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**Holders / Adapters - Tips - Bar Stock (RWMA alloys)
Forgings & Castings, Fixtures - Accessories**



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SPOT WELDING PRODUCTS

Worton Manufacturing Company Limited is a leader in the manufacture of resistance welding electrodes.

We market a complete line of tips, holders and accessories.

Since 1963 Worton has developed its expertise as a manufacturer servicing the welding markets.

“Worco” brand welding products are all manufactured at this location to exact specifications and are subjected to strict quality control through our ISO 9002 Quality System. You will not find a better welding product than “Worco”.

The latest in precision equipment allows us to process all metals with particular expertise in copper, brass, aluminum and stainless steel.

We solicit custom work on our CNC lathes and machining centres as part of our service. Our technical experts take a personal interest in solving your welding and custom machining problems.

Put our experience to work for you today. You'll quickly see how our products, people, technology and service have made Worton Manufacturing Co. Ltd. one of the resistance welding industries leading manufacturers.



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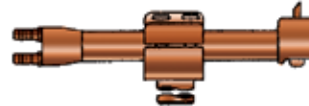
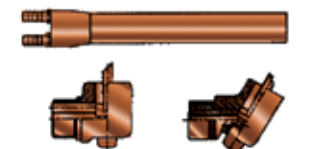
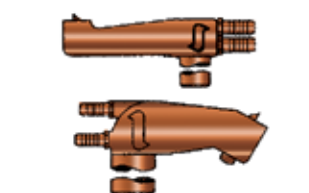
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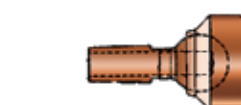
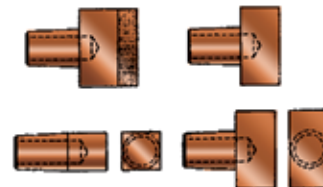
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WELDING ELECTRODE ALLOYS AND THEIR APPLICATIONS

GROUP A - COPPER BASE ALLOYS

CLASS 1 - Copper zirconium alloy that is superior to pure copper because of its higher annealing temperature, 350°C (662°F), while still maintaining comparable electrical and thermal conductivity. It is recommended for spot welding aluminum and magnesium alloys, coated material (terne plate, tin plate, galvanized iron, cadmium plate), brass and bronze.

CLASS 2 - A chromium copper alloy most generally used for spot welding electrodes. This material is a precipitation hardened material having a high annealing temperature, 500°C (932°F). It is recommended for welding clean, low alloy steels, stainless steel, low conductivity brasses, and nickel alloys.

CLASS 3 - A beryllium m-copper alloy possessing a combination of toughness, hardness and high resistance to annealing, 550°C (1022°F). It is recommended for welding stainless steel, monel metal and special welding components requiring high strength, wear resistance and good conductivity. Also available in Beryllium free (alloy 18000).

GROUP B - COPPER TUNGSTEN ALLOYS, TUNGSTEN and MOLYBDENUM

Generally this group of materials is recommended for electrode facings and welding dies. The hardness of these materials is unaffected by welding temperature; this quality gives them definite advantages where adequate cooling cannot be maintained.

CLASS 11 - A tungsten copper alloy recommended as facings and inserts for flash and butt welding dies and general purpose projection welding electrodes. It is recommended for high melting steels such as stainless steel.

CLASS 13 - Pure Tungsten

This material does not alloy readily with non-ferrous metals and therefore is used in welding copper and brass. It is also used for electro-brazing electrodes. This material is not readily machinable.

CLASS 14 - Pure Molybdenum

This material is used for electro-brazing and welding nonferrous metals as is class 13.

It is not as hard as tungsten, however it is readily machinable which may be advantageous.

CLASS 20 - Dispersion strengthened copper (Glidcop)

This material has very high resistance to annealing (1000°C). Most commonly available in male /female caps yielding a long life premium cap.

PROPERTIES OF TYPICAL RWMA WELDING METALS

ALLOY		PRINCIPAL ELEMENTS	RWMA GROUP	HARDNESS ROCKWELL	ELECTRICAL CONDUCTIVITY % I.A.C.S.	ULTIMATE STRENGTH P.S.I.	ELONGATION % IN 2"	ANNEALING TEMP °C °F	
CLASS 1	WROUGHT	COPPER, ZIRCONIUM	A	70B	92	65000	18	350	662
CLASS 2	CAST	COPPER, CHROMIUM	A	70B	80	53000	17	500	932
	WROUGHT			80B	80	72000	18	500	932
CLASS 3	CAST	COPPER, BERYLLIUM COBALT	A	90B	52	100000	12	550	1022
	WROUGHT		A	90B	52	110000	14	550	1022
CLASS 11	SINTERED	COPPER, TUNGSTEN	B	98B	46	90000	—	—	—
CLASS 13	CAST	TUNGSTEN	B	70A	32	100000	—	—	—
CLASS 14	CAST	MOLYBDENUM	B	90B	31	110000	—	—	—
CLASS 20	WROUGHT	COPPER, ALUMINIUM OXIDE	C	75B	85	54000	25	1000	1832



Recommended Electrode Materials for Resistance Welding SIMILAR and DISSIMILAR Metals, Using Conventional Methods

	Tungsten Molybdenum	Magnesium Alloys	Zinc	Nickel Alloys	Nickel	Tin	Lead	Stainless Steel	Chrome Plate	Cadmium Plate	Galvan- ized Iron Zn Plate	Terne Plate	Tin Plate	Scaly Steel	C. R. Steel	Phos- phor Bronze	Silicon Bronze	Nickel Silver	Cupro Nickel	Brass Yellow	Brass Red	Copper	Alu- minum Alloys	Alu- minum
Aluminum		C I D II	E H E II	E H E II	E H E II	H I H I	H I H I	H I H I	H I H I	E I D I	D I D I	D I D I	D I D I	E H D II	D II D II					D II E V	H V C I	C I C I		
Aluminum Alloys Duralumin		C I D II	E H E II	E H E II	E H E II	H I H I	H I H I	H I H I	H I H I	E I D I	D I D I	D I D I	D I D I	E H D II	D II D II					D II E V	H V C I	C I C I		
Copper—Pure	H II	H I H I	E H E II	E H E II	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I	H I H I
Brass—Red 5-25% Zinc																								
Brass—Yellow 25-40% Zinc																								
Cupro-Nickel																								
Nickel-Silver																								
Silicon Bronze																								
Phosphor Bronze Grades A, C, & D																								
C. R. Steel H. R. Steel—Clean																								
Scaly H. R. Steel																								
Tin Plate																								
Terne Plate																								
Galvanized Iron Zinc-Plate																								
Cadmium Plate																								
Chrome Plate																								
Stainless Steel 18-8 Type																								
Lead																								
Tin																								
Nickel																								
Nickel Alloys Monel-Nichrome (High Rec.)																								
Zinc																								
Magnesium Alloys																								
Molybdenum Tungsten																								

LEGEND

A. Block Interpretation

Weld- ability	Electrode Against
Electrode Against	Special Information

B. WELDABILITY

A - Excellent
B - Very Good
C - Good
D - Fair
E - Poor
H - Very Poor
K - Impractical

C. ELECTRODES

- I - ZIRCONIUM COPPER CLASS 1
- II - CHROMIUM COPPER CLASS 2
- III - BERYLLIUM COPPER CLASS 3
- IV - COPPER TUNGSTEN CLASS 11
- V - TUNGSTEN CLASS 13
- MOLYBDENUM CLASS 14

○ Electrode materials in circles are second choice.

D. SPECIAL INFORMATION

- Good weld strength.
- May be welded under special conditions.
- Low weld strength.
- No actual weld nugget occurs, a "stick" is obtained.
- Welding conditions must be accurately controlled.
- Keep electrodes clean to prevent sticking to the work.
- Good practice recommends cleaning steel before welding.
- Use one flat tip to minimize distortion or discoloration.
- Coating may dissolve in other metals or burn away.
- Should be projection welded.

