACE													■ UNEQUAL CURRENT DISTRIBUTION
COMMUTATOR HAS ASYMMETRICAL MARKINGS													■ BRUSHES NOT SLIDING FREELY IN BOXES
COMMUTATOR HAS SYMMETRICAL MARKINGS													■ BRUSH BOXES WORN OR OVER SIZED
COLLECTOR SURFACE AND BRUSHES TOO HOT													■ LOOSE CONNECTIONS TO BRUSH HOLDERS
PITTED BRUSH CONTACT SURFACES													■ TOO MUCH CLEARANCE BETWEEN BRUSH BOX & COLLECTOR SURFACE
COMMUTATOR STREAKY													■ FLATS ON THE COMMUTATOR OR SLIPRING
CHIPPING OF BRUSH EDGES OR BRUSH BREAKAGE													■ HUMIDITY OF ATMOSPHERE TOO LOW
FAILURE TO DEVELOP A PROTECTIVE SKIN													■ DUSTY ATMOSPHERE
													■ GAS OR ACID FUMES IN THE ATMOSPHERE
													■ INCORRECT SPRING TENSION
													■ HIGH OR LOW COMMUTATOR BARS
													■ BRUSHES TOO ABRASIVE
													■ BRUSHES CONTAMINATED WITH OIL / GREASE
													■ BRUSH GRADES MIXED
													■ BRUSH FLEXIBLE CONNECTIONS FAULTY
													■ COMMUTATOR BARS LOOSE
													■ MICA NOT UNDERCUT
													■ COLLECTOR SURFACE OUT OF ROUND

## Appearance of the brush sliding face

The following pictures show typical brush-sliding faces. For easy identification we suggest you use the symbols S1, S3 etc.



S1 ■ Dense, shining sliding face



S3 ■ Slight porous sliding face



S5 ■ Fine hairlining



S7 ■ Hairlining



S9 ■ Tracking with hairlining and groves



S11 ■ Ghostmarks, difficult commutation



S13 ■ Burning edge of the leaving or trailing edge



S15 ■ Eroded brush face



S17 ■ Lamination of sliding face



S19 ■ Double facing here for a twin brush



S21 ■ Copper nests



S23 ■ Broken edges

S1, S3 and S5 are satisfactory sliding faces, indicating that there are no mechanical or electrical problems. Depending on the carbon material, the sliding surface appears dense or porous and shiny, dull or matt. If there is dust in the circulating air, fine hairlining may occur as shown in S5.

S1 ■ Normal operation

S3 ■ Normal operation

S5 ■ Normal operation, slight dust influence

S7 ■ Causes: Underload, influence of dust, oil or grease, weak spring pressure

S9 ■ Causes: Like S7, but stronger

S11 ■ Causes: Commutation problems, e.g. false or incorrect position of the neutral zone or interpole

S13 ■ Causes: Difficult commutation, heavy sparking, interruption of contact due to out of round of commutator or insufficient brush holder spring pressure

S15 ■ Causes: Electrical overload, interruption of contact

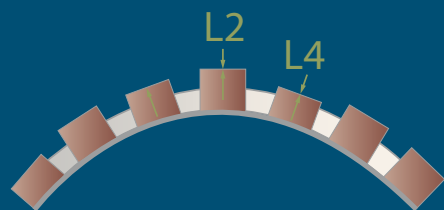
S17 ■ Causes: Burned segments of the sliding face caused by a winding fault giving voltage surge during commutation

S19 ■ Causes: Tilting of the brush in dual direction machine

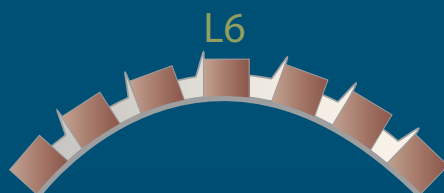
S21 ■ Causes: Pick up of copper particles, often following copper drag

S23 ■ Causes: High raised lamination, commutator seriously out of round, brush chatter by low load idle running

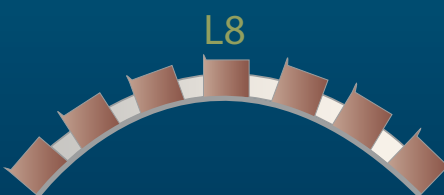
# Commutator Conditions



**L2** Protruding segment



**L4** Low segment



**L6** Raised mica



**L8** Ridge on the segment edge



**L10** Copper drag

■ Causes: Faulty commutator segments

■ Causes: Bumps or vibrations with various causes

## Operating Difficulties

### Strong brush sparking

Cause	Corrective measures
Out of round commutator or slipping	Turning or grinding
Insufficient brush pressure	Increase brush pressure
Carbon brushes are stuck in holder	Carefully remove foreign bodies and dust from brush and holder. Dust grooves are recommended
Oil or dirt between segments	Clean segments, filter cooling air, and possibly seal bearings
Carbon brushes badly bedded in	Repeat bedding in
Brush holder too far from the commutator or slipring	Adjust distance between holder and commutator to 2mm
Protruding insulation segments	Undercut insulation and chamfer segments
Machine vibrating or chattering	If it is not possible to reduce the vibration of the machine, increase brush pressure or use a brush design fitted with fibre and rubber top
Wrong position of brush bridge	Establish neutral position and adjust brush arms accordingly
Faulty installation of brush arms	Adjust brush arms correctly
Interpole too strong or weak	Machine manufacturer to correct fault, or install another brush grade to compensate
Incorrect brush grade	Please contact our technical service

### Patches or burn marks

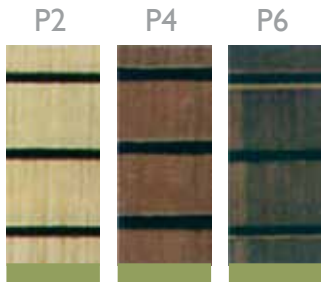
Cause	Corrective measures
Producing or low segments (L2, L4)	Retighten and turn the commutator
Raised mica insulation (T16, P24)	Turning the commutator, undercut mica and possibly retighten commutator
Out of round commutator or sliprings, i.e. badly out of balance (P16)	Rebalance and / or remachine commutator or slipring
Bad soldering of risers (P42, P46)	Resolder risers
Electrolytic deposit from brush to steel on stationary steel sliprings (galv. element)	In case of long standstill periods, insert insulating strip under the carbon brush

■ For additional information, please contact our sales team and they will assist you further

**Commutator Appearance**

In addition to the physical appearance of the commutator's surface, the skin or patina is of equal importance for the good running of the carbon brushes. Each carbon brush builds a characteristic patina which is affected by operating and ambient conditions. The patina consists mainly of copper oxides, graphite deposits and absorbed water, and its appearance is of importance for the assessment of the running behaviour of the commutation set.

The following pictures are used by carbon brush manufacturers and users of brushes as a guide to assist in judging the operation of carbon brushes.



**P2, P4 and P6**

These are examples of normal skin or patina formation. When a machine runs well, the patina or skin on a commutator will be even, slightly shiny and coppery brown to black in colour.

There may be appearance of greyish, blueish and reddish hues, but of importance is the evenness of the skin formation and not its colour.

