FLEX-CABLE

FURNACE DIVISION

&

WELDING TECHNOLOGY

Cables for

CHEMICAL FURNACES INDUCTION REHEATING VACUUM FURNACES
HIGH FREQUENCY CURRENT TRANSMISSIONS SPECIAL WELDING CABLES
COAXIAL CABLE FOR HIGH FREQUENCY COPPER ALUMINUM
SPECIAL METALS SPECIAL TERMINALS ELECTRIC ARC FURNACES

DEDICATED TO SERVICE, QUALITY AND TECHNOLOGY

CABLE TECHNOLOGY BY FLEX-CABLE

CABLES FOR:

CHEMICAL FURNACES
INDUCTION HEATING
VACUUM FURNACES
HIGH FREQUENCY CURRENT TRANSMISSIONS
SPECIAL WELDING CABLES
COAXIAL CABLES FOR HIGH FREQUENCY
COPPER, ALUMINUM, SPECIAL METALS
SPECIAL TERMINALS
ELECTRIC ARC FURNACES
SHUNTS
BRAIDING
MACHINING
WELDING

CONTENTS

Precision machining makes for leak proof operation.

This flange-type terminal (used on a Brown Boveri foundry furnace) requires precision maching as the flange surface must be perfectly flat so that the O-ring seated in the concentric, annular groove will make a water-tight seal. The thermo-glass cover over the hose protects it from hot metal splash and radiant heat.

Large or small, all cables receive the same careful attention to detail.

The termials on these power lead cables (for use on Inductotherm furnaces) are equipped with female, swivel nut straight thread fittings with centralized water flow passage. One cable is shown with a vacuum plug for vacuum furnace application.

Innovative design make field repair easy.

Offset terminals are often difficult to repair. Flex-Cable engineers designed this special offset terminal connection to make it easy to disassemble and return to the manufacturer for repair or for rework in your own shop. The terminal features solderless connections with the individual conductors pressed into pockets by a 600 ton hydraulic press. The hose can be slipped off and repair work done on the female portion of the terminal.

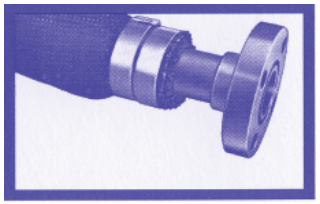
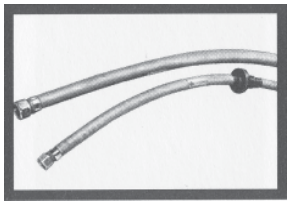
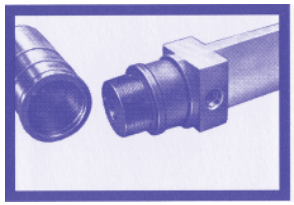
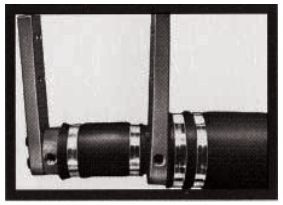
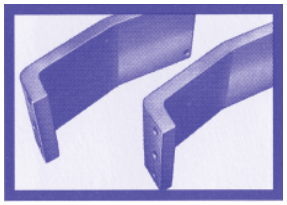
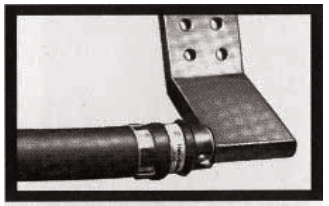
Flex-Cable engineers provide practical solutions to problen applications.

Flex-Cable designed and built this dual polarity coaxial cable for Cameron Iron Works of Houston, Texas. Spacing between positive and negative terminals was critical because the terminals had to fit into designated ridges in an existing bus bar.

These castings were manufactured for a special application which required transistion pieces and bus bars. Flex-Cable designed and fabricated all the necessary components as well as the cables connecting the secondaries.

Functional design and rugges simplicity extend service life.

This secondary power cable used in a special foundry application was designed to alleviate cable bending. By combining a transition piece and terminal in one high conductivity casting. Flex-Cable engineers minimized in-service mechanical wear on the internal conductors and eliminated the possiblity of restricted cooling water flow due to acute bending action. In addition, the design leaves the opposite end of the cable free of obstruction so that the hose can be readily slipped over the terminal for field repair or shipment back to the manufacturer for service.