WELDABILITY INTERPRETATION

It should be understood that any metal, similar or dissimilar, may be joined by resistance welding methods and a strength of bond obtained which may be satisfactory for the purpose intended.

The weldability as expressed in this chart applies only with the use of conventional spot welding methods and is intended to serve as a guide.

Many metal combinations which are expressed as having a "poor weldability" in the chart may be joined by using a special set-up or procedure.

For example, pure copper is expressed as being "impractical to weld" in the chart but it may be joined by such expedients as the insertion of a third metal (as silver solder) between the sheets or plating another metal (nickel, tin) on the surfaces or by welding underwater, etc.

The weldability of any two materials as expressed in this chart was derived after a careful study and survey of the many factors which influence the welding or resultant weld of the metals.

- Technical research and laboratory tests.
- Field tests and production.
- Thermal and electrical conductivity.
- Metallurgical properties, melting and boiling points.
- Nature of resultant weld or alloy.
- Weld strength.
- Relative accuracy in control of welding conditions necessary.




As a basis for comparison cold rolled (mild) steel has been chosen and its weldability designated as "excellent".



APPLICATION DATA SHEET




Spot Welding Data

Optimum Conditions Schedules For Spot Welding Low Carbon Steel — SAE 1010

Thick- ness of Thinnest Outside *Piece (Inches)	Electrode Diameters and Shape*			Recommended Minimum Standard Electrode Size	Weld Force (Lbs.)	Weld Time (Cycles) (60 Cycles per Sec.)	Hold Time (Cycles) Min.	Welding Current (Amps.) (Approx.)	Weld Shear Strength (For Steels Having Ultimate Tensile Strength of 90,000 psi and below) Minimum Strength (Lbs/Weld)	Diameter of Fused Zone (Approx.)	Minimum Weld Spacing	Minimum Contacting Overlap
	Flat Face		Radius Face									
	Maximum d (Inches)	Min. D (Inches)										
0.010	0.125	1/2	2	4RW 1MT	160	4	5	4,000	130	0.113	1/4	3/8
0.021	0.187	1/2	2	4RW 1MT	244	6	8	6,500	300	0.139	3/8	7/16
0.031	0.187	1/2	2	4RW 1MT	326	8	10	8,000	530	0.161	1/2	7/16
0.040	0.250	5/8	3	5RW 2MT	412	10	12	8,800	812	0.181	3/4	1/2
0.050	0.250	5/8	3	5RW 2MT	554	14	16	9,600	1,195	0.210	7/8	9/16
0.062	0.250	5/8	3	5RW 2MT	670	18	20	10,600	1,717	0.231	1	5/8
0.078	0.312	5/8	3	5RW 2MT	903	25	30	11,800	2,365	0.268	1 1/8	11/16
0.094	0.312	5/8	4	7RW 3MT	1,160	34	35	13,000	3,054	0.304	1 1/4	3/4
0.109	0.375	7/8	4	7RW 3MT	1,440	45	40	14,200	3,672	0.338	1 1/2	13/16
0.125	0.375	7/8	4	7RW 3MT	1,760	60	45	15,600	4,300	0.375	1 1/2	7/8
0.156	0.500	7/8	6	Male or Female Threaded	2,500	93	50	18,000	6,500	0.446	1 3/4	1
0.187	0.625	1	6	Male or Female Threaded	3,340	130	55	20,500	9,000	0.516	2	1 1/2
0.250	0.750	1 1/4	6	Male or Female Threaded	5,560	230	60	26,000	18,000	0.660	4	1 1/2

PERMISSIBLE SCHEDULE VARIATIONS FOR SPOT WELDING LOW CARBON STEEL

Low Carbon Steel Spot Welding Data Chart—Single Impulse Welding

DATA COMMON TO ALL CLASSES OF SPOT WELDS					WELDING SET-UP FOR BEST QUALITY—CLASS A WELDS					WELDING SET-UP FOR MEDIUM QUALITY—CLASS B WELDS					WELDING SET-UP FOR GOOD QUALITY—CLASS C WELDS				
Thick- ness of Each of the Two Work Pieces Inches	Electrode Diam. & Shape		Min. Weld Spacing (Note 4) Inches	Min. Contacting Overlap (Note 6) Inches	Weld Time (Note 7) Cycles	Electrode Force Pounds	Weld- ing Current Amps.	Diam. of Fused Zone 	Average Tensile Shear Strength ±14% Pounds	Weld Time (Note 7) Cycles	Electrode Force Pounds	Weld- ing Current Amps.	Diam. of Fused Zone 	Average Tensile Shear Strength ±17% Pounds	Weld Time (Note 7) Cycles	Electrode Force Pounds	Weld- ing Current Amps.	Diam. of Fused Zone 	Average Tensile Shear Strength ±20% Pounds
	Min. D Inches	Max. d Inches																	
.010	1/2	3/8	1/4	3/8	4	200	4000	.13	235	5	130	3700	.12	200	15	65	3000	.11	160
.021	1/2	3/16	3/8	7/16	6	300	6100	.17	530	10	200	5100	.16	460	22	100	3800	.14	390
.031	1/2	3/16	1/2	7/16	8	400	8000	.21	980	15	275	6300	.20	850	29	135	4700	.18	790
.040	5/8	1/4	3/4	1/2	10	500	9200	.23	1305	21	360	7500	.22	1230	38	180	5600	.21	1180
.050	5/8	1/4	7/8	9/16	12	650	10300	.25	1820	24	410	8000	.23	1700	42	205	6100	.22	1600
.062	5/8	1/4	1	5/8	14	800	11600	.27	2350	29	500	9000	.26	2150	48	250	6800	.25	2050
.078	5/8	3/16	1 1/8	11/16	21	1100	13300	.31	3225	36	650	10400	.30	3025	58	325	7900	.28	2900
.094	5/8	3/16	1 1/4	3/4	25	1300	14700	.34	4100	44	790	11400	.33	3900	66	390	8800	.31	3750
.109	7/8	3/8	1 1/2	13/16	29	1600	16100	.37	5300	50	960	12200	.36	5050	72	480	9500	.35	4850
.125	7/8	3/8	1 1/2	7/8	30	1800	17500	.40	6900	60	1140	12900	.39	6500	78	570	10000	.37	6150

NOTES:

- Low Carbon Steel as hot rolled, pickled, and slightly oiled with an ultimate strength of 42,000 to 45,000 PSI Similar to SAE 1005—SAE 1010.
- Electrode Material is CLASS 2.
- Surface of steel is lightly oiled but free from grease, scale or dirt.
- Minimum weld spacing is that distance for which no increase in welding current is necessary to compensate for the shunted current effect in adjacent welds.
- Radius Face electrodes may be used:

0.010 to 0.031 — 2" Radius
0.031 to 0.078 — 3" Radius
0.078 to 0.125 — 4" Radius

6.



7. Weld time is indicated in cycles of 60 cycle frequency.

8. Tensile shear strength values are based on




recommended test sample sizes:

Direction of Force	Thickness	Width
Length	.000" to .029"	3"
	.030" to .058"	4"
	.059" to .115"	5"
	.116" to .190"	6"

- Tolerance for machining of electrode diameter "d" is ±.015" of specified dimension.
- Electrode force does not provide for force to press ill-fitting parts together.