**Electrical, mechanical and atmospheric influences on the patina appearance**



**P12** Streaky patina having some wide and narrow tracks of different colour. No commutator wear.

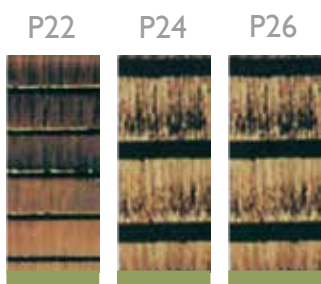
■ Causes: High humidity, oil vapour, aggressive gases in atmosphere, low electrical load on the brushes

**P14** Torn patina, general appearance as in P12, but with commutator wear.

■ Causes: As in P12, but the conditions have been maintained for a longer period causing commutator damage

**P16** Smutty patina, uneven skin having patchy colours and random spots.

■ Causes: Uneven commutator or unclean operating conditions



**P22** Patina with dark areas, regular or irregular patches covering one of more commutator segment.

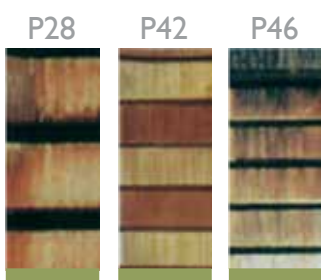
■ Causes: Out of round commutator, vibrations of the motor caused by badly adjusted shaft or damaged bearings

**P24** Dark patchy patina having definite edges as in T12 and T14.

■ Causes: Raised segment or group of segment causing the brush to bounce

**P26/P28**  
Commutator segments having patches in the middle or at the edges.

■ Causes: Often due to faulty grinding of the commutator or commutating problems



**P42** Alternating light and dark bar markings.

■ Causes: Uneven current distribution over two parallel windings caused by double windings crossing the same slot

**P46** Mat patches in double pole pitches.

■ Causes: Usually by faulty soldering of the risers or segment connections





### **B2, B6, B8**

Burning at the edge or in the middle of bar.

**B10** Perforated patina, light, dense, or distributed build-up spots.

**T10** Dark patches at edges of bars in direction of rotation.

**T12** Burning of a trailing edge and the next leading edge of a bar.

**T14** Dark markings.

**T16** Clearly defined dark markings together with segment edges burnt.

**T18** Dark makings.

### **Commutator Wear**

**R2** Top view of a commutator.

**R4** Commutator bar showing abnormal metal abrasion.

- Causes: Sparking caused by commutation problems

- Causes: Patina destruction caused by too large electrical resistance

- Causes: Frequently caused by long periods with the motor being stationary without power or short stationary periods under load

- Causes: Caused by protruding segments as in L2

- Causes: Sign of low segment, could also be caused by a flat spot on the commutator

- Causes: Raised mica (See L6)

- Causes: Badly undercut segment edges (See L8)

- Causes: Trackwise normal metal abrasion after long period of operation with correctly positioned brushes

- Causes: Abnormal abrasion is caused by incorrect brush alignment, inadequate brush material or contamination etc...

# Commstone Information

## DIRECTIONS FOR USING COMMSTONES

- If grease or oil is present, wipe or sandpaper the commutator thoroughly before applying the stone.
- Run the machine at full speed.
- Do not rock the stone; hold it firmly in order to get a true arc as quickly as possible.
- Apply with sufficient pressure to get rapid cutting. If the stone wears faster on one side than on the other, it is because the pressure is not applied perpendicularly. This may be corrected by turning the stone three or four times until the full face has been obtained.
- During grinding, move the stone slowly from side to side. This will prevent ridges in the commutator from wearing grooves in the stone.
- Large stones which are difficult to move while grinding may be held in one place for a few seconds, then lifted, moved about 1/4 inch, applied again for a few seconds, moved again, and so on until the commutator is true.

## For Commutators and Brass or Copper Slip Rings

Grade	Description
GRADE EC	(Extra Coarse – 36 Grit) for use where a great deal of copper is to be removed and a very fast cutting stone is desired for pitted and grooved conditions
GRADE C	(Coarse – 46 Grit) recommended for general fast cutting
GRADE M	(Medium – 90 Grit) for use where only high mica or a small amount of copper is to be removed
GRADE F	Fine – 120 Grit) recommended for general finishing, for periodic preventative maintenance or removing small ridges
GRADE P	(Extra Fine or Polishing – 220 Grit) for finishing or polishing / burnishing where a high mirror-like polish is desired
GRADE EP	(Extra Polish – 320 Grit) for finishing of small commutators

## For Cast Iron and Steel Slip Rings - When using on cast iron or steel slip rings, run at 1800 or more surface feet per minute.

Grade	Description
GRADE SRC	(Coarse – 36S Grit) for removing large quantities of metal
GRADE SRM	(Medium – 60S Grit) for general use and removing pits
GRADE SRF	(Finish – 90S Grit) for finishing

## DON'T USE TOO SMALL OF A STONE

- COMMSTONES can be made in ANY SIZE.
- A Commutator stone should be as long as will work freely between adjacent brush sets, and should also be twice as long as the width of the largest flat spot. This latter requirement may occasionally make it necessary to remove one brush-holder stud during the grinding, to prevent commutator ridges from wearing grooves in the stones.
- A Commstone that meets these size requirements will give much better results than too small a stone and will prove more economical. If in doubt about the size to order, give us dimensions “W”, “L” and “D” of your commutator and we will supply the proper size.



# Engineering Carbon Products Forms



- Forms for ordering brush and ancillary products
- Complete and return via email, fax or by hand
- Service offered from two dedicated UK sites
- Large range of ancillary products from stock
- Download any of our forms from our website

# Brush Order Form

Customer Address			Contact		
			Tel		
			Fax		
			Date	Existing Brush Grades	
Quantity		Delivery Req.		Order Number	

For these styles give height of turned head

--

**SPRING DETAILS**

Length

Diameter

No of turns

Wire gauge

Please circle correct style from above - or sketch on separate sheet

<p><b>Commutator/Slipring</b></p> <p>COMMUTATOR <input type="checkbox"/> SLIPRING <input type="checkbox"/></p>	<p>T <input type="text"/></p> <p>W <input type="text"/></p> <p>H <input type="text"/></p> <p>Brush Worn Y <input type="checkbox"/> N <input type="checkbox"/></p>	<p>B1 <input type="text"/></p> <p>B2 <input type="text"/></p>	<p><b>Contact Radius</b> (Use brush to draw curvature here)</p> <p>A <input type="text"/></p> <p>B <input type="text"/></p> <p>R <input type="text"/></p>	<p><b>Top Groove</b></p> <p>W <input type="text"/></p> <p>D <input type="text"/></p>
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**Tops / Inserts**

<p>Fibre</p> <p>W <input type="text"/></p> <p>R <input type="text"/></p>	<p>Fibre</p> <p>W <input type="text"/></p> <p>H <input type="text"/></p> <p>R <input type="text"/></p>	<p>Rubber (B)/Fibre(A)</p> <p>W <input type="text"/></p> <p>R <input type="text"/></p> <p>A <input type="text"/></p> <p>B <input type="text"/></p>	<p>Rubber (B)/Fibre(A)</p> <p>W <input type="text"/></p> <p>R <input type="text"/></p> <p>A <input type="text"/></p> <p>B <input type="text"/></p>	<p>Loose Rubber(B)/Fibre(A)</p> <p>Thickness</p> <p>B <input type="text"/></p> <p>A <input type="text"/></p>	<p>Metal Top</p> <p>L <input type="text"/></p> <p>W <input type="text"/></p>
--	--	--	--	--	--

<p>Flex Length <input style="width: 50px;" type="text"/></p> <p>Flex Diameter <input style="width: 50px;" type="text"/></p> <p>Is Flex Insulated Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Is Flex Tinned Y <input type="checkbox"/> N <input type="checkbox"/></p>	<p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> I <input type="checkbox"/></p> <p>STYLE <input style="width: 50px;" type="text"/> SLOT/HOLD SIZE <input style="width: 50px;" type="text"/> No. OF TERMINALS <input style="width: 50px;" type="text"/></p>	<p>a <input type="text"/></p> <p>b <input type="text"/></p> <p>c <input type="text"/></p> <p>d <input type="text"/></p> <p>e <input type="text"/></p>
--	--	---

# Brush Grade Selection

To:	Tech Rep:	Date:
Customer Name:		Contact Tel No:

**Brush Details**

Customer Part No:		
T (Thickness) Dimensions:	A (Width) Dimensions:	Existing Grades:

**Object Request**

<input type="checkbox"/> Enquiry for Order	<input type="checkbox"/> Technical Query	<input type="checkbox"/> Information Only
--	--	---

**Machine Details**

Type of Motor/Generator:	Manufacturer:	Model No:
Rated Power (Kw or Hp):		