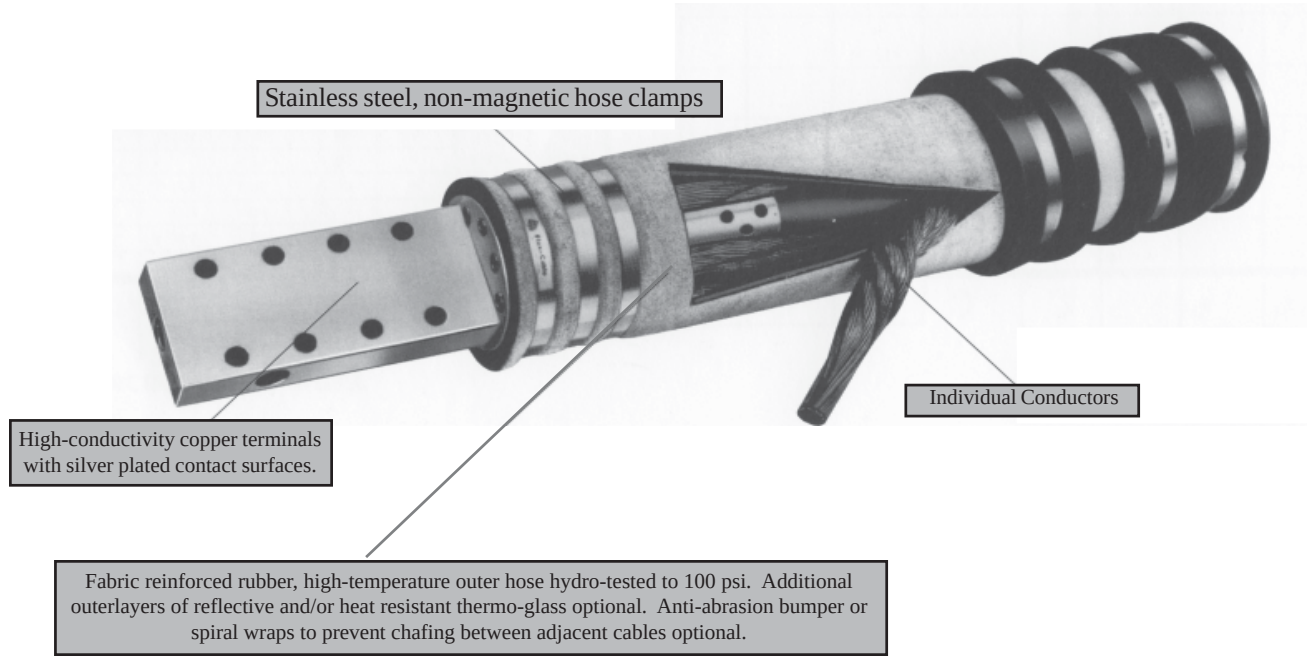
STANDARD OR CUSTOM

FLEX-CABLE QUALITY IS BUILT IN

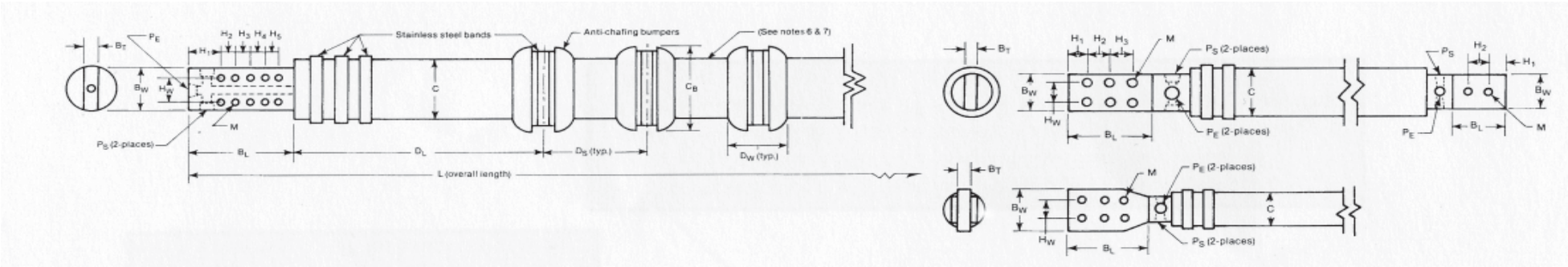
FROM TERMINAL TO TERMINAL

Choice of resilient rubber for minimizing wire wear or corrugated, non-collapsing core for maximum flexibility.

Individual conductors peripherally located for maximum geometric mean diameter and low AC/DC resistance ration minimizing voltage loss.



All water ports and passages designed for lowest pressure drop and maximum water flow for cooler operation.



FURNACE CABLE SPECIFICATION SHEET

CATALOG NO. (STYLE*)	CABLE SIZE (MCM)	B_L	B_W	B_T	H_W	MOUNTING HOLES							P_E NPT	P_S NPT	C	C_B	D_L	D_S	D_W	REMARKS See Notes
						QTY	H_1 (In.)	H_2	H_3	H_4	H_5	M (Dia.)								
150 IFS-1	1500	5	2-1/2	1.00	0	2	1-1/4	2				1-1/16	1/2	1/2 See Note 1	3-1/4					3
150 IFS-2		7	3-3/4	1.50	2.00	6		1-3/4	1-3/4			9/16								
200 IFS-1	2000	5	2-1/2	1.00	0	2	1-1/4	2				1-1/16	1/2	1/2 See Note 1	3-1/4					3
200 IFP-2		7	3-3/4	1.50	2.00	6		1-3/4	1-3/4			9/16								
250 IFS-2	2500	6	3	1.25	1.50	6	1-1/4	1-3/4	1-3/4			1-1/16	1/2 See Note 2	1/2 See Note 1	3-3/4					3
250 IFP-2		7	3-3/4	1.50	2.25	6														
300 IFS-2	3000	6	3	1.25	1.50	6	1-1/4	1-3/4	1-3/4			1-1/16	1/2 See Note 2	1/2 See Note 1	3-3/4					3
300 IFP-2		7	3-3/4	1.50	2.25	6														
400 AFS-1	4000	8	4	1.50	2.25	6	1-1/2	2	2			1-1/16	3/4		4-7/8					4 & 5
500 AFS-1	5000	8	4	1.50	2.25	6														
600 AFS-1	6000	10	4-1/2	2.00	2.50	8	2	2	2	2		1-1/16	1		5-1/2	7	24	7	4	4,5,6 & 7
600 AFS-2			6												7	8-1/2				
700 AFS-1	7000	10	5	2.00	2.50	8	2	2	2	2		1-1/16	1		6	7-1/2	24	7	4	4,5,6 & 7
700 AFS-2			6												8	9-1/2				
800 AFS-1	8000	12	5	2.00	2.50	8	2-1/2	2	2	2		1-1/16	1	1	6	7-1/2	24	7	4	4,5,6 & 7
800 AFS-2			6												7-1/2	9				
900 AFS-1	9000	12	5	2.00	2.50	8	2-1/2	2	2	2		1-1/16	1	1	6-1/2	8	24	7	4	4,5,6 & 7
900 AFS-2			6												8-1/2	10				
1000 AFS-1	10000	12	6	2.00	3.00	8	2-1/2	2	2	2		1-1/16	1	1	7	8-1/2	24	7	4	4,5,6 & 7
1000 AFS-2															10-1/2	12				
1200 AFS-1	12000	14	6	2.50	3.00	8	3	2-1/2	2-1/2	2-1/2		1-3/16	1-1/4	1-1/4	8-1/2	10	24	7	4	4,5,6 & 7
1200 AFS-2															10	11-1/2				
1400 AFS-1	14000	14	6	2.50	3.00	8	3	2-1/2	2-1/2	2-1/2		1-3/16	1-1/4	1-1/4	10	11-1/2	30	7	4	4,5,6 & 7
1600 AFS-1	16000	16	7	3.00	3.50	10	3	2-1/2	2-1/2	2-1/2	2-1/2	1-3/16	1-1/4	1-1/4	10	11-1/2	30	7	4	4,5,6 & 7
1800 AFS-1	18000	16	7	3.00	3.50	10	3	2-1/2	2-1/2	2-1/2	2-1/2	1-3/16	1-1/4	1-1/4	10	11-1/2	30	7	4	4,5,6 & 7

FURNACE CABLE SPECIFICATION SHEET (CON'T)

Catalog No. (Style)	Cables Size MCM (mm^2)	Ampacity*	DC Resistance Micro-OHMS/ft.		$^{R}AC/^{R}DC$ Ratio @60Hz	GMR	GPM **/Cable	Minimum Bend Radius (inches)	Appx. Wt. (25' Cable)
			20°C	45°C Rise					
150 IFS-1	1500 (750)	4500	7.150	8.000	1.148	0.64	2	16	190
150 IFP-2									
200 IFS-1	2000 (1000)	6000	5.360	6.000	1.240	0.60	2	20	240
200 IFP-2									
250 IFS-2	2500 (1250)	7500	4.290	4.800	1.349	1.10	2	24	290
250 IFP-2									
300 IFS-2	3000 (1500)	9000	3.580	4.000	1.455	1.18	2	24	350
300 IFP-2									
400 AFS-1	4000 (2000)	12000	2.680	3.000	1.642	1.62	3	32	550
500 AFS-1	5000 (2500)	15000	2.150	2.400	1.811	1.22	4	32	650
600 AFS-1	6000 (3000)	18000	1.790	2.000	1.963	1.72	5	36	760
600 AFS-2						2.57			
700 AFS-1	7000 (3500)	21000	1.530	1.710	2.103	2.05	7	40/56	890
700 AFS-2						3.20			
800 AFS-1	8000 (4000)	24000	1.340	1.500	2.225	2.06	8	40/52	1000
800 AFS-2						2.68			
900 AFS-1	9000 (4500)	27000	1.190	1.330	2.344	2.37	10	39/60	1150
900 AFS-2						3.40			
1000 AFS-1	10000 (5000)	30000	1.073	1.200	2.453	2.57	11	48/76	1400
1000 AFS-2						4.28			
1200 AFS-1	12000 (6000)	36000	0.894	1.000	2.660	3.73	14	60/72	1750
1200 AFS-2						4.44			
1400 AFS-1	14000 (7000)	40000	0.766	0.857	2.850	4.43	17	80	2100
1600 AFS-1	16000 (8000)	45000	0.671	0.750	3.030	4.46	20	80	2450
1800 AFS-1	18000 (9000)	50000	0.596	0.667	3.180	4.27	23	80	2800

NOTE - Requests for quotes or orders require the specific Cable No. (style), Overall Length (ft.) and should reference the following when applicable:

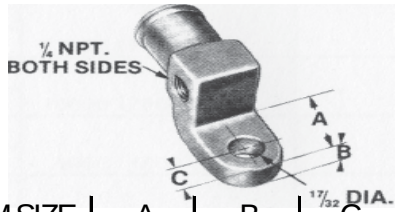
1. Side ports (Ps) only if specified.
2. 3/4" NPT available on request. Inless otherwise specified water ports P_e and P_s will be 1/2" NPT as listed.
3. Heat shield sleeve for splash protection available on request.
4. Full length vulcanized heat shield protection available on request.
5. Standard 4" wide bumpers available if specified.
6. Additional layer of vulcanized, aluminized material for reflecting radiant heat for one-half hose length available on request.
7. Special anti-chafing gear other than shown (and referenced in note 4) must be specified at time of order.