APPLICATION DATA SHEET



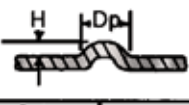

Schedule for Spot Welding Stainless Steel

THICKNESS "T" of THINNEST OUTSIDE PIECE (See Notes 1, 2, 3 and 4 Below)	ELECTRODE DIAMETER AND SHAPE (See Note 5)		ELECTRODE FORCE	WELD TIME CYCLES (60 Per Sec.)	WELDING CURRENT (Approx.)		MINIMUM CONTACTING OVERLAP 	MINIMUM WELD SPACING (See Note 6 Below) 	DIAMETER OF FUSED ZONE 	MINIMUM SHEAR STRENGTH		
	LB.											
	Ultimate Tensile Strength of Metal											
	70000 Up to 90000 Psi	90000 Up to 150000 Psi			150000 Psi and Higher							
	D, IN., Min.	d, IN., Max.			IN. Approx.							
INCHES												
0.006	3/16	3/32	180	2	2000	2000	3/16	3/16	0.045	60	70	85
0.008	3/16	3/32	200	3	2000	2000	3/16	3/16	0.065	150	170	210
0.012	1/4	1/8	260	3	2100	2000	1/4	1/4	0.076	185	210	250
0.014	1/4	1/8	300	4	2500	2200	1/4	1/4	0.082	240	250	320
0.016	1/4	1/8	330	4	3000	2500	1/4	3/16	0.088	280	300	380
0.018	1/4	1/8	380	4	3500	2800	1/4	3/16	0.093	320	360	470
0.021	1/4	3/32	400	4	4000	3200	3/16	3/16	0.100	370	470	500
0.025	3/8	3/32	520	5	5000	4100	3/8	7/16	0.120	500	600	680
0.031	3/8	3/16	650	5	6000	4800	3/8	1/2	0.130	680	800	930
0.034	3/8	3/16	750	6	7000	5500	7/16	3/4	0.150	800	920	1100
0.040	3/8	3/16	900	6	7800	6300	7/16	3/4	0.160	1000	1270	1400
0.044	3/8	3/16	1000	8	8700	7000	7/16	1 1/16	0.180	1200	1450	1700
0.050	1/2	1/4	1200	8	9500	7500	1/2	3/4	0.190	1450	1700	2000
0.056	1/2	1/4	1350	10	10300	8300	3/4	7/8	0.210	1700	2000	2450
0.062	1/2	1/4	1500	10	11000	9000	3/4	1	0.220	1950	22400	2900
0.070	3/4	1/4	1700	12	12300	10000	3/4	1 1/8	0.250	2400	2800	3550
0.078	3/4	3/16	1900	14	14000	11000	1 1/8	1 1/4	0.275	2700	3400	4000
0.094	3/4	3/16	2400	16	15700	12700	3/4	1 1/2	0.290	3550	4200	5300
0.109	3/4	3/8	2800	18	17700	14000	1 1/8	1 1/2	0.290	4200	5000	6400
0.125	3/4	3/8	3300	20	18000	15500	1 1/8	2	0.300	5000	6000	7600

NOTES:

- Types of Steel—301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347 and 349
- Material should be free from scale, oxides, paint, grease and oil.
- Welding conditions determined by thickness of thinnest outside piece "T."
- Data for total thickness of pile-up not exceeding 4 "T". Maximum ratio between two thicknesses 3 to 1.
- Electrode Material, CL2, CL3, OR CL11.
- Minimum weld spacing is that spacing for two pieces for which no special precautions need be taken to compensate for shunted current effect of adjacent welds. For three pieces increase spacing 30 per cent.

Design And Welding Data For Projection Welding Low Carbon Steels

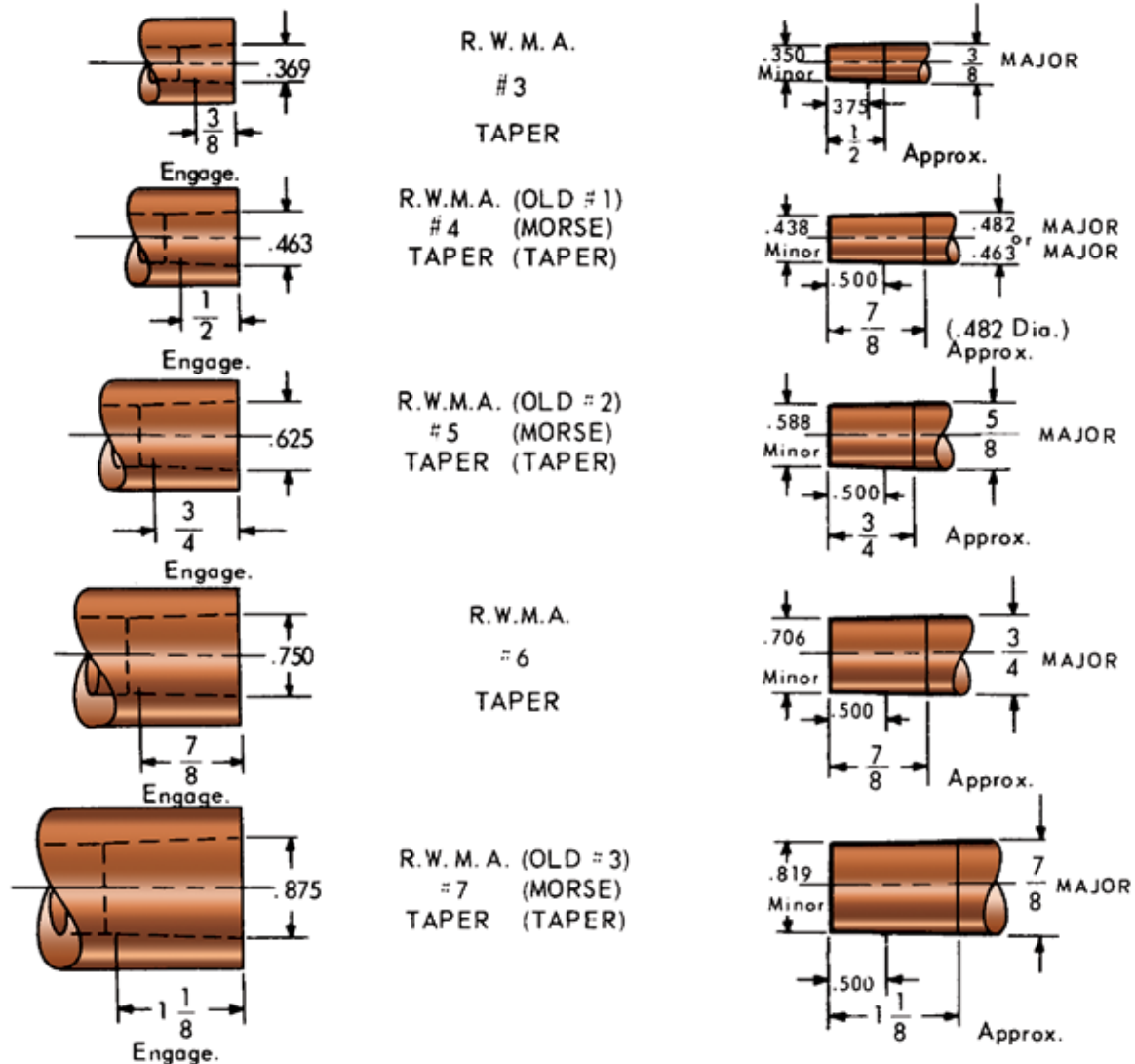
Thickness of Thinnest Outside Piece Inches	PROJECTION DESIGN		ELECTRODE DIAMETERS (d=2x Projection Diameter)		Electrode Force Pounds	Weld Time (Cycles) 60 Cycles per Sec.	Hold Time (Cycles) Minimum	Welding Current Amperes (Approx.)	 Diameter of Fused Zone Dw Inches	Minimum Shear Strength (Single Projection Only) (For Steels Having Strength of 100,000 psi and below) Pounds	 Minimum Contacting Overlap L, S Inches S = 2 DP MIN.
	 Base Diameter of Projection Dp Inches	Height of Projection H Inches	 Minimum Inches	Minimum D Inches							
0.010	0.055	0.015	0.125	1/2	50	3	3	2,800	0.112	150	1/8
0.012	0.055	0.015	0.125	1/2	80	3	3	3,100	0.112	200	1/8
0.014	0.055	0.015	0.125	1/2	100	3	3	3,400	0.112	250	1/8
0.016	0.067	0.017	0.187	1/2	115	4	4	3,600	0.112	285	5/32
0.021	0.067	0.017	0.187	1/2	150	6	6	4,000	0.140	380	5/32
0.025	0.081	0.020	0.187	1/2	200	6	8	4,500	0.140	525	3/16
0.031	0.094	0.022	0.187	1/2	300	8	8	5,100	0.169	740	7/32
0.034	0.094	0.022	0.187	1/2	350	10	10	5,400	0.169	900	7/32
0.044	0.119	0.028	0.250	3/8	480	13	14	6,500	0.169	1,080	3/32
0.050	0.119	0.028	0.250	3/8	580	16	16	7,100	0.225	1,500	3/32
0.062	0.156	0.035	0.312	7/8	750	21	20	8,400	0.225	2,100	3/8
0.070	0.156	0.035	0.312	7/8	900	24	24	9,200	0.281	2,550	3/8
0.078	0.187	0.041	0.375	7/8	1,050	26	30	10,500	0.281	2,950	7/16
0.094	0.218	0.048	0.500	7/8	1,300	32	30	11,800	0.281	3,700	1/2
0.109	0.250	0.054	0.500	7/8	1,650	38	36	13,300	0.338	4,500	5/8
0.125	0.281	0.060	0.500	7/8	1,800	45	40	15,000	0.338	5,200	1 1/16
0.140	0.312	0.066	0.625	1	2,300	60	45	15,700	0.437	6,000	3/4
0.156	0.343	0.072	0.625	1	2,800	80	50	17,250	0.500	7,500	13/16
0.171	0.375	0.078	0.750	1	3,300	105	50	18,600	0.562	8,500	7/8
0.187	0.406	0.085	0.750	1	3,800	125	50	20,000	0.562	10,000	15/16
0.203	0.437	0.091	0.875	1 1/4	4,500	145	55	21,500	0.625	12,000	1
0.250	0.531	0.110	1.000	1 1/4	6,600	230	60	26,000	0.687	15,000	1 1/4