**Electrical / Mechanical Details**

Supply (AC / DC / Rectified AC)		Supply Frequency (Hz):
Voltage:	Full load rated current:	Speed (RPM):
For machine with sliprings please supply Rotor or Excitation current:	Actual Current:	Variable Speed (RPM):
Type of Collector Comm <input type="checkbox"/> Ring <input type="checkbox"/>	Collector Dia:	Collector Material:
	No of Brush Arms:	No of Brush per Set:

**Application Details**

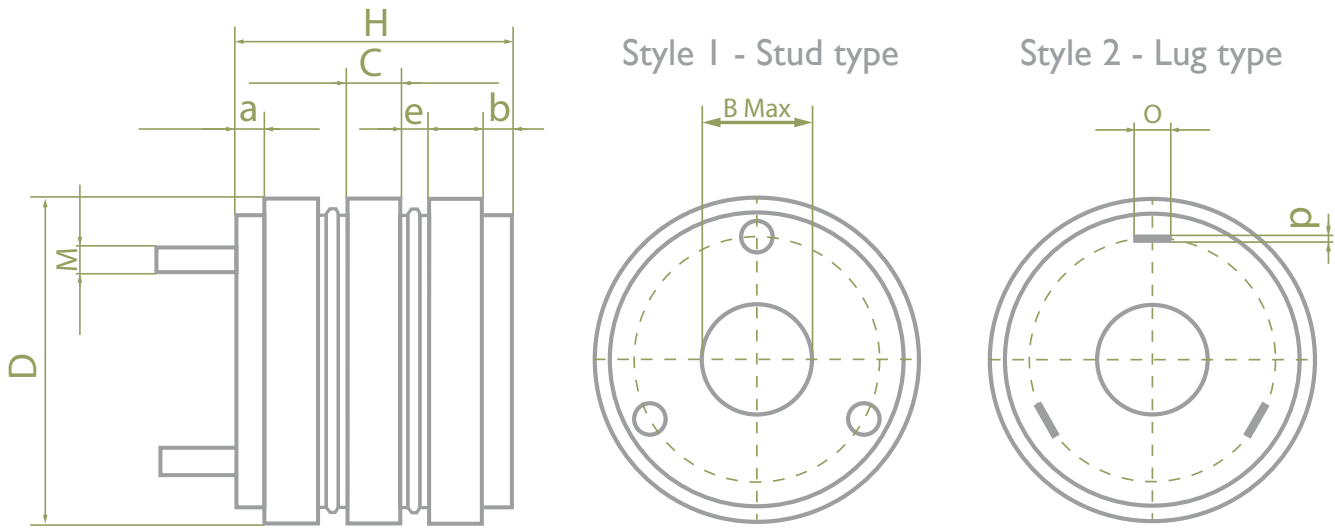
Application	Rotation - one way or reversing operation	
Environmental Conditions ie. Dust, Gases, Chemicals:	Operating Temperature:	
	Duty Cycle (on):	Duty Cycle (off):

Notes:

Recommended Grade:
--------------------

Signature.....

# Slipring Survey Form

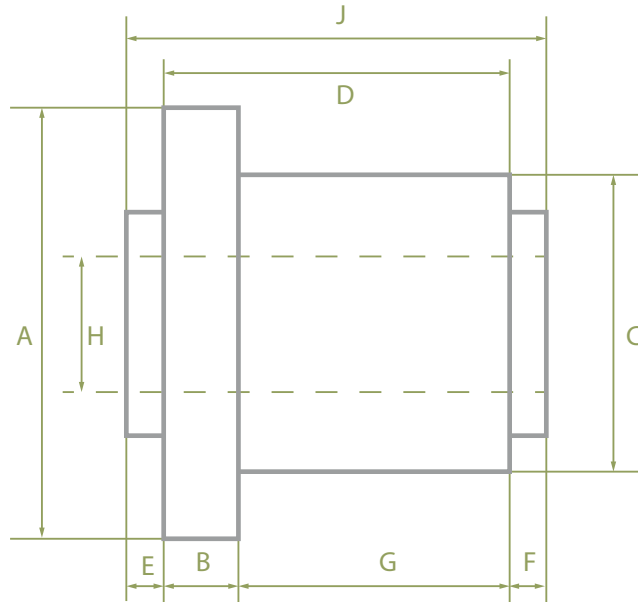


	No. of Rings	
C	Width of Ring	
e	Distance Between Rings	
D	Diameter of Rings	
B	Diameter of Bore	
b	Width of Rear Extension	
a	Width of Front Extension	
	Dia. Over Insulation Bush	
H	Overall Length	
M, o, p	Stud Size	
	Working Voltage	
	Current rating (rotor)	
	Maximum Speed	
	Quantity Required	

**Special Remarks**

Fixing method required, i.e. keyway or grub screw - please provide sizes required:

# Commutator Survey Form



No. of Width Segments	
A Dia Over Risers	
B Width of Risers	
C Dia Over Brush Track	
D Length of Segments	
E Width of Rear Extension	
F Width of Front Extension	
G Length of Brush Track	
H Dia of Bore	
J Overall Length	
Riser Slot Width	
Riser Slot Depth	
Working Voltage	
Maximum Speed	
Armature Current	
Quantity Required	
Delivery Required	

Special Remarks ie. Type of fixing required:

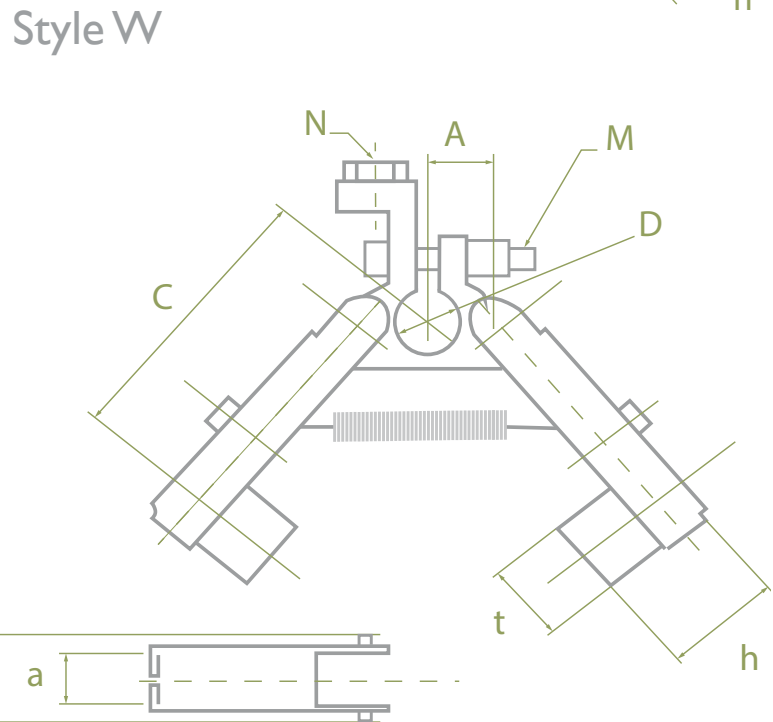
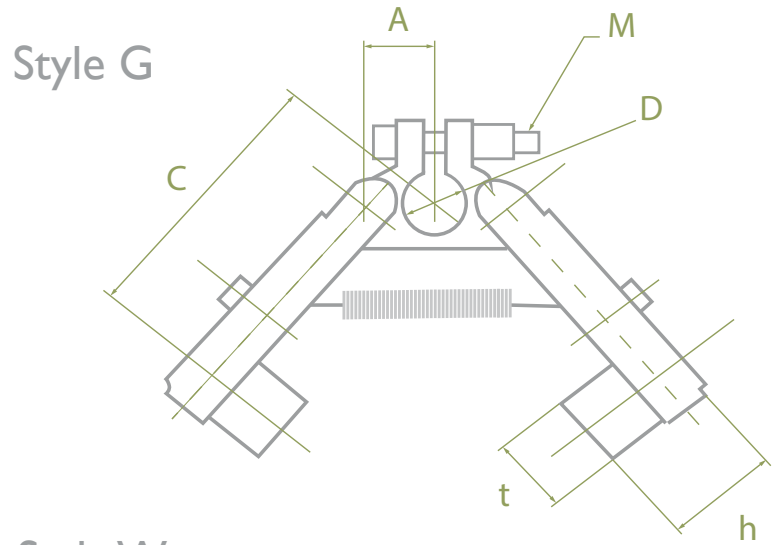
# Slipring Brush Holder Survey Form - A