* Rated at maximum of 3000 amps/1000 MCM ($500mm^2$)

** Minimum to maintain a maximum exit temperature of 65°C (150°F) for a 25' cable

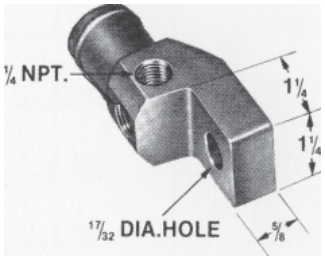
STANDARD WATER COOLED TERMINAL SELECTION CHART

1



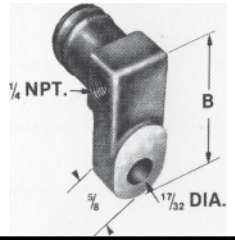
MCM SIZE	A	B	C
266 to 400	1-3/8	1/2	1/2
500 to 600	1-1/2	5/8	5/8
665 to 798*	1-5/8	5/8	3/4
1000*	1-3/4	5/8	7/8

1F



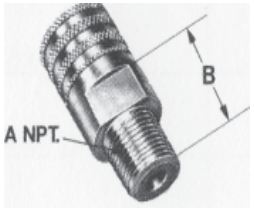
Available on MCM sizes 266 through 1000 MCM only.

2



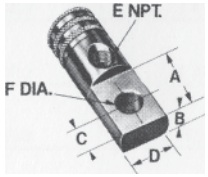
MCM SIZE	B
266 to 500	2-11/16
532 to 600	3
665 to 798*	3-1/4
1000*	3-11/16

4



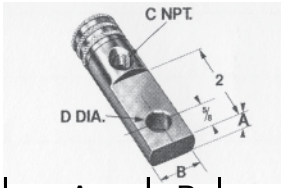
MCM SIZE	A	B
266 TO 500	1/2	1-3/8
532 TO 600	1/2	1-3/4
665 TO 1000	3/4	1-7/8

5



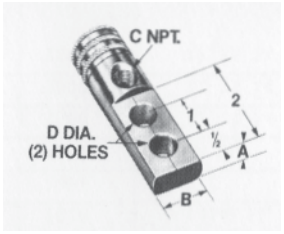
MCM SIZE	A	B	C	D	E	F
70	1-1/4	1/4	1/2	1/2	1/8	9/32
100 TO 216	1-1/4	3/8	1/2	3/4	1/8	13/32
266 TO 400	1-1/4	9/16	1/2	1	1/4	17/32
500 TO 600	1-1/4	9/16	1/2	1-1/4	1/4	17/32
665 TO 798*	1-3/8	5/8	5/8	1-1/2	1/4	17/32
1000*	1-3/8	5/8	5/8	1-3/4	1/4	17/32

6



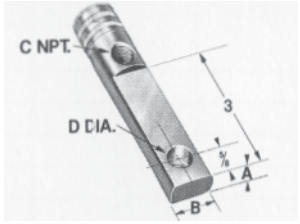
MCM Size	A	B	C	D
70	1/4	1/2	1/8	9/32
100 TO 216	3/8	3/4	1/8	13/32
266 TO 400	9/16	1	1/4	17/32
500 TO 600	9/16	1-1/4	1/4	17/32
665 TO 798*	5/8	1-1/2	1/4	17/32
1000*	5/8	1-3/4	1/4	17/32

6-2



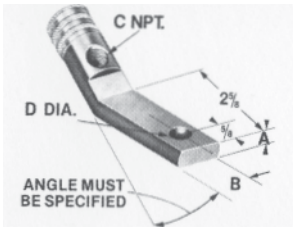
MCM SIZE	A	B	C	D
70	1/4	1/2	1/8	9/32
100 to 216	3/8	3/4	1/8	13/32
266 to 400	9/16	1	1/4	17/32
500 to 600	9/16	1-1/4	1/4	17/32
665 to 798*	5/8	1-1/2	1/4	17/32
1000*	5/8	1-3/4	1/4	17/32

7



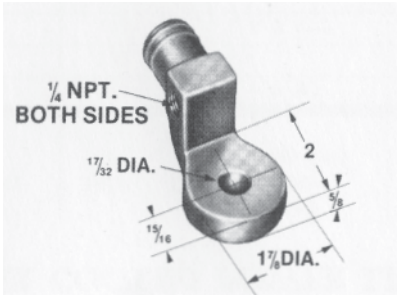
MCM SIZE	A	B	C	D
70	1/4	1/2	1/8	9/32
100 to 216	3/8	3/4	1/8	13/32
266 to 400	9/16	1	1/4	17/32
500 to 600	9/16	1-1/4	1/4	17/32
665 to 798*	5/8	1-1/2	1/4	17/32
1000*	5/8	1-3/4	1/4	17/32

7B



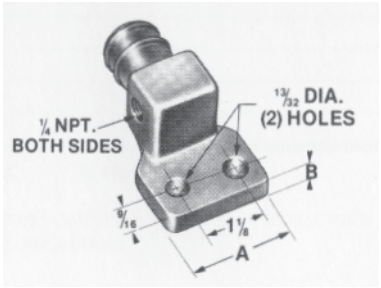
MCM SIZE	A	B	C	D
70	1/4	1/2	1/8	9/32
100 to 216	3/8	3/8	1/8	13/32
266 to 400	9/16	1	1/7	17/32
500 to 600	9/16	1-1/4	1/7	17/32
665 to 798*	5/8	1-1/2	1/4	17/32
1000*	5/8	1-3/4	1/4	17/32

9



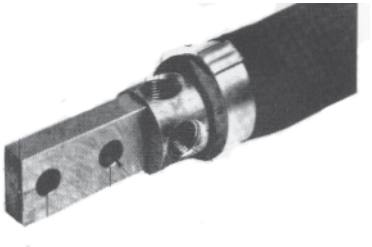
Available on MCM sizes 266 through 1000 only.