NOTES:

- Type of Steel—Low Carbon SAE 1010—0.15% Carbon Maximum.
- Material free of scale, oxide, paint, dirt, etc.
- Size of projection determined by thickness of thinnest piece and projection should be on thickest piece.
- Data is based on thickness of thinnest sheet for two thicknesses only. Maximum ratio between two thicknesses = 3 to 1.
- See TABLE BELOW for design of punch and die for making projections.
- Contacting overlap does not include any radii from forming.
- Projection should be located in center of overlap.
- Tolerance for Projection Dimensions:

Dimension	Thickness Up to 0.050"	Thickness Over 0.050"
Diameter "D"	±0.003"	±0.007"
Height "H"	±0.002"	±0.005"

R.W.M.A. STANDARD TAPERS



The above new R.W.M.A. tapers cover a broader range than the old Morse tapers. These new tapers are .0001" taper per foot and replace the Morse tapers which vary from .5986 on the #1 M.T. to .6024 on the #3 M.T. The new R.W.M.A. #4, #5, and #7 tapers are inter-changeable with the old #1, #2, and #3 Morse tapers. You will note there are 2 new sizes, the #3 and #6 R.W.M.A. Tapers.



STANDARD ELECTRODE HOLDERS

STANDARD ELECTRODE HOLDERS

STRAIGHT STYLE, EJECTOR AND NON-EJECTOR TYPES

Non-Ejector Holder No.	Barrel Dia. (Inches)	Barrel Length (Inches)	RWMA Taper Size	Ejector Holder No.
N-06034	3/4	3	4	E-06034
N-07034	7/8	3	4	E-07034
N-08034	1	3	4	E-08034
N-10034	1-1/4	3	4	E-10034
N-12034	1-1/2	3	4	E-12034
N-06084	3/4	8	4	E-06084
N-07084	7/8	8	4	E-07084
N-08084	1	8	4	E-08084
N-10084	1-1/4	8	4	E-10084
N-12084	1-1/2	8	4	E-12084
N-06124	3/4	12	4	E-06124
N-07124	7/8	12	4	E-07124
N-08124	1	12	4	E-08124
N-10124	1-1/4	12	4	E-10124
N-12124	1-1/2	12	4	E-12124
N-07035	7/8	3	5	E-08035
N-08035	1	3	5	E-10035
N-10035	1-1/4	3	5	E-12035
N-12035	1-1/2	3	5	
N-07085	7/8	8	5	E-07085
N-08085	1	8	5	E-08085
N-10085	1-1/4	8	5	E-10085
N-12085	1-1/2	8	5	E-12085
N-07125	7/8	12	5	E-08125
N-08125	1	12	5	E-10125
N-10125	1-1/4	12	5	E-12125
N-12125	1-1/2	12	5	
N-10086	1-1/4	8	6	E-10086
N-12086	1-1/2	8	6	E-12086
N-10126	1-1/4	12	6	E-10126
N-12126	1-1/2	12	6	E-12126
N-10087	1-1/4	8	7	E-10087
N-12087	1-1/2	8	7	E-12087
N-10127	1-1/4	12	7	E-10127
N-12127	1-1/2	12	7	E-12127

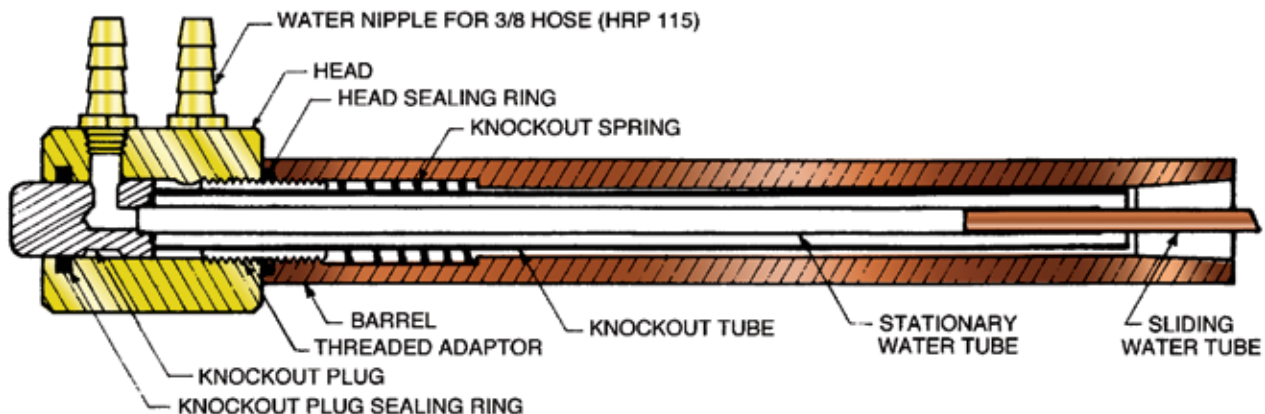
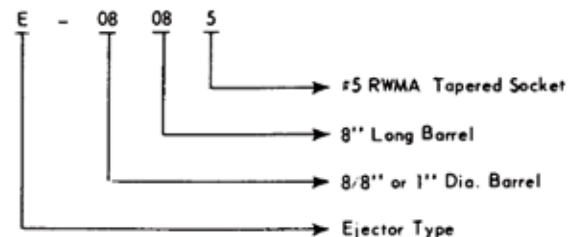
CLOSE-COUPLED STRAIGHT HOLDERS

Barrel Dia. (Inches)	RWMA Taper Size	Barrel Length (Inches)	Non-Ejector Holder No.
3/4	4	3	N-06034
7/8	4	3	N-07034
1	4	3	N-08034
1-1/4	4	3	N-10034
1-1/2	4	3	N-12034
7/8	5	3	N-07035
1	5	3	N-08035
1-1/4	5	3	N-10035
1-1/2	5	3	N-12035

NOTE:
HEAVY DUTY HOLDERS ARE DESIGNATED BY PREFIX "2"
EG. 2 E-08-08-5
PREFIX "2" DESIGNATES RWMA CLASS 2 MATERIAL

Explanation of holder code number:

Example: E-08085

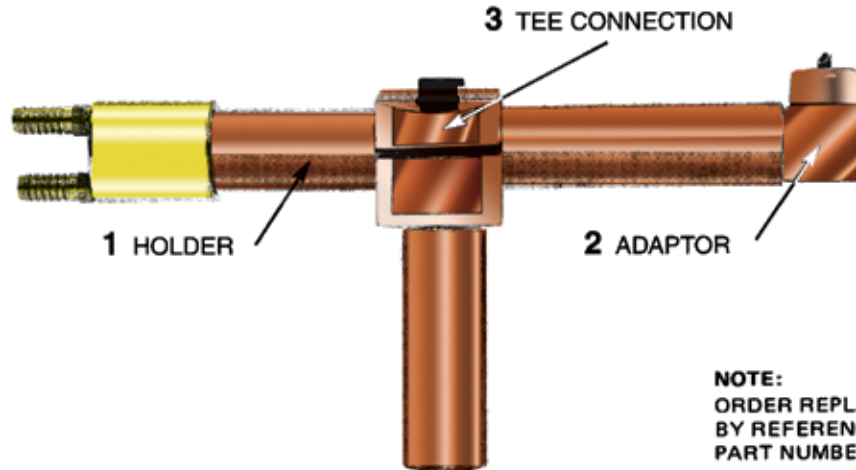


NOTE:
ORDER REPLACEMENT PARTS BY REFERENCE
TO HOLDER NUMBER OR DESCRIPTION



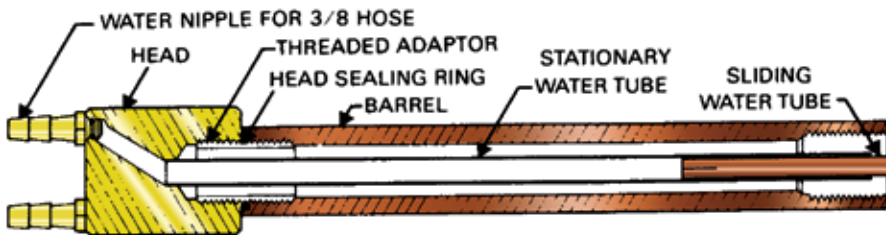
UNIVERSAL WATER COOLED HOLDERS

GENERAL ASSEMBLY



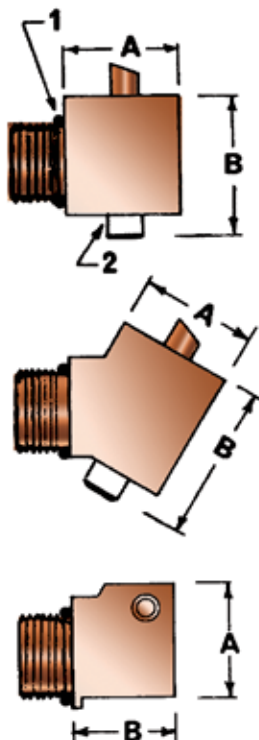
NOTE:
ORDER REPLACEMENT PARTS
BY REFERENCE TO COMPONENT
PART NUMBER OR DESCRIPTION

1 "2N" HEAVY-DUTY HOLDER (CLASS 2 ALLOY)



2 N 08 08 7 14	
2 N 10 08 7 14	
2 N 10 08 8 14	
2 N 12 08 8 14	
	CODE
	THREADS PER INCH
	8/8" or 1" THD. SIZE TO TAKE "M" ADAPTORS
	EG. 8 INCH BARREL LENGTH
	EG. 12/8 or 1 1/2" BARREL DIAMETER
	NON EJECTOR DESIGNATION
	CLASS 2 ALLOY

2 "M" ADAPTOR



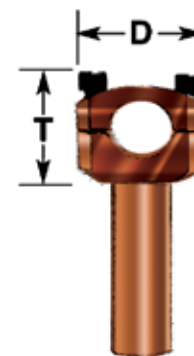
1 SEALING RING
2 KNOCKOUT PLUG

PART No.	A	B
M 7 14 4 90	1	1 5/8
M 7 14 5 90	1	1 7/8
M 8 14 5 90	1 1/4	1 7/8
M 7 14 4 30	1	1 5/8
M 7 14 5 30	1	1 7/8
M 8 14 5 30	1 1/4	1 7/8
M 7 14 5 00	1 3/8	3/4
M 8 14 5 00	1 3/8	3/4

CODE

M 7 14 4 90	
	ANGLE (DEGREES)
	RWMA TAPER
	THREADS PER IN
	7/8" THREAD
	ADAPTOR DESIGNATION

3 "H" TEE CONNECTION



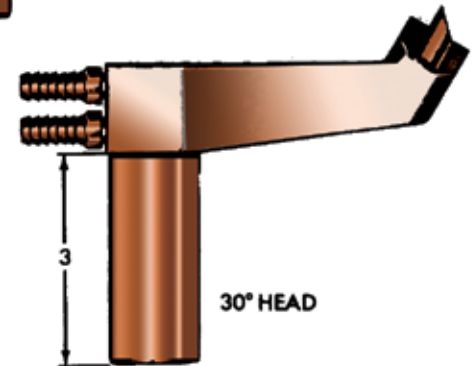
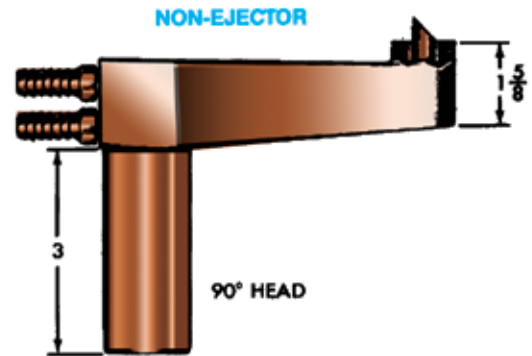
	T	D
H 08 08 3	2 1/8	2 1/2
H 10 10 3 1/2	2 1/2	3
H 12 10 4	2 3/4	3
H 12 12 4	2 3/4	3
H 10 12 4	2 1/2	3
	SHANK LENGTH IN.	
	EG. 12/8 or 1 1/2" SHANK DIA.	
	10/8 or 1 1/4" HOLDER DIA.	
	TEE DESIGNATION	



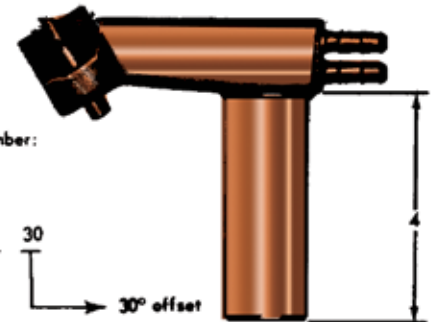
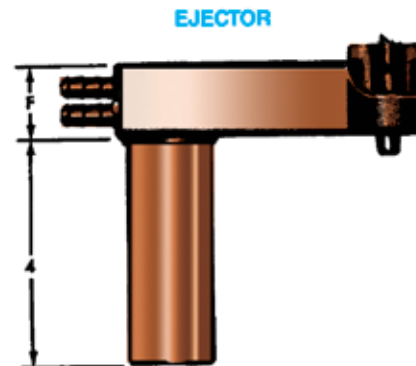
OFFSET WATER COOLED HOLDERS

STANDARD ELECTRODE HOLDERS OFFSET STYLE, EJECTOR AND NON-EJECTOR TYPES

Non-Ejector Holder No.	Shank Dia. Inches	RWMA Taper Size	Offset Inches	Taper Socket Angle (Degree)	Ejector Holder No.
ON-064-230	3/4	4	2	30	
ON-074-230	7/8	4	2	30	
ON-084-230	1	4	2	30	
ON-104-230	1-1/4	4	2	30	
ON-064-430	3/4	4	4	30	
ON-074-430	7/8	4	4	30	
ON-084-430	1	4	4	30	
ON-104-430	1-1/4	4	4	30	
ON-075-230	7/8	5	2	30	
ON-085-230	1	5	2	30	
ON-105-230	1-1/4	5	2	30	
ON-125-230	1-1/2	5	2	30	
ON-075-430	7/8	5	4	30	OE-075-430
ON-085-430	1	5	4	30	OE-085-430
ON-105-430	1-1/4	5	4	30	OE-105-430
ON-125-430	1-1/2	5	4	30	OE-125-430
ON-106-230	1-1/4	6	2	30	
ON-126-230	1-1/2	6	2	30	
ON-106-430	1-1/4	6	4	30	OE-106-430
ON-126-430	1-1/2	6	4	30	OE-126-430
ON-107-230	1-1/4	7	2	30	
ON-127-230	1-1/2	7	2	30	
ON-107-430	1-1/4	7	4	30	OE-107-430
ON-127-430	1-1/2	7	4	30	OE-127-430