Brush Size	
t	
h	
Thickness (a)	

Holder Dimensions	
C	
D	
No. of Legs	
A	
M - Stud Size	

Brush Size	
t	
h	
Thickness (a)	

Holder Dimensions	
C	
D	
E	
N	
A	
M - Stud Size	

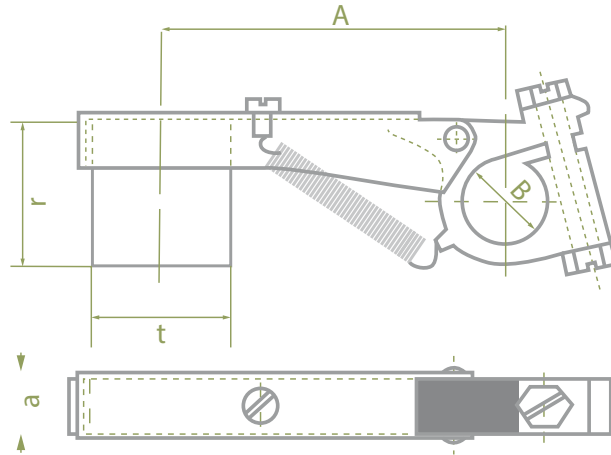


**Additional Information**

Make & Type of Machine:			
Slipring Width:		Diameter:	
AC or DC:	Speed:	HP/Kw:	
Rotor or Excitation Voltage:		Rotor or Excitation Current:	
# Brushes:		Delivery Required:	
# Brush Holders per Ring:			



# Slipring Brush Holder Survey Form - B

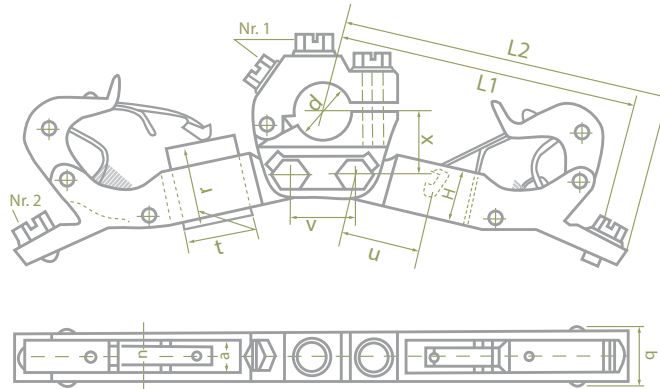


Brush Size	r	
	t	
	a	
Holder	A	
	B	

## Additional Information

Make & Type of Machine:			
Slipring Width:		Diameter:	
AC or DC:	Speed:	HP/Kw:	
Rotor or Excitation Voltage:		Rotor or Excitation Current:	
# Brushes:		Delivery Required:	
# Brush Holders per Ring:			

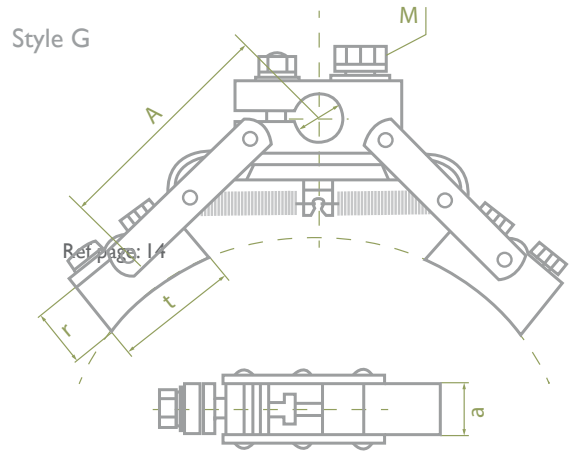
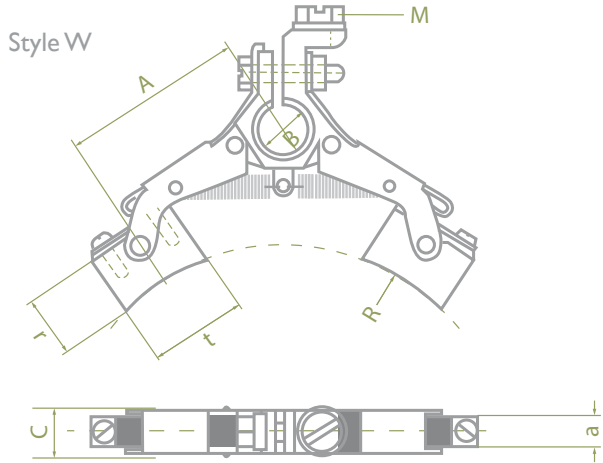
## Double Clamping Slipping Brush Holder Survey Form



Brush Size	t	
	a	
	r	
Arm Length	L1	
	L2	
Bore	d	
	H	
	N	
	q	
	u	
	v	
	x	
Bolt	1	
	2	

Make & Type of Machine:		
Slipping width:		Diameter:
AC or DC:	Speed:	HP/Kw:
Rotor or Excitation Voltage:		
# Brushes:		Rotor or excitation current:
# Brush Holders per Ring:		Delivery Required:

# High Current Slipping Brush Holder Survey Form

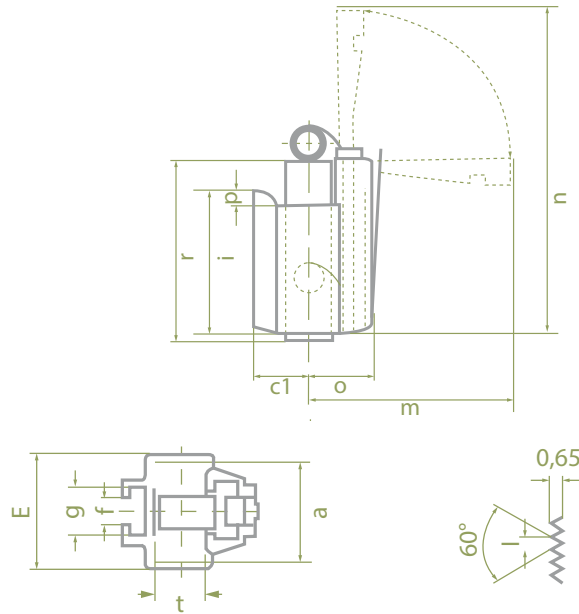


Brush Size	r	
	t	
	a	
Holder	A	
	B	
	C	
	R - Radius	

### Additional Information

Type of Machine:			
Slipping Width:		Diameter:	
AC or DC:	Speed:	HP/Kw:	
Rotor or Excitation Voltage:		Rotor or Excitation Current:	
# Brushes:		Delivery Required:	
# Brush Holders per Ring:			