11



MCM SIZE	A	B
266 to 600	2	3/16
665 to 798*	2	5/16
1000*	2-7/16	7/16

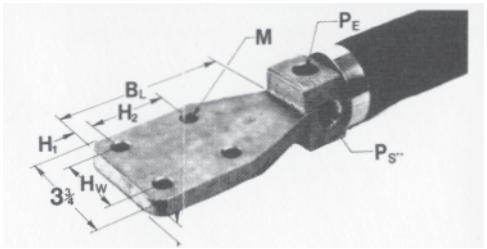
12



MCM SIZE	B_L	B_W	B_T	H_1	H_2	M	P_E	P_S**
1200	4	1-7/8	3/4	1	1-3/4	9/16	1/2	1/2
1500	5	2-3/8	1	1-1/4	2	11/16	1/2	1/2

** Side port P_S only if specified, P_E standard.

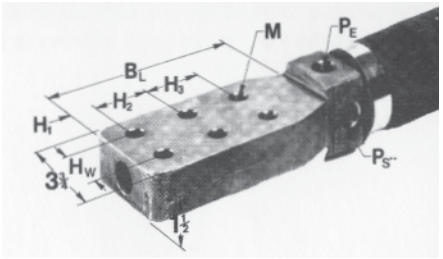
13



MCM	B_L	B_T	H_1	H_2	H_W	M	P_E	P_S**
750	6	5/8	1	2	2	9/16	1/2	1/2
1000	6	5/8	1	2	2	9/16	1/2	1/2
1200	6	1	1	2	2	9/16	1/2	1/2
1500	7	1-1/2	1-1/4	2-1/2	2	9/16	1/2	1/2

**Side Port P_S only if specified, P_E standard.

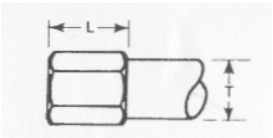
14



MCM SIZE	B_L	H_1	H_2	H_3	H_W	M	P_E	P_S**
1500	7	1-1/4	1-3/4	1-3/4	2	9/16	1/2	1/2
2000	7	1-1/4	1-3/4	1-3/4	2	9/16	1/2	1/2
2500	7	1-1/4	1-3/4	1-3/4	2-1/4	1-1/16	1/2	1/2

**Side port P_S only if specified, P_E standard.

C



SIZE	HEX	L (Lgth)	T (tube O.D.)
8C	7/8	0.84	0.50
10C	1	0.97	0.63
12C	1-1/4	1.02	0.75
16C	3/8	3/8	1/8
20C	9/16	1	1/7
24C	9/16	1-1/4	1/7
32C	5/8	1-1/2	1/4

(ref Parker Triple-Lok Nut & Sleeve for 37 Flare)

Flex-Cable water cooled power leads are available in sizes from 70 MCM through 2500 MCM. One hundred percent conductivity stranded copper wire is used throughout. All conductors are encased in an abrasion and temperature resistant external rubber hose with a 15,000 volt dielectric strength.

Flex-Cable offers a broad range of terminals to fit standard power lead applications (see Water Cooled Cable-Terminal Selection Chart on Pages 5 and 6). Special terminals can be fabricated to customer specifications.

WATER COOLED POWER LEADS

CATALOG NO. (STYLE)	MCM SIZE	STANDARD TERMINALS (see opp.side)	COVER O.D. inches (mm)	DC RESISTANCE MICRO OHMS/FT.		GPM/CABLE
7 IF	70	5,6,7,8C	15/16 (24)	148.10	163.02	2
10 IF	100	10C	1-5/32 (29)	103.70	114.11	2
13 IF	133	5,6,7,12C	1-7/32 (31)	77.97	85.80	2
21 IF	216	5,6,7	1-7/32 (31)	48.01	52.83	2
26 IF	266	5,6,7,16C	1-9/16 (39)	39.98	42.90	4
35 IF	350	1 thru 11	1-9/16 (39)	29.63	32.60	4
40 IF	400	1 thru 11	1-9/16 (39)	25.92	28.53	4
50 IF	500	1 thru 11	1-7/8 (47)	20.74	22.82	4
53 IF	532	20C	1-7/8 (47)	19.49	24.47	4
60 IF	600	1 thru 11	1-7/8 (47)	17.28	19.02	4
66 IF	665	1 thru 11	2-1/16 (52)	15.59	17.16	6
75 IF	750	1 thru 11, 13	2-1/16 (52)	13.83	15.21	6
79 IF	798	24 C	2-1/16 (52)	12.99	14.30	6
100 IF	1000	1 thru 11,13	2-11/32 (59)	10.37	11.41	6
106 IF	1065	32C	2-5/8 (67)	9.75	10.72	8
120 IF	1200	12,14	2-5/8 (67)	8.64	9.51	8
150 IF	1500	12,13,14	3-5/32 (80)	6.91	7.61	8
200 IF	2000	12,13,14	3-5/32 (80)	5.8	5.70	8
250 IF	2500	12,13,14	3-3/4 (95)	4.15	4.56	8

Cable sizes for R_{AC}/R_{DC} ratios for both skin and proximity effect.

WATER COOLED POWER LEADS (con't)

CABLE SIZE MCM	CABLE O.D. (inches)	R_{DC} @ 45°C micro-ohms/ft.	R_{AC}/R_{CD} RATIO (skin effect only)				R_{AC}/R_{DC} RATIO			
			60 Hz	1 KHz	3 KHz	10 KHz	60Hz	1 KHz	3 KHz	10KHz
133	1.31	87.51	1.001	1.281	2.040	3.485	1.002	1.33	2.1	3.53
216	1.62	52.78	1.003	1.555	2.519	4.366	1.005	1.61	2.58	4.58
266	1.62	42.86	1.005	1.708	2.768	4.826	1.008	1.80	2.88	5.08
350	1.94	32.57	1.009	1.924	3.126	5.481	1.014	2.03	3.25	5.57
400	1.94	28.5	1.012	2.044	3.327	5.844	1.020	2.18	3.47	5.97
500	1.94	22.8	1.018	2.250	3.686	6.515	1.035	2.45	3.91	6.71
532	1.94	21.43	1.021	2.310	3.791	6.704	1.040	2.54	4.04	6.94
600	2.12	19	1.026	2.439	4.014	7.105	1.046	2.61	4.21	7.3
750	2.12	15	1.04	2.687	4.447	7.900	1.082	3.00	4.8	8.28
798	2.38	14.29	1.052	2.764	4.767	8.368	1.099	3.18	4.95	8.65
1000	2.62	11.4	1.07	2.884	5.100	9.093	1.139	3.41	5.5	9.51
1064	2.62	10.71	1.08	3.033	5.261	9.391	1.143	3.42	5.56	10.04
1200	2.62	9.2	1.101	3.351	5.604	10.023	1.186	3.75	5.94	11.67

To determine resistance at frequencies shown, multiply R_{DC} by the applicable R_{AC}/R_{DC} ratio.

Proper sizing of water cooled cables for any application is important for proper cable operation, equipment life, system efficiency and operating costs.

In addition to the pumping capacity of your cooling system; the line size, orifices, cable size, length of cable run, types of cable terminations and the number and size of ports must be taken into consideration when calculating the proper size cables.

In sizing water-cooled cables, watt losses and voltage drop (IR drop) must be considered of primary importance especially when long cable runs and low secondary voltages are involved. The following formulas can be used to calculate watt loss and voltage drop (IR drop).