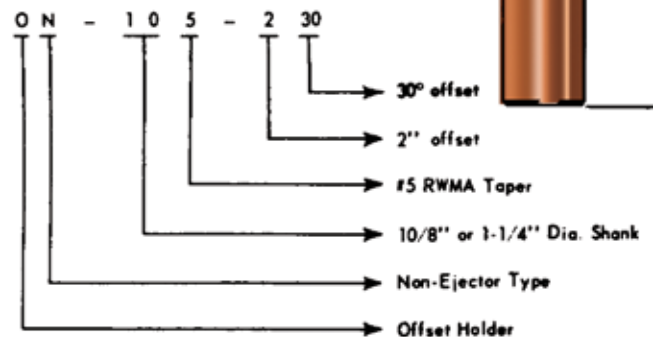


Non-Ejector Holder No.	Shank Dia. Inches	RWMA Taper Size	Offset Inches	Taper Socket Angle (Degree)	Ejector Holder No.
ON-064-290	3/4	4	2	90	
ON-074-290	7/8	4	2	90	
ON-084-290	1	4	2	90	
ON-104-290	1-1/4	4	2	90	
ON-064-490	3/4	4	4	90	
ON-074-490	7/8	4	4	90	
ON-084-490	1	4	4	90	
ON-104-490	1-1/4	4	4	90	
ON-075-290	7/8	5	2	90	OE-075-290
ON-085-290	1	5	2	90	OE-085-290
ON-105-290	1-1/4	5	2	90	OE-105-290
ON-125-290	1-1/2	5	2	90	OE-125-290
ON-075-490	7/8	5	4	90	OE-075-490
ON-085-490	1	5	4	90	OE-085-490
ON-105-490	1-1/4	5	4	90	OE-105-490
ON-125-490	1-1/2	5	4	90	OE-125-490
ON-106-290	1-1/4	6	2	90	OE-106-290
ON-126-290	1-1/2	6	2	90	OE-126-290
ON-106-490	1-1/4	6	4	90	OE-106-490
ON-126-490	1-1/2	6	4	90	OE-126-490
ON-107-290	1-1/4	7	2	90	OE-107-290
ON-127-290	1-1/2	7	2	90	OE-127-290
ON-107-490	1-1/4	7	4	90	OE-107-490
ON-127-490	1-1/2	7	4	90	OE-127-490



Explanation of holder code number:

Example: ON-105-230



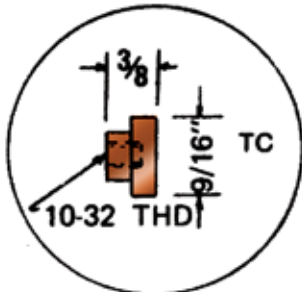


SLIMLINE OFFSET HOLDERS

Worco's "Slimline" Holders are manufactured from durable class 2 alloy for long trouble free life. It requires no "Tee" connection and is therefore more economical than many other set-ups. The shank is available in various sizes as indicated below. Worco "Button type" Tips are available in class 1 or class 2 alloy for use with the "Slimline" Holder. The four styles available are illustrated below.

BUTTON TYPE HOLDER

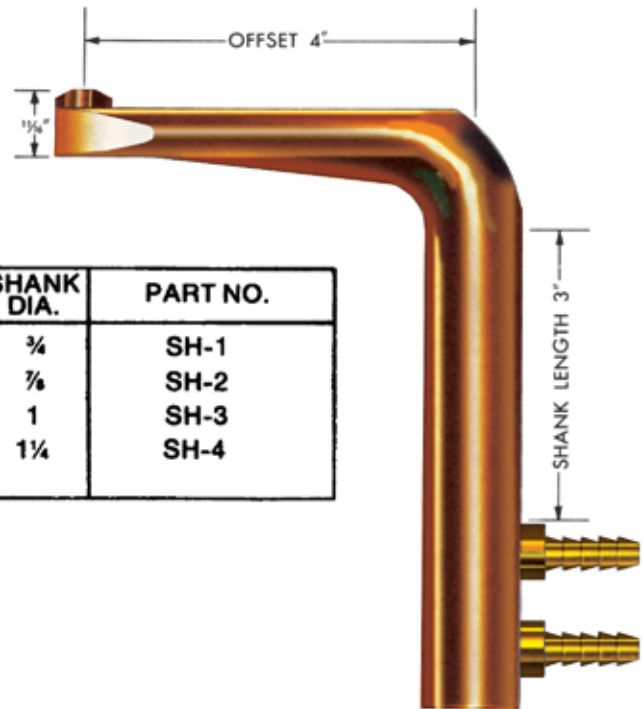
BUTTON TYPE TIPS



STYLES
TC2
TD2
TE2
TF2



SHANK DIA.	PART NO.
3/4	SH-1
7/8	SH-2
1	SH-3
1 1/4	SH-4



WORTON WELDER ARMS

Spot welding machine arms made by Worton reduce set up time and give longer life.

Electrode holder shanks can be attached to these arms from the front, by bolting the cap over them. This means no extra clearance is required between the arms to allow running a shank up (or down) into a hole in the arm.

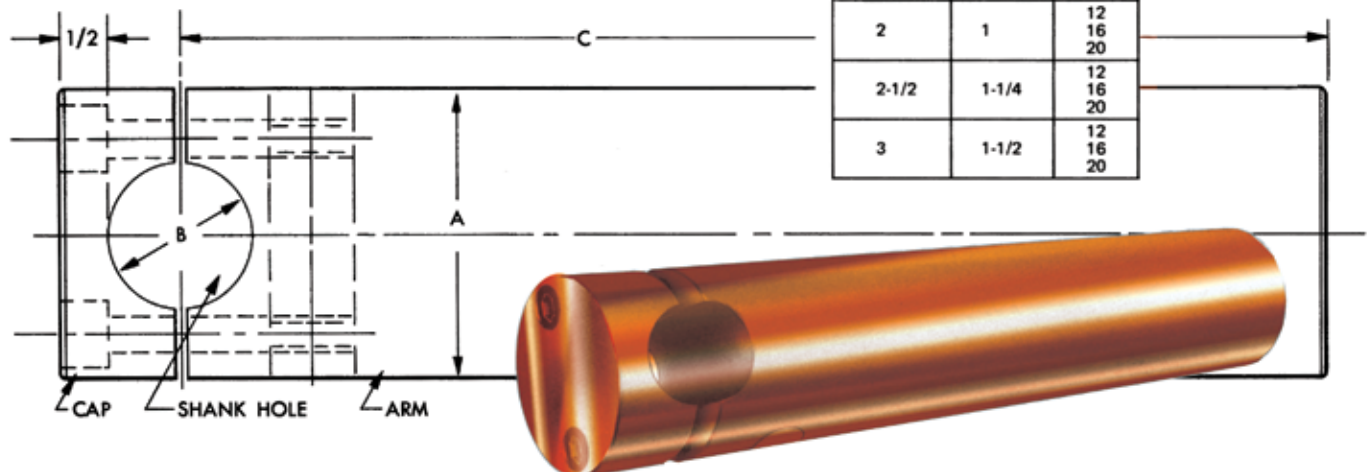
Example: W A 0 9 0 8 1 6

Dia. in 1/4" INC.

Hole DIA in 1/8" INC.