# Constant Force Spring Brush Holder Survey Form

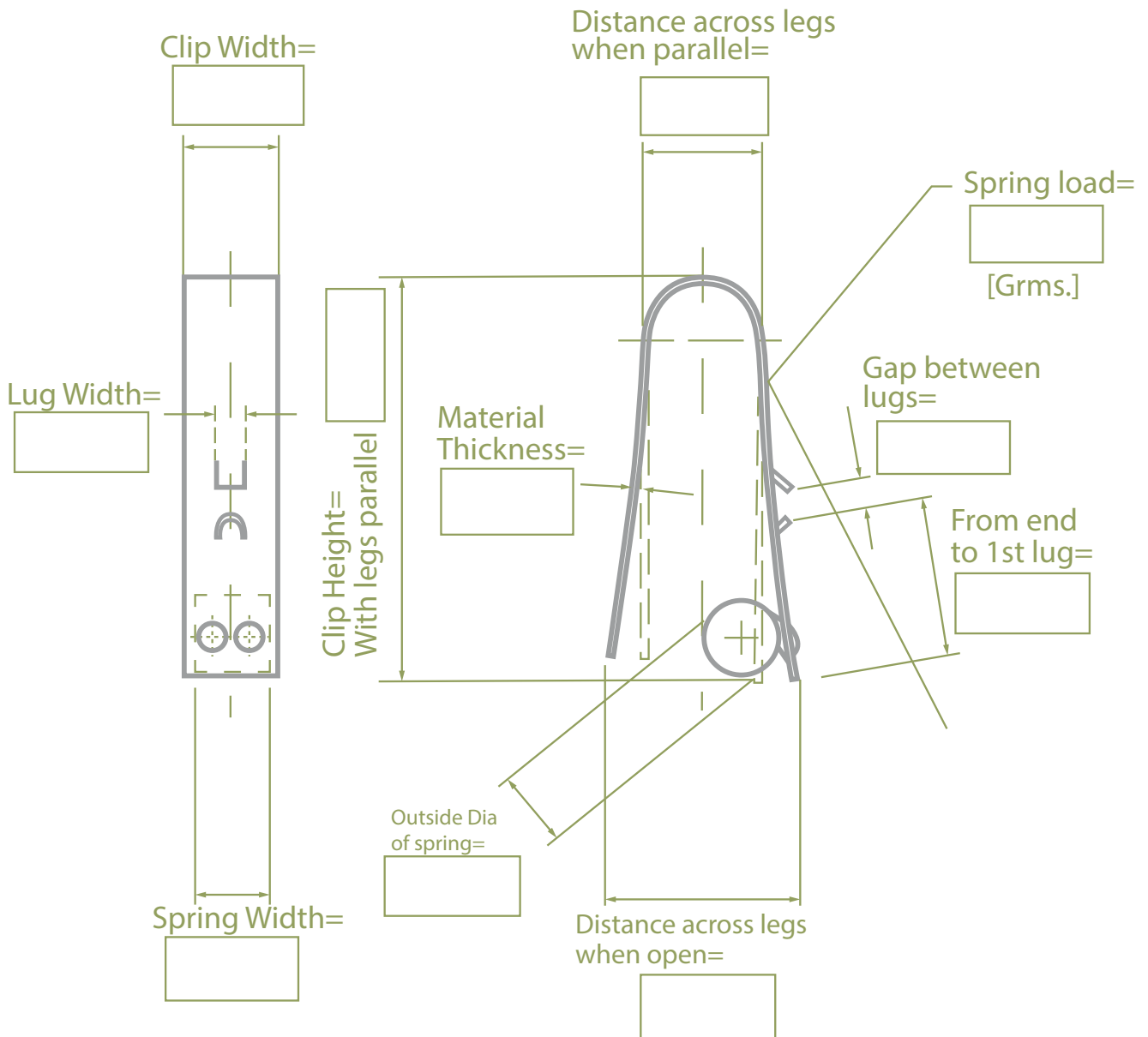


Brush Size	r	
	t	
	a	
Holder	E	
	f	
	g	
	r	
	i	
	p	
	C <sup>1</sup>	
	o	
	m	

### Additional Information

Make & Type of Machine:		
Commutator Width:		Diameter:
Speed:		HP/Kw:
Armature Voltage:		Armature Current:
# Brushes:		Delivery Required:
# Brush Arms:		# Holders per Arm:

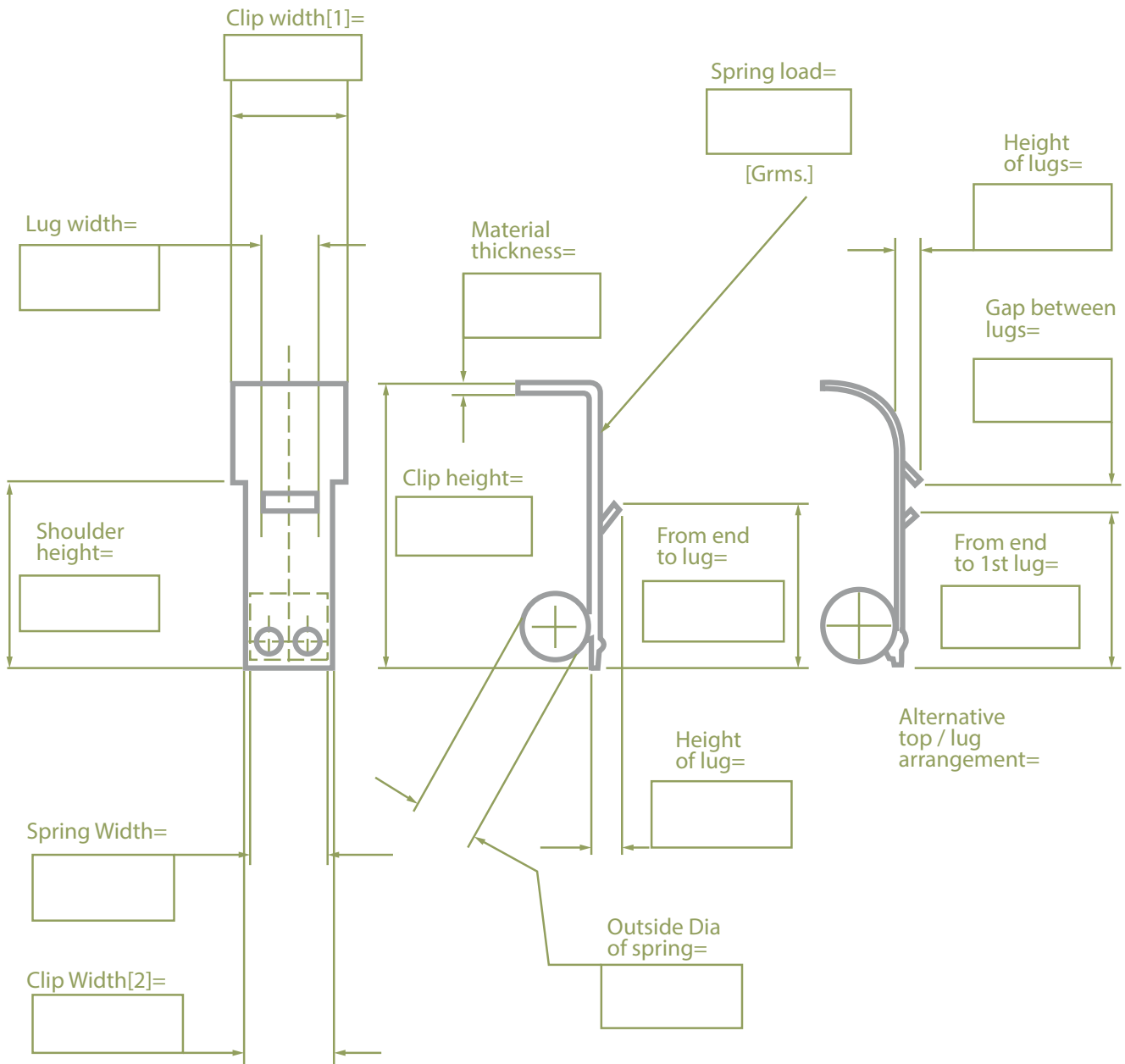
# U-Shaped Constant Force Spring & Clip Survey Form



For the purpose of quotation (prior to sending any damaged/broken spring clips through to us), please advise the following details to enable us to select the most appropriate replacement spring coil:

- Coil – ‘OUTSIDE DIAMETER’
- Coil – ‘WIDTH’
- Carbon brush – ‘WIDTH’
- Carbon brush – ‘THICKNESS’
- Motor application i.e. static slipping motor on an overhead crane or a traction motor on a forklift truck