SIZING WATER COOLED CABLES

1.0 Watt loss = $I^2 \times R_C \times L$

2.0 Voltage Drop (IR drop) = $I \times R_C \times L$

I = current (amperes)
RC = resistance (AC or DC) in ohms/ft
L = cable length in ft

To determine cable conductor size MCM and resistance (RC) or impedance refer to applicable techinical reference charts. Or, if you wish to make resistance calculations in relation to temperature rises other than shown in the charts, use the following formula:

3.0 RC = $R_T [1.0 + K_T \frac{(t-T)}{2}]$

Where RT = 10.58×10^{-6}/ft 1000 MCM@20°C
KT = 0.00363(temperature coefficient of resistance of copper@20°C)
T = reference temperature constant of 20°C
t = temperature °C of water at cable exhaust end

For cable sizes other than 1000 MCM:

RT = $\frac{10.58 \times 10^{-3}}{\text{MCM SIZE}}$

4.0 GPM = $\frac{\text{Watt loss (refer to 1.0)}}{147^* \times \text{F° rise}}$

or F° Rise = $\frac{\text{Watt loss (refer to 1.0)}}{147^* \times \text{GPM}}$

5.0 Amperage = $\sqrt{\frac{\text{GPM} \times \text{°F rise} \times 147^*}{R_C/\text{ft} \times \text{total cable length}}}$

CAUTION: Coolant exhaust temperature should not exceed 65°C (150°F) continuous.

NOTE: If cable coolant is connected in series to a second cable, use the length of both cables for total cable length.

Example:

Cable Size:	1200 MCM
Cable Length:	25ft
Cable Load:	8000 amperes
Input Temperature:	68°F (20°C)
Maximum Temperature Rise:	55°F (30C)°
Calculated R_{AC} (60Hz):	10.46×10^{-6} ohms/ft

**RAC taken from techincal reference data "Power Leads Water Cooled" FC5181-3

FROM 4.0

GPM = $\frac{8000^2 \text{ ampers} \times 10.46 \times 10^{-6} \text{ ohms} \times 25\text{ft.}}{147^* \times 55° \text{ rise}}$

= $\frac{64 \times 10^6 \times 10.46 \times 10^{-6} \times 25}{8085}$

= $\frac{16736}{8085}$

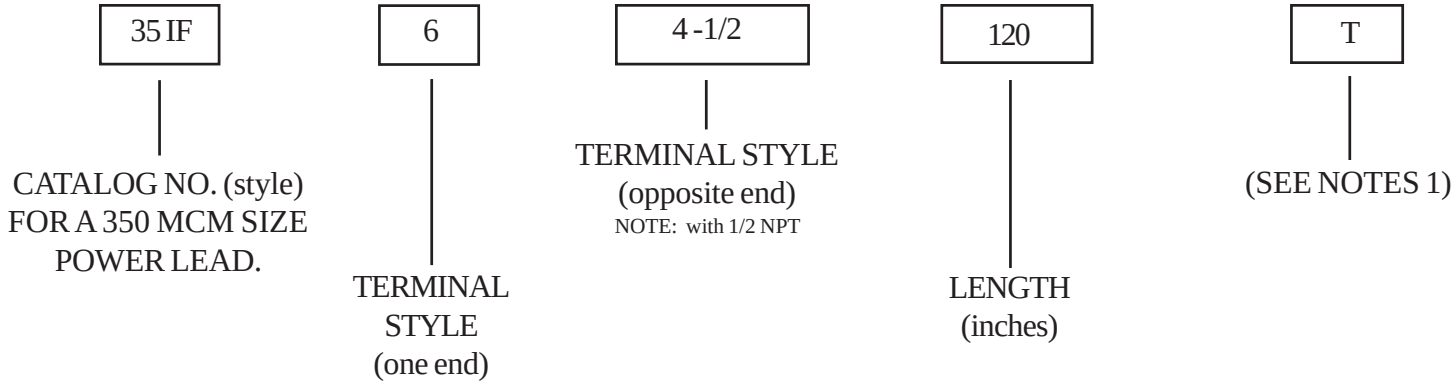
GPM = 2.07

* Use 2.68 for C° rise

ORDER INFORMATION

Refer to chart on pages 7/ 8 and Water Cooled Terminal Selection Chart on pages 5/6 when ordering Water Cooled Power Leads.

EXAMPLE:



Note:

1) Add suffix "T" when ordering a THG Heat Shield sleeve covering.
2) Refer to Technical Reference Data Sheet Power Lead Water-Cooled (FC-5181-3) and Product Data Sheet Power Leads Water-Cooled (FC-181-5) to determine resistance at other frequencies.
3) GPM flow shown is the minimum requires to maintain maximum exit temperature of 65°C (150°F) of cable 2.5ft long.

GPM shown is also suggested for use in calculating ampacity. Refer to Technical Reference Data Sheet Coolant Flow Charts for Water Cooled Power Leads (FC 5181-6)

To calculate ampacities use the following formula:

$$\text{AMPACITY} = \sqrt{\frac{\text{GPMX°F temperature rise x 147*}}{\text{Resistance/ft x Cable Length (total)}}}$$

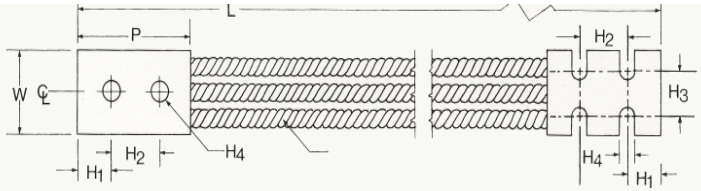
*Use 268 for °C temperature rise

WHERE: GPM = Desired (or required) coolant-flow in gallons per minute.

F temp rise = Exhaust coolant temperature minus input coolant temperature. NOTE: Do not exceed 65°C

TYPE FLEX-LINK JUMPERS

These highly flexible, strap-type leads are used to connect moving electrical components or to take up expansion in buss connections. Where special sizes are required contact our Sales Department.



Style No.


A


B


C


D


E

CAT NO	STYLE	MCM SIZE	ampacity* @ 25°C AMB & 40°C Rise	W (in)	P (in)	T**(in)	H_1	H_2	H_3	H_4
R007	A,B,C,D,E	70	125	1	FOR STYLE A P=1-1/2 FOR ALL OTHER STYLES P=3	1/8	3/4 (5/8N)	1-1/2 1-3/4 N	N/A	13/32 DIA
R010	A,B,C,D,E	100	160	1		1/8				
R014	A,B,C,D,E	140	250	1-1/4		5/32				
R020	A,B,C,D,E	200	290	1-1/4		13/64				
R027	A,B,C,D,E	266	360	1-1/2		7/32				17/32 DIA
R030	A,B,C,D,E	300	390	1-1/2		17/64				
R040	A,B,C,D,E	400	490	1-1/2		9/32				
R050	(all)	500	570	1-3/4	3	1/4	3/4 (5/8N)	1-1/2 1-3/4N	1-1/4	SLOT TYPE 17/32 WIDE
R053	(all)	532	600	1-3/4		13/32				
R065	(all)	650	680	1-3/4		15/32				
R080	(all)	800	775	2		13/32			1-1/2	
R105	(all)	1050	950	2		1/2				
R120	(all)	1200	1040	2-1/2		9/16	5/8N	1-3/4N	1-3/4N	DIA 17/32
R140	(all)	1400	1215	3-1/2	3-1/2	15/32				
R160	(all)	1600	1380	3-1/2		17/32				
R200	(all)	2000	1730	4		9/16				
R240	(all)	2400	2070	4	4	5/8	1			
R300	(all)	3000	2600	4-1/2		11/16				

ORDER INFORMATION

FLJ – [ ] – [ ] – [ ] – [ ]

CATALOG NUMBER — LENGTH — STYLE

Add suffix "N" for NEMA hole spacing noted in column H_1 and H_2.