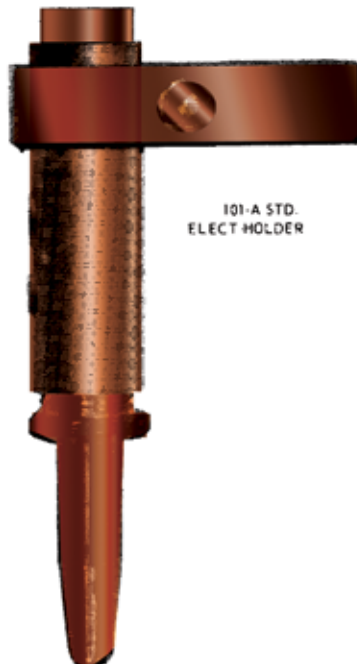
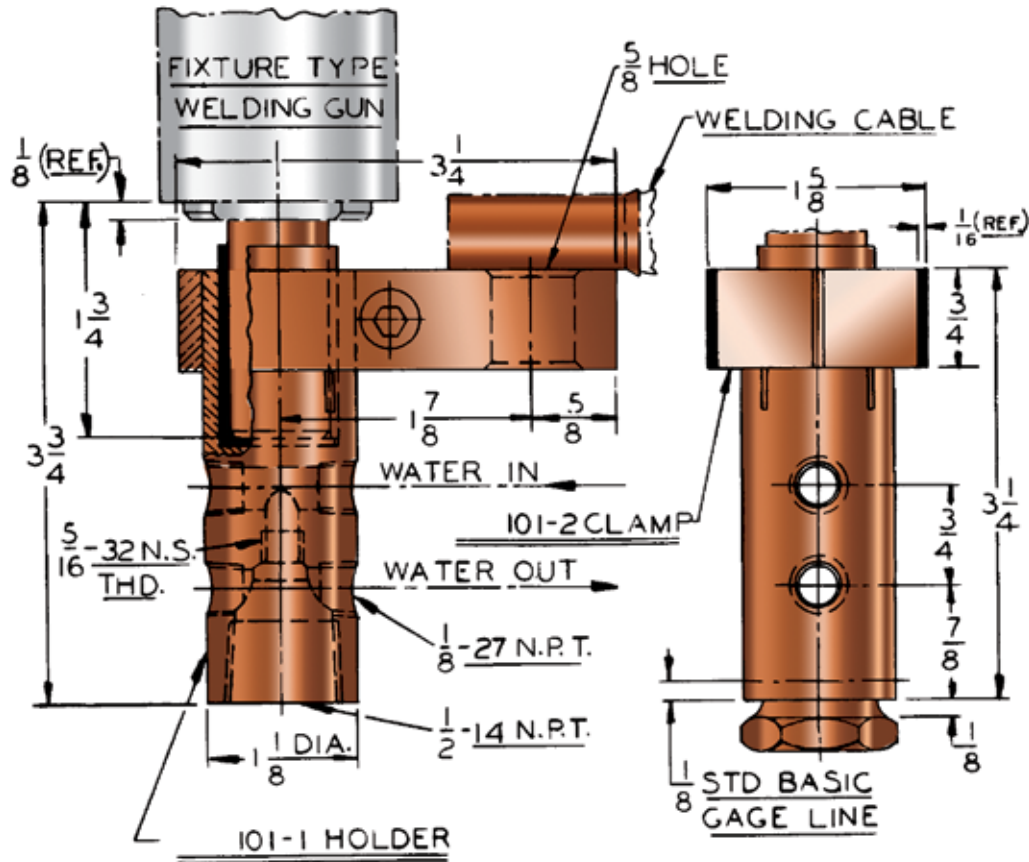
Dimension

Length in 1" INC





ELECTRODE HOLDERS FOR SERIES A PISTON ROD ENDS



101-A STD.
ELECT HOLDER

Stationary Water Tube = WTA 101-L
[L = length in 1/8" increments]

Sliding Water Tube = HRP 110-L
[L = length in inches]

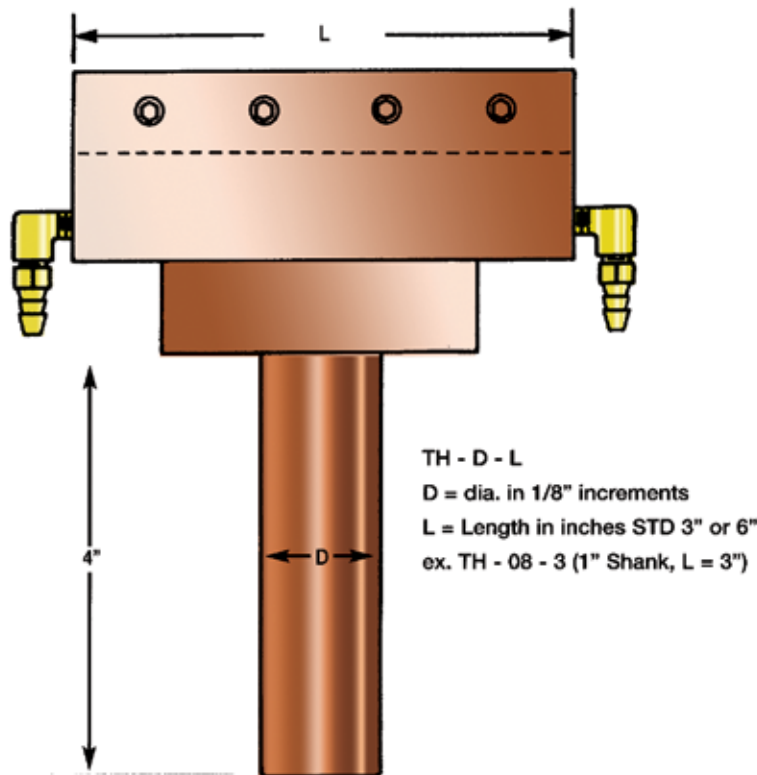
Note: HRP 110 is 4.5" long.

THE 101A HOLDER ASSEMBLY IS ILLUSTRATED, HOWEVER OTHER VARIATIONS ON THIS STYLE ARE AVAILABLE WHICH INCLUDE LONGER BARREL, LARGER BARREL, LARGER CLAMP AND LARGER PIPE THREAD SIZE.



WATER COOLED TEE HOLDER

HOLDS BAR FOR CROSS-WIRE OR PROJECTION WELDING
CAN BE MADE TO SUIT PARTICULAR MACHINE OR JOB.



TH - D - L

D = dia. in 1/8" increments

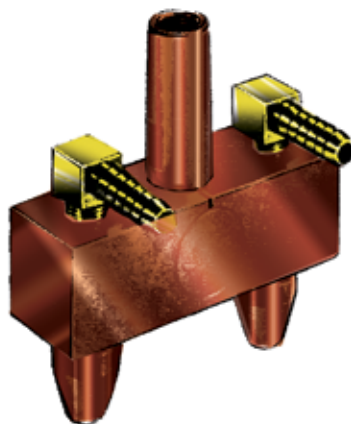
L = Length in inches STD 3" or 6"
ex. TH - 08 - 3 (1" Shank, L = 3")

DA 300 COMPACT DUAL ADAPTER

- WATER COOLED WITH NO HOSE CONNECTIONS
- FITS A STANDARD WATER COOLED ELECTRODE HOLDER WITH #5 RWMA TAPER
- 1" TIP SPACING
- EQUILIZED TIP PRESSURE

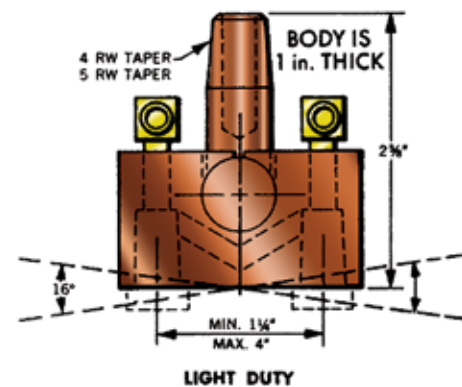


DUAL ELECTRODE HOLDER

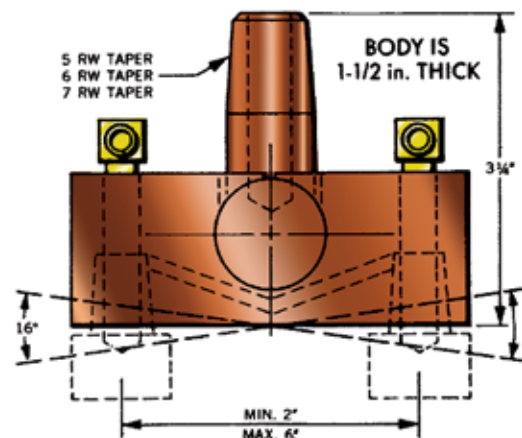


THIS EQUAL PRESSURE ADAPTOR PIVOTS TO BALANCE LOAD ON TWO ELECTRODES. IT PROVIDES UNIFORM WELD NUGGETS WHEN WELDING TWO SPOTS WITH ONE HOLDER. THE UNIT IS WATER COOLED AND CAN BE MADE TO TAKE STANDARD CAPS OR RWMA ELECTRODES.