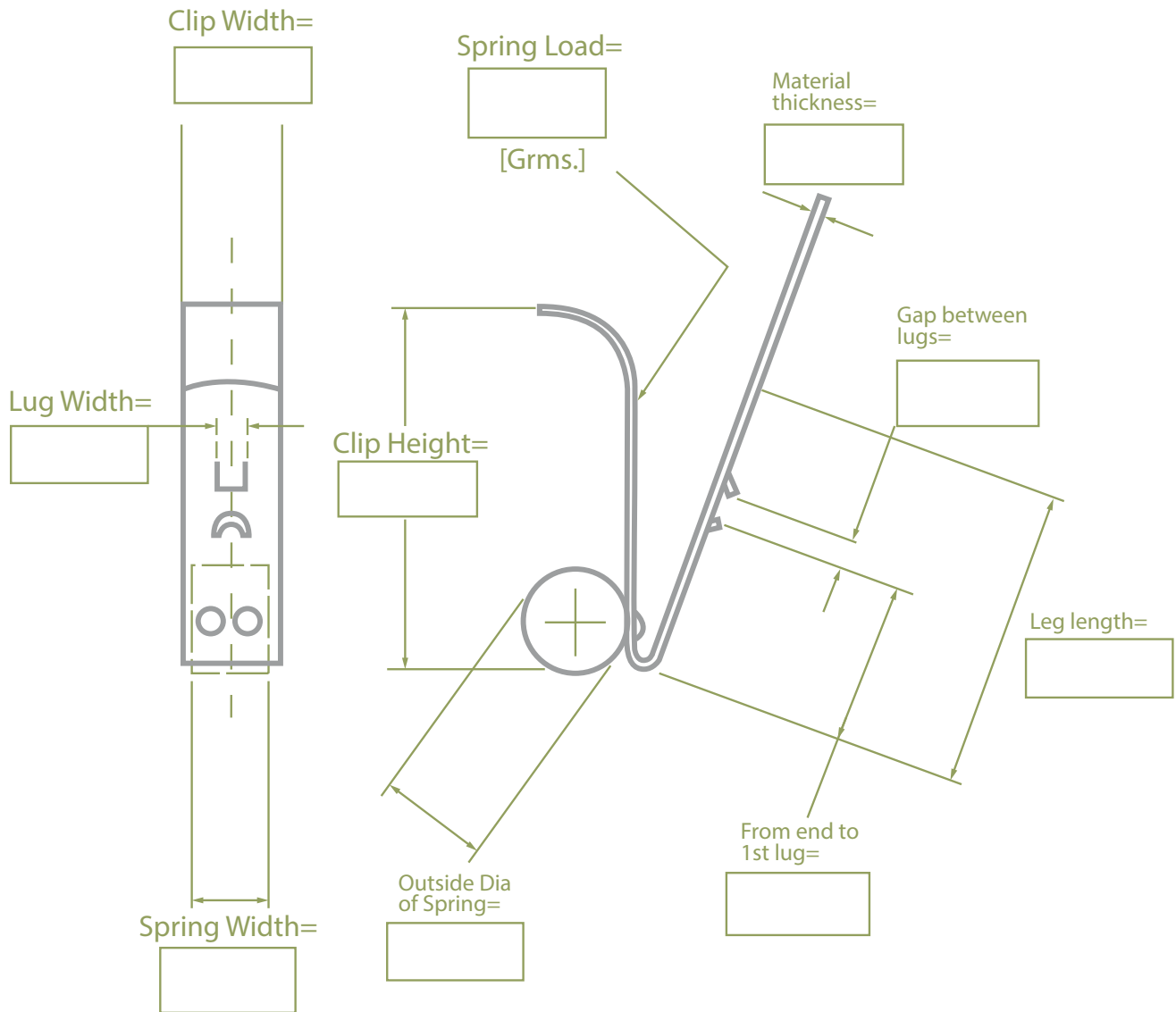
# L-Shaped Constant Force Spring & Clip Survey Form



For the purpose of quotation (prior to sending any damaged/broken spring clips through to us), please advise the following details to enable us to select the most appropriate replacement spring coil:

- Coil – ‘OUTSIDE DIAMETER’
- Coil – ‘WIDTH’
- Carbon brush – ‘WIDTH’
- Carbon brush – ‘THICKNESS’
- Motor application i.e. static slipping motor on an overhead crane or a traction motor on a forklift truck

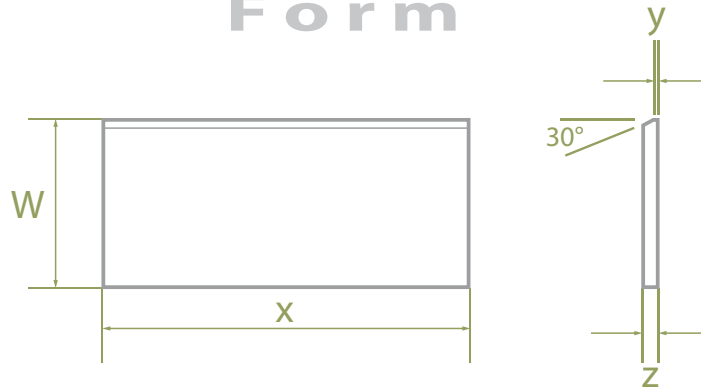
# V-Shaped Constant Force Spring & Clip Survey Form



For the purpose of quotation (prior to sending any damaged/broken spring clips through to us), please advise the following details to enable us to select the most appropriate replacement spring coil:

- Coil – ‘OUTSIDE DIAMETER’
- Coil – ‘WIDTH’
- Carbon brush – ‘WIDTH’
- Carbon brush – ‘THICKNESS’
- Motor application i.e. static slipping motor on an overhead crane or a traction motor on a forklift truck

# Vacuum Pump Vane Survey Form



Customer	<input type="text"/>	Contact	<input type="text"/>
Address	<input type="text"/>	Tel	<input type="text"/>
		Fax	<input type="text"/>
		Date	<input type="text"/>
Quantity	<input type="text"/>	Delivery Required	<input type="text"/>
		Order Number	<input type="text"/>

Please supply the following

Quantity	
Width	
Length	
Thickness	
Material being pumped	

If a chamfered or angled edge is required, please draw a sketch in the box below and indicate the required angle.

Please provide any additional information below.





## 1. INTERPRETATION

1.1 The definitions and rules of interpretation in this condition apply in these conditions.

Buyer: the person, firm or company who purchases the Goods and/or Services from the Company.

Company: Erodex (UK) Limited, Company Number 1153404, whose registered office is at Unit 6, Tipper Industrial Estate, Park Road, Halesowen, West Midlands, B63 2RH.

Contract: any contract between the Company and the Buyer for the sale and purchase of the Goods and/or provision of the Services, incorporating these conditions.

Delivery Point: the place where delivery of the Goods and/or performance of the Services is to take place under condition 4.

Goods: any goods agreed in the Contract to be supplied to the Buyer by the Company (including any part or parts of them).

Input Material: all necessary information relating to the Goods and/or Services including, without limitation, all documents, products and materials provided by the Buyer in relation to the Goods and/or Services in any form.

Services: the Services to be provided by the Company to the Buyer pursuant to these conditions.

1.2 A reference to a particular law is a reference to it as it is in force for the time being taking account of any amendment, extension, application or re-enactment and includes any subordinate legislation for the time being in force made under it.

1.3 Words in the singular include the plural and in the plural include the singular.

1.4 A reference to one gender includes a reference to the other gender.

1.5 Condition headings do not affect the interpretation of these conditions.

## 2. APPLICATION OF TERMS

2.1 Subject to any variation under condition 2.3 the Contract shall be on these conditions to the exclusion of all other terms and conditions (including any terms or conditions which the Buyer purports to apply under any purchase order, confirmation of order, specification or other document).

2.2 No terms or conditions endorsed on, delivered with or contained in the Buyer's purchase order, confirmation of order, specification or other document shall form part of the Contract simply as a result of such document being referred to in the Contract.

2.3 These conditions apply to all the Company's sales of Goods or supply of Services and any variation to these conditions and any representations about the Goods and/or Services shall have no effect unless expressly agreed in writing and signed by a director or the company secretary of the Company. The Buyer acknowledges that it has not relied on any statement, promise or representation made or given by or on behalf of the Company which is not set out in the Contract. Nothing in this condition shall exclude or limit the Company's liability for fraudulent misrepresentation.