EXAMPLE: If you wish to order a Flex-Link Jumper type FLJ of MCM size 70, in Style A and an overall length of 24", the correct order number would be FLJ-R007-24-A.

If you desire to use higher ampacities than shown DO NOT exceed a conductor temperature of 80°C (176°F) or approx. 120% of ampacities shown.
*For R_{AC}/R_{DC} ratios and effect of frequencies refer to appropriate data sheet on air-cooled cables.
**Appropriate thickness + or - .0625

The following table shows cable sizes and recommended ampacities for air-cooled cables based on 25°C ambient temperature and 40°C rise.

R_{AC}/R_{DC} ratios and derating formula shown below can be used to derate ampacity for frequencies not shown in the table.

MCM SIZE	AMP RATING	R_{AC}/R_{DC} RATIO* (Skin Effect Only)					
		IR DROP MV/ft	RDC MICRO OHMS/ft AT (65°C)	60Hz	1 KHz	3KHz	10KHz
100	180	22.0	122	1.0007	1.175	1.800	3.059
133	225	20.6	91.7	1.0013	1.281	1.800	3.485
167	260	19.0	73.1	1.0021	1.398	2.250	3.873
216	305	17.2	56.5	1.0030	1.55	2.519	4.366
266	360	16.4	45.7	1.0050	1.708	2.768	4.826
350	450	15.7	34.9	1.0090	1.924	3.126	5.481
400	490	14.9	30.5	1.0115	2.044	3.327	5.844
500	575	14.0	24.4	1.0180	2.250	3.686	6.515
600	645	13.1	20.3	1.0260	2.439	4.014	7.105
750	740	12.0	16.3	1.0400	2.687	4.447	7.900
1000	910	11.1	12.2	1.0700	2.884	5.100	9.093
1200	1030	10.5	10.0	1.1010	3.251	5.604	10.023
1500	1195	9.7	8.1	1.1480	3.693	6.198	11.116
2000	1450	8.8	6.1	1.2400	4.214	7.102	12.758

(Ref. IPCEA P-43-457)

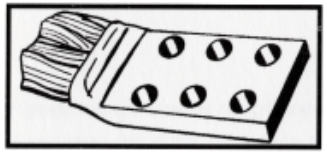
*To derate for other frequencies use the following formula:

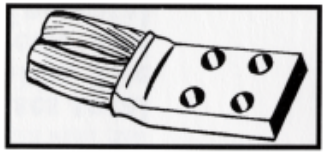
$$\text{AMPACITY RATING} \times \frac{1}{\sqrt{R_{AC}/R_{DC}}}$$

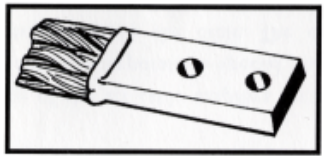
AIR-COOLED CABLES

FOR ELECTRIC FURNACES AND OTHER APPLICATIONS

Increased Life
Increased Load Distribution
Increased Conductivity
Reduced Terminal Weight
Specially Engineered Designs
Increased Cable Life with Wear Bumpers and Other Sleeves







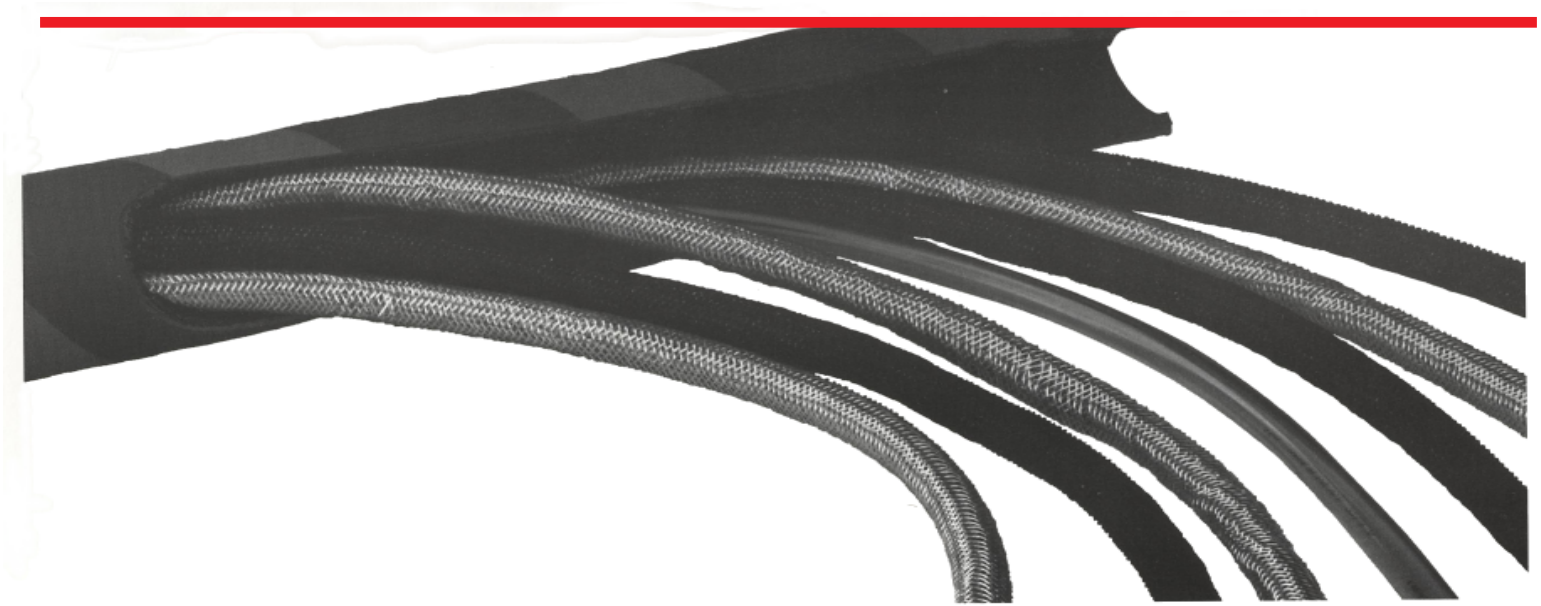
ON LINE WITH FLEX-CABLE

Kickless and Water-Cooled Cables

This state of the art cable employs the latest technology and space-age engineering materials. The Flex-Cable process incorporates a material which covers the individual conductor ropes within the cable reducing wire-to wire abrasion within the cable. This process also serves to capture and isolate broken strands of copper wire, preventing cooling system contamination and obstructed water flow.

The material mesh is flexible at each crossover point, which increases total cable flexibility by reducing the overall moment of inertia of the cable. The material adds a cushion to the wire when the magnetic and mechanical forces act on the cable, reducing wire fatigue and prolonging total cable life.

Votrex water flow action causes increased heat transfer, resulting in higher cooling efficiency. This results in increased felxibility, as well as additional water volume to alleviate heat. The Flex-Cel process insulates the wires from each other and allows water to come into direct contact with the copper wires. Flex-Cable's Flex-Cel construction is available in various jackets and terminal configurations.



FLEX-CABLE'S FABRICATION CAPABILITIES

PRECISION MACHINING
Flex-Cable specializes in machining copper and other material of value. Engineered products with .001 tolerance. One of a kind parts to large production runs are part of Flex-Cable's expertise.

Machining and fabrication in copper electrolode holders, terminals, tuyeres, adapters, buss systems and Delta closures.