SPACING BETWEEN ELECTRODES IS MADE TO ORDER WITHIN LIMITS ILLUSTRATED.



LIGHT DUTY

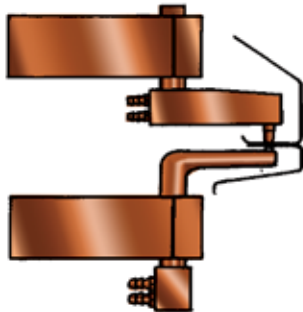


HEAVY DUTY

Style	Shank Taper	Description*	Tip Spacing Range Inches	Socket Taper		
LIGHT Duty	4RW	DA-1408	1-1/4 to 2	4RW	4CT	5CT
	4RW	DA-1416	2 to 4	4RW	4CT	5CT
	5RW	DA-1508	1-1/2 to 2	4RW	4CT	5CT
	5RW	DA-1516	2 to 4	4RW	4CT	5CT
HEAVY Duty	5RW	DA-2516	2 to 4	4RW	5RW	4CT 5CT
	5RW	DA-2524	4 to 6	4RW	5RW	4CT 5CT
	6RW	DA-2616	2 to 4	4RW	5RW	4CT 5CT
	6RW	DA-2624	2 to 6	4RW	5RW	4CT 5CT
	7RW	DA-2716	2 to 4	4RW	5RW	4CT 5CT
	7RW	DA-2724	2 to 6	4RW	5RW	4CT 5CT

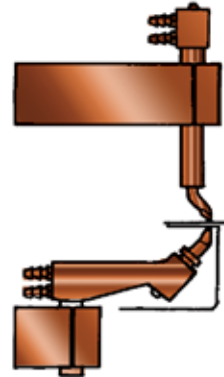
* When ordering, also state exact tip spacing and tip socket size.
Example: DA-1508 - 1-1/2 - 5CT. (5CT means 5/8" diameter cap, 4CT means 1/2" diameter cap.

**A. OFFSET WATER COOLED HOLDER
NON-EJECTOR TYPE**



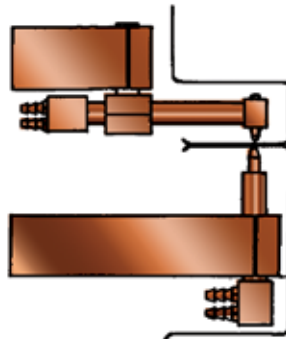
**SLIMLINE OFFSET HOLDER
FOR NARROW CHANNEL**

**B. STANDARD WATER COOLED HOLDER
EJECTOR TYPE WITH OFFSET ELECTRODE**



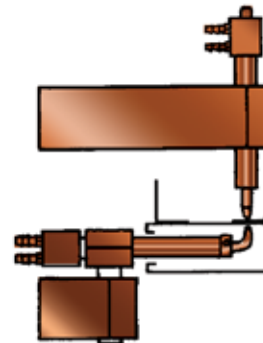
**OFFSET WATER COOLED HOLDER
EJECTOR TYPE 30° HEAD
WITH BENT ELECTRODE**

**C. UNIVERSAL WATER COOLED
HOLDER ASSEMBLY**



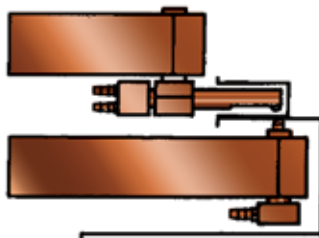
**STANDARD WATER COOLED HOLDER
NON-EJECTOR TYPE**

**D. STANDARD WATER COOLED HOLDER
EJECTOR TYPE**



**UNIVERSAL WATER COOLED
HOLDER ASSEMBLY
STRAIGHT "M" ADAPTOR
WITH RADIUS BEND ELECTRODE**

**E. SPECIAL ADAPTED HOLDER
FOR NARROW CHANNEL APPLICATION**



**SPECIAL ADAPTED HOLDER
FOR SHORTEST OVERALL LENGTH**

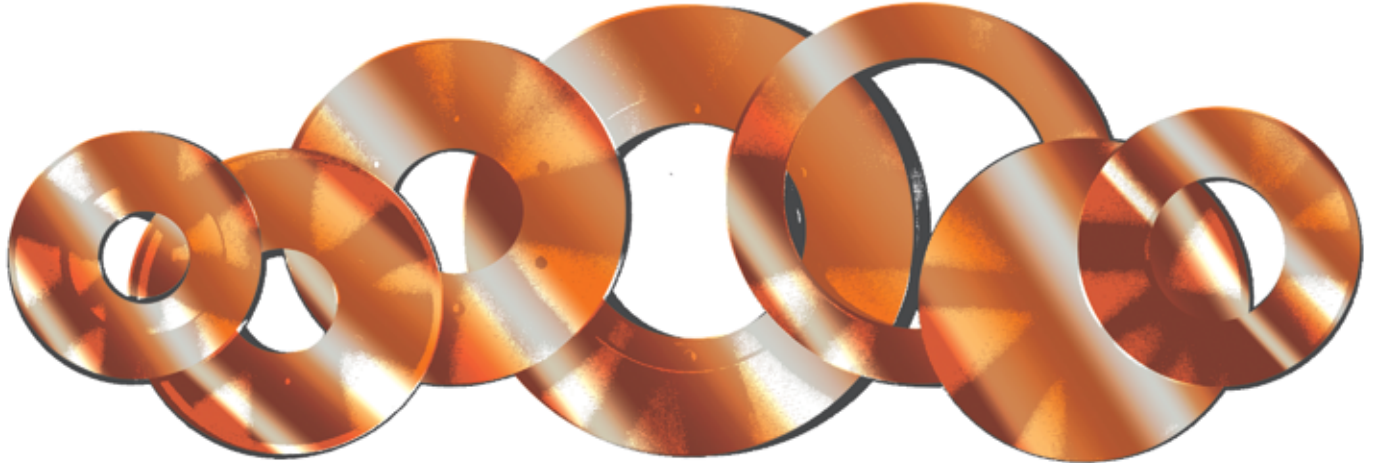
**F. WATER COOLED
DUAL ELECTRODE HOLDER,
OR ADAPTOR, EQUALIZING PRESSURE
FOR TWO WELDS**



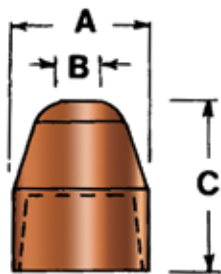


WELDING WHEELS

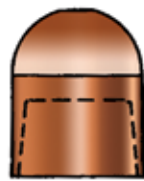
Worco Seam Welding Wheels are produced from forgings; a process that imparts the optimum properties for weld life. The wheels can be furnished as rough blanks, or finished machined to customer's specifications. They are available in RWMA Class 1, 2 or 3 alloys. For selection of alloys, consult our chart on page 3.



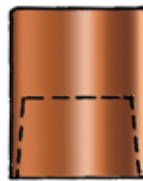