2.4 Each order or acceptance of a quotation for Goods and/or Services by the Buyer from the Company shall be deemed to be an offer by the Buyer to buy Goods and/or Services subject to these conditions.

2.5 No order placed by the Buyer shall be deemed to be accepted by the Company until a written acknowledgement of order is issued by the Company or (if earlier) the Company delivers the Goods to the Buyer or commences the performance of the Services.

2.6 The Buyer shall ensure that the terms of its order and any applicable specification are complete and accurate and shall provide the Company with the Input Material within a sufficient time to enable the Company to perform the Contract in accordance with its terms.

2.7 Any quotation is given on the basis that no Contract shall come into existence until the Company despatches an acknowledgement of order to the Buyer or (if earlier) the Company delivers the Goods to the Buyer or commences the performance of the Services. Any quotation is valid for a period of 30 days only from its date, provided that the Company has not previously withdrawn it.

## 3. DESCRIPTION AND INDEMNITY

3.1 The quantity and description of the Goods and/or Services shall be as set out in the Company's quotation or acknowledgement of order.

3.2 All samples, drawings, descriptive matter, specifications and advertising issued by the Company and any descriptions or illustrations contained in the Company's catalogues or brochures are issued or published for the sole purpose of giving an approximate idea of the Goods and/or Services described in them. They shall not form part of the Contract and this is not a sale by sample.

3.3 If the Goods are to be manufactured or any process is to be applied to the Goods by the Company; or if the Goods and/or Services are to be provided in accordance with a specification or any other document, data, information, Input Material or materials submitted by the Buyer, the Buyer shall indemnify the Company against all loss, damages, costs and expenses awarded against or incurred by the Company in connection with or paid or agreed to be paid by the Company in settlement of any claim for infringement of any patent, copyright, design, trademark or other industrial or intellectual property rights of any other person which results from the Company's use of the Buyer's information.

## 4. DELIVERY

4.1 Unless otherwise agreed in writing by the Company, delivery of the Goods shall take place at the Buyer's premises.

4.2 Any dates specified by the Company for delivery of the Goods and/or performance of the Services are intended to be an estimate and time for delivery shall not be made of the essence by notice. If no dates are so specified, delivery shall be within a reasonable time.

4.3 Subject to the other provisions of these conditions the Company shall not be liable for any direct, indirect or consequential loss (all three of which terms include, without limitation, pure economic loss, loss of profits, loss of business, depletion of goodwill and similar loss), costs, damages, charges or expenses caused directly or indirectly by any delay in the delivery of the Goods and/or provision of the Services (even if caused by the Company's negligence), nor shall any delay entitle the Buyer to terminate or rescind the Contract unless such delay exceeds 180 days.

4.4 If for any reason the Buyer fails to accept delivery of any of the Goods when they are ready for delivery, or the Company is unable to deliver the Goods on time because the Buyer

has not provided appropriate instructions, documents, licences or authorisations:

(a) risk in the Goods shall pass to the Buyer (including for loss or damage caused by the Company's negligence);

(b) the Goods shall be deemed to have been delivered; and

(c) the Company may store the Goods until delivery, whereupon the Buyer shall be liable for all related costs and expenses (including, without limitation, storage and insurance).

4.5 The Buyer shall provide at the Delivery Point and at its expense adequate and appropriate equipment and manual labour for loading the Goods and co-operate with the Company in all matters arising relating to the provision of the Services.

4.6 If the Company delivers to the Buyer a quantity of Goods of up to 10% more or less than the quantity accepted by the Company, the Buyer shall not be entitled to object to or reject the Goods or any of them by reason of the surplus or shortfall and shall pay for such goods at the pro rata Contract rate.

4.7 The Company may deliver the Goods and/or Services by separate instalments. Each separate instalment shall be invoiced and paid for in accordance with the provisions of the Contract.

4.8 Each instalment shall be a separate Contract and no cancellation or termination of any one Contract relating to an instalment shall entitle the Buyer to repudiate or cancel any other Contract or instalment.

## 5. NON-DELIVERY

5.1 The quantity of any consignment of Goods as recorded by the Company on despatch from the Company's place of business shall be conclusive evidence of the quantity received by the Buyer on delivery unless the Buyer can provide conclusive evidence proving the contrary.

5.2 The Company shall not be liable for any non-delivery of Goods (even if caused by the Company's negligence) unless the Buyer gives written notice to the Company of the non-delivery within 14 days of the date when the Goods would in the ordinary course of events have been received.

5.3 Any liability of the Company for non-delivery of the Goods shall be limited to replacing the Goods within a reasonable time or issuing a credit note at the pro rata Contract rate against any invoice raised for such Goods.

## 6. RISK/TITLE

6.1 The Goods are at the risk of the Buyer from the time of delivery.

6.2 Ownership of the Goods shall not pass to the Buyer until the Company has received in full (in cash or cleared funds) all sums due to it in respect of:

(a) the Goods; and

(b) all other sums which are or which become due to the Company from the Buyer on any account.

6.3 Until ownership of the Goods has passed to the Buyer, the Buyer shall:

(a) hold the Goods on a fiduciary basis as the Company's bailee;

(b) store the Goods (at no cost to the Company) separately from all other goods of the Buyer or any third party in such a way that they remain readily identifiable as the Company's property;

(c) not destroy, deface or obscure any identifying mark or packaging on or relating to the Goods; and

(d) maintain the Goods in satisfactory condition and keep them insured on the Company's behalf for their full price against all risks to the reasonable satisfaction of the Company.

On request the Buyer shall produce the policy of insurance to the Company.

6.4 The Buyer may resell the Goods before ownership has passed to it solely on the following conditions:

(a) any sale shall be effected in the ordinary course of the Buyer's business at full market value; and

(b) any such sale shall be a sale of the Company's property on the Buyer's own behalf and the Buyer shall deal as principal when making such a sale.

6.5 The Buyer's right to possession of the Goods shall terminate immediately if:

(a) the Buyer has a bankruptcy order made against him or makes an arrangement or composition with his creditors, or otherwise takes the benefit of any statutory provision for the time being in force for the relief of insolvent debtors, or (being a body corporate) convenes a meeting of creditors (whether formal or informal), or enters into liquidation (whether voluntary or compulsory) except a solvent voluntary liquidation for the purpose only of reconstruction or amalgamation, or has a receiver and/or manager, administrator or administrative receiver appointed of its undertaking or any part thereof, or documents are filed with the court for the appointment of an administrator of the Buyer or notice of intention to appoint an administrator is given by the Buyer or its directors or by a qualifying floating charge holder (as defined in paragraph 14 of Schedule B1 to the Insolvency Act 1986), or a resolution is passed or a petition presented to any court for the winding-up of the Buyer or for the granting of an administration order in respect of the Buyer, or any proceedings are commenced relating to the insolvency or possible insolvency of the Buyer; or

(b) the Buyer suffers or allows any execution, whether legal or equitable, to be levied on his/its property or obtained against him/it, or fails to observe or perform any of his/its obligations under the Contract or any other contract between the Company and the Buyer, or is unable to pay its debts within the meaning of section 123 of the Insolvency Act 1986 or the Buyer ceases to trade; or

(c) the Buyer encumbers or in any way charges any of the Goods.

6.6 The Company shall be entitled to recover payment for the Goods notwithstanding that ownership of any of the Goods has not passed from the Company.

6.7 The Buyer grants the Company, its agents and employees an irrevocable licence at any time to enter any premises where the Goods are or may be stored in order to inspect them, or, where the Buyer's right to possession has terminated, to recover them.