Stainless steel, fixtures, die repair, mast arms and flame and plasma cutting.

MACHINE BUILDING
We can design or build small to medium die machines to improve production and assist in specific manufacturing tasks. Call and ask for an engineering evaluation on your requirements.

WELDING
SMAW, gas welding, flame cutting, plasma cutting, GTAW, GMAW, arc gouging, silver brazing.

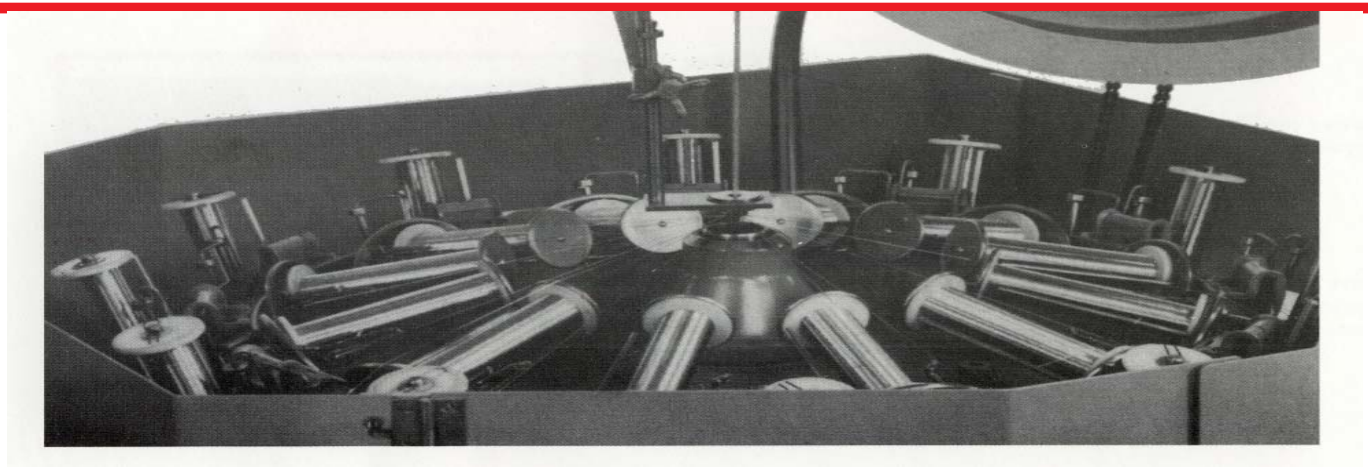
METALS
Copper, Stainless steel, steel, monel, aluminum, brass and bronzes and dissimilar metals.

Flex-Cable can provide high tech braiding using textiles and wire on composite materials. Our engineering department will help you on shielding to provide protection from harsh environments or to add strength through reinforcement for braiding harness assemblies, electrical cable, battery cables, pressure hoses and many other engineering applications.

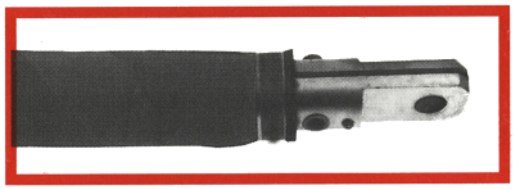
COMPOSITES
Kevlar, Fiberglass, Teflon, rubber, polyester (spun and mono), nylon, romex, stainless wire, copper wire.

WIRE
Stainless, Copper (diameter .005 to .030), applications electric wiring harness, battery cable, pressure hoses.

ENGINEERING & TECHNICAL SUPPORT
Flex-Cable engineering and field tech support is available for your assistance. The principal of helping our customers through precise engineering is the hallmark of Flex-Cable.



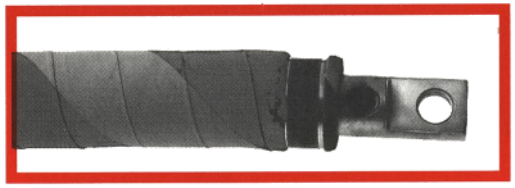
CABLES FOR WELDING APPLICATIONS



KICKLESS CABLES

Reasons for the use of Flex-Cable Kickless - flexibility, longer cable life, less maintenance. Magnetic stresses are essentially eliminated with our six conductor design. Bend and twist are enhanced. Size for size, the Flex-Cable conductor arrangement gives approximately 10% more current for a given applied voltage than other available cable sizes.

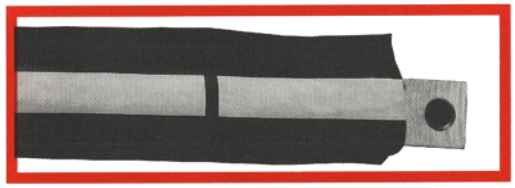
MCM Ratings	300	400	500	650	800



WATER COOLED CABLES

In applications where the current carrying capacity of an air cooled jumper is insufficient, free water passing though the new design permits cable to operate under twisting and bending conditions without contricting the water flow. Six standard MCM ratings are available.

MCM Ratings	350	400	500	600	750	1000



AIR COOLED CABLES

Air-Cooled terminals are swaged formed and flared on each end. Available in individually wrapped, forced air cooled, and loose fitting cover designs. Color ID plate strip shows color, MCM size length. Flex-Cable industry and other demanding high current applications.

MCM Ratings	400	500	600	750	1000	1200	1500	2000

CUSTOMIZED SHUNTS

Flex-Cable's new improved technique of fusing assures the highest electrical conductivity. This process, which involves an intimate molecular bond does not adversely anneal the shunt. Computer controlled cutting assures uniform blousing which allows us to engineer unique designd for special applications.

Made from tin plated copper - standard.

Call our Engineering Department for further details on other materials and sizes.

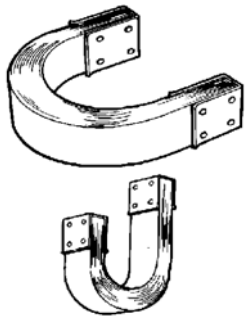
CUSTOMER	**Cust. Approval**
CUSTOMER PART #	**Work Order #**
FLEX-CABLE CODE #	

SHUNT ORDERING FORM
FLEX-CABLE

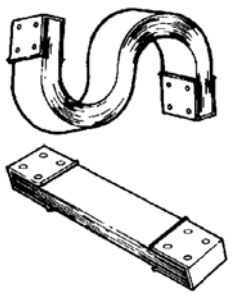
5822 N Henkel Rd
Howard City, MI 49329
www.flexcable.com
Ph: 231-937-8000
Fax: 231-937-8091
sales@flexcable.com

1 SHUNT TYPE
PLEASE CHECK DESIRED TYPE

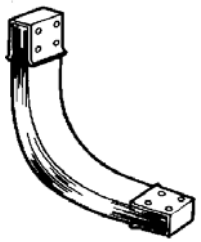
☐ **C/J**



☐ **S/F**



☐ **L**

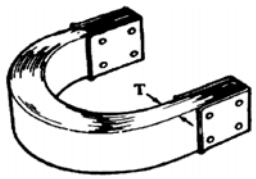


☐ **SPECIAL** (SEE PRINT)

PRINT #

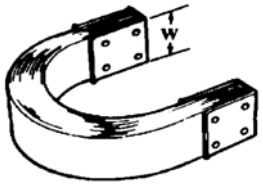
2 DIMENSIONS, in mm
ENTER DIM. AFTER EACH FIG.