- 6.8 Where the Company is unable to determine whether any Goods are the goods in respect of which the Buyer's right to possession has terminated, the Buyer shall be deemed to have sold all goods of the kind sold by the Company to the Buyer in the order in which they were invoiced to the Buyer.
- 6.9 On termination of the Contract, howsoever caused, the Company's (but not the Buyer's) rights contained in this condition 6 shall remain in effect.
7. PRICE
- 7.1 Unless otherwise agreed by the Company in writing, the price for the Goods and/or the Services shall be the price set out in the Company's price list as at the date of delivery or deemed delivery.
- 7.2 The price for the Goods and/or Services shall be exclusive of any value added tax and all costs or charges in relation to packaging, loading, unloading, carriage and insurance, all of which amounts the Buyer shall pay in addition when it is due to pay for the Goods and/or Services.
8. PAYMENT
- 8.1 Subject to condition 8.4, payment of the price for the Goods and/or Services is due in pounds sterling on the last working day of the month following the month in which the Goods are delivered or deemed to be delivered or in which the Services are performed.
- 8.2 Time for payment shall be of the essence.
- 8.3 No payment shall be deemed to have been received until the Company has received cleared funds.
- 8.4 All payments payable to the Company under the Contract shall become due immediately on its termination despite any other provision.
- 8.5 The Buyer shall make all payments due under the Contract in full without any deduction whether by way of set-off, counterclaim, discount, abatement or otherwise unless the Buyer has a valid court order requiring an amount equal to such deduction to be paid by the Company to the Buyer.
9. QUALITY
- 9.1 Where the Company is not the manufacturer of the Goods, the Company shall endeavour to transfer to the Buyer the benefit of any warranty or guarantee given to the Company.
- 9.2 The Company warrants that (subject to the other provisions of these conditions) on delivery and for a period of 12 months from the date of delivery, the Goods shall:
- be of satisfactory quality within the meaning of the Sale of Goods Act 1979;
  - be reasonably fit for any particular purpose for which the Goods are being bought if the Buyer had made known that purpose to the Company in writing and the Company has confirmed in writing that it is reasonable for the Buyer to rely on the skill and judgement of the Company.
- 9.3 The Company warrants that (subject to the other provisions of these conditions) the Services will be provided using reasonable care and skill and, as far as reasonably possible, in accordance with the Contract and within the times and at the intervals referred to in the Contract.
- 9.4 The Company shall not be liable for a breach of any of the warranties in condition 9.2 unless:
- the Buyer gives written notice of the defect to the Company, and, if the defect is as a result of damage in transit by the carrier, within 24 hours of delivery and otherwise within 14 days of the time when the Buyer discovers or ought to have discovered the defect; and
  - the Company is given a reasonable opportunity after receiving the notice of examining such Goods and the Buyer (if asked to do so by the Company) returns such Goods to the Company's place of business at the Company's cost for the examination to take place there.
- 9.5 The Company shall not be liable for a breach of any of the warranties in conditions 9.2 and 9.3 if:
- the Buyer makes any further use of such Goods after giving such notice; or
  - the defect arises because the Buyer failed to follow the Company's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods or (if there are none) good trade practice; or
  - the Buyer alters or repairs such Goods without the written consent of the Company; or
  - the defect arises from the Company's use of any Input Material.
- 9.6 Subject to conditions 9.4 and 9.5, if any of the Goods and/or Services do not conform with any of the warranties in conditions 9.2 and 9.3 the Company shall at its option repair or replace such Goods (or the defective part), re-supply the Services or refund the price of such Goods and/or Services at the pro rata Contract rate provided that, if the Company so requests, the Buyer shall, at the [Company's] expense, return the Goods or the part of such Goods which is defective to the Company.
- 9.7 If the Company complies with condition 9.6 it shall have no further liability for a breach of any of the warranties in condition 9.2 and 9.3 in respect of such Goods and/or Services.
- 9.8 Any Goods replaced shall belong to the Company and any repaired or replacement Goods shall be guaranteed on these terms for the unexpired portion of the 12 month period.
10. LIMITATION OF LIABILITY
- 10.1 Subject to condition 4, condition 5 and condition 9, the following provisions set out the entire financial liability of the Company (including any liability for the acts or omissions of its employees, agents and sub-contractors) to the Buyer in respect of:
- any breach of these conditions;
  - any use made or resale by the Buyer of any of the Goods, or of any product incorporating any of the Goods; and
  - any representation, statement or tortious act or omission including negligence arising under or in connection with the Contract.
- 10.2 All warranties, conditions and other terms implied by statute or common law (save for the conditions implied by section 12 of the Sale of Goods Act 1979) are, to the fullest extent permitted by law, excluded from the Contract.
- 10.3 Nothing in these conditions excludes or limits the liability of the Company:
- for death or personal injury caused by the Company's negligence; or
  - under section 2(3), Consumer Protection Act 1987; or
  - for any matter which it would be illegal for the Company to exclude or attempt to exclude its liability; or
  - for fraud or fraudulent misrepresentation.
- 10.4 Subject to condition 10.2 and condition 10.3:
- the Company's total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise, arising in connection with the performance or contemplated performance of the Contract shall be limited to the Contract price; and
  - the Company shall not be liable to the Buyer for loss of profit, loss of business, or depletion of goodwill in each case whether direct, indirect or consequential, or any claims for consequential compensation whatsoever (howsoever caused) which arise out of or in connection with the Contract.
11. ASSIGNMENT
- 11.1 The Company may assign the Contract or any part of it to any person, firm or company.
- 11.2 The Buyer shall not be entitled to assign the Contract or any part of it without the prior written consent of the Company.
12. FORCE MAJEURE
- The Company reserves the right to defer the date of delivery or to cancel the Contract or reduce the volume of the Goods ordered by the Buyer (without liability to the Buyer) if it is prevented from or delayed in the carrying on of its business due to circumstances beyond the reasonable control of the Company including, without limitation, acts of God, governmental actions, war or national emergency, acts of terrorism, protests, riot, civil commotion, fire, explosion, flood, epidemic, lock-outs, strikes or other labour disputes (whether or not relating to either party's workforce), or restraints or delays affecting carriers or inability or delay in obtaining supplies of adequate or suitable materials, provided that, if the event in question continues for a continuous period in excess of 180 days, the Buyer shall be entitled to give notice in writing to the Company to terminate the Contract.
13. GENERAL
- 13.1 Each right or remedy of the Company under the Contract is without prejudice to any other right or remedy of the Company whether under the Contract or not.
- 13.2 If any provision of the Contract is found by any court, tribunal or administrative body of competent jurisdiction to be wholly or partly illegal, invalid, void, voidable, unenforceable or unreasonable it shall to the extent of such illegality, invalidity, voidness, voidability, unenforceability or unreasonableness be deemed severable and the remaining provisions of the Contract and the remainder of such provision shall continue in full force and effect.
- 13.3 Failure or delay by the Company in enforcing or partially enforcing any provision of the Contract shall not be construed as a waiver of any of its rights under the Contract.
- 13.4 Any waiver by the Company of any breach of, or any default under, any provision of the Contract by the Buyer shall not be deemed a waiver of any subsequent breach or default and shall in no way affect the other terms of the Contract.
- 13.5 The parties to the Contract do not intend that any term of the Contract shall be enforceable by virtue of the Contracts (Rights of Third Parties) Act 1999 by any person that is not a party to it.
- 13.6 This Contract and any dispute or claim arising out of or in connection with it or its subject matter or formation (including non-contractual disputes or claims) shall be governed by and construed in accordance with English law, and the parties submit to the exclusive jurisdiction of the English courts.
14. COMMUNICATIONS
- 14.1 All communications between the parties about the Contract shall be in writing and delivered by hand or sent by pre-paid first class post or sent by fax:
- (in case of communications to the Company) to its registered office or such changed address as shall be notified to the Buyer by the Company; or
  - (in the case of the communications to the Buyer) to the registered office of the addressee (if it is a company) or (in any other case) to any address of the Buyer set out in any document which forms part of the Contract or such other address as shall be notified to the Company by the Buyer.
- 14.2 Communications shall be deemed to have been received:
- if sent by pre-paid first class post, two days (excluding Saturdays, Sundays and bank and public holidays) after posting (exclusive of the day of posting); or
  - if delivered by hand, on the day of delivery; or
  - if sent by fax on a working day prior to 4.00 pm, at the time of transmission and otherwise on the next working day.
- 14.3 Communications addressed to the Company shall be marked for the attention of the Company Secretary.



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