THICKNESS



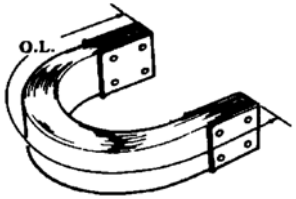
T= ___.___ ___ ___

WIDTH



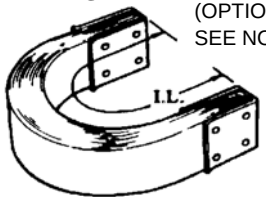
W= ___.___ ___ ___

OUTSIDE LENGTH



O.L.= ___ ___.___ ___

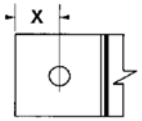
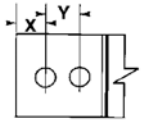
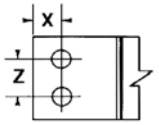
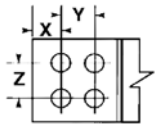
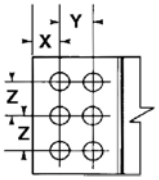
INSIDE LENGTH (OPTIONAL SEE NOTE)



I.L.= ___ ___.___ ___

BLOUSING THICKNESS WILL BE APPROX. 1.5 X T IF INSIDE LENGTH IS NOT SPECIFIED

3 HOLE SPECIFICATIONS
CHECK HOLE PATTERN

END 1		END 2
☐		☐
☐		☐
☐		☐
☐		☐
☐		☐

CUSTOM HOLE PATTERN

☐ **(SEE PRINT)** ☐

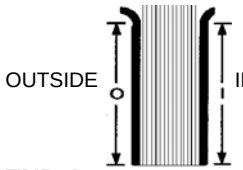
HOLE DIMENSIONS SEE FIG. ABOVE

END 1	END 2
X=	X=
Y=	Y=
Z=	Z=
HOLE SIZE END 1	HOLE SIZE END 2

4 END TREATMENT
CHECK END TREATMENT

END 1		END 2
☐	FUSED / BONDED (default)	☐
☐	PLATE	☐
☐	LOOSE	☐
☐	OTHER (SEE PRINT)	☐

ENTER PLATE DIMENSIONS



END 1	END 2
O=	O=
I=	I=

CIRCLE YES OR NO FOR FLARING
DEFAULT FLARE IS 1/4" AT 45 °
UNLESS OTHERWISE SPECIFIED

END 1		END 2	
INSIDE FLARE			
YES	NO	YES	NO
OUTSIDE FLARE			
YES	NO	YES	NO

CIRCLE YES OR NO FOR SILVER PLATED CONTACT SURFACE

END 1		END 2	
INSIDE			
YES	NO	YES	NO
OUTSIDE			
YES	NO	YES	NO

5 SHUNT OPTIONS
CHECK MATERIAL THICKNESS

☐ .003
☐ .005
☐ .010

.005 is default for shunts less than 2" wide.
.010 is default for shunts greater than 2" wide.

MATERIAL AVAILABLE

HALF-HARD TIN COATED (DEFAULT)

☐ SPECIAL ORDER (SEE COMMENTS)

CIRCLE COATING (OPTIONAL)

FIBERGLASS SHIELD
INSIDE OUTSIDE

TEFLON TAPE
INSIDE OUTSIDE

TEFLON ARMOR
INSIDE OUTSIDE

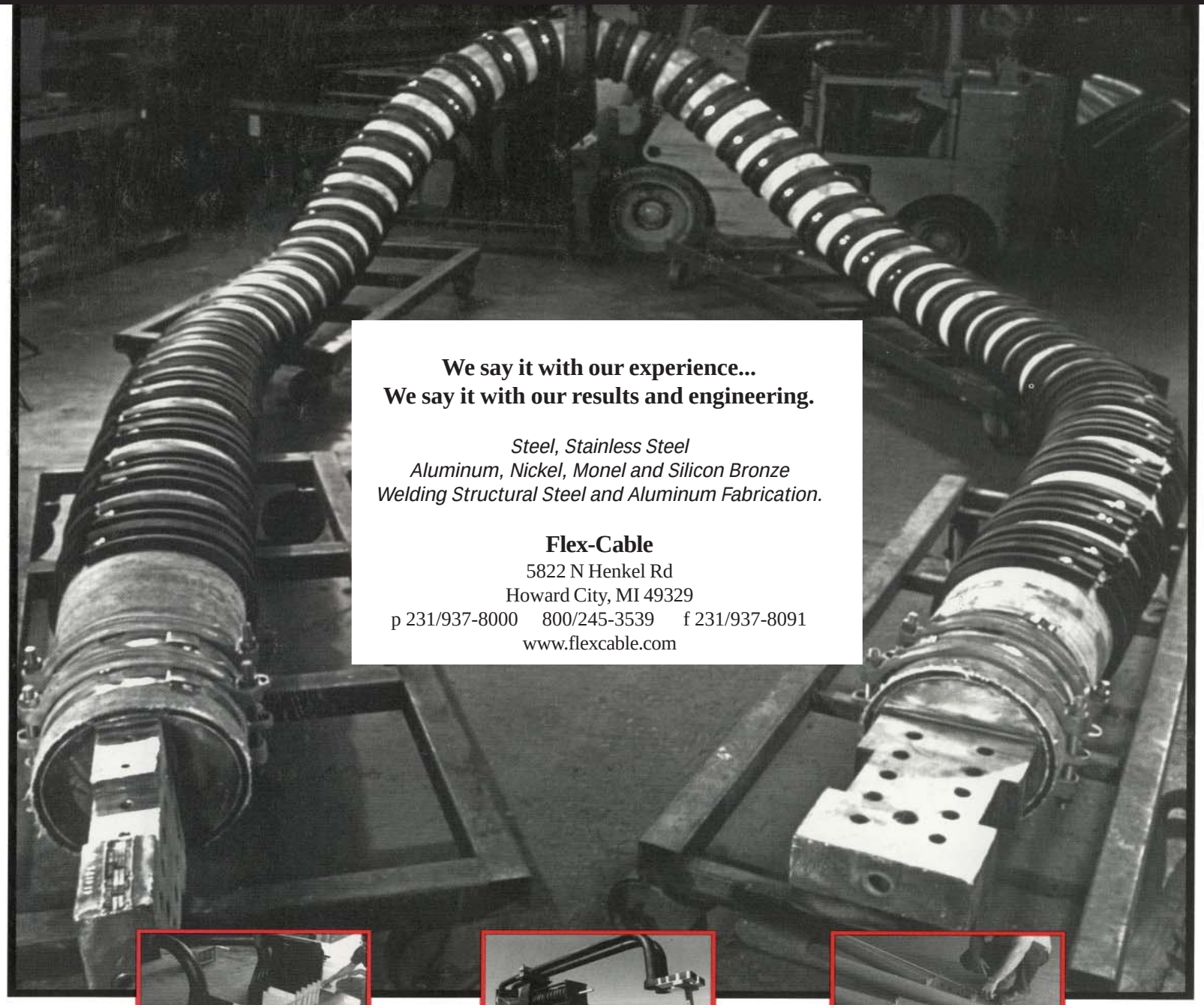
TEFLON JACKET
OUTSIDE ONLY

CIRCLE PLATE THICKNESS
(1/16" DEFAULT)
1/8" 3/16" 1/4"

COMMENTS:

Manufacturing

Foi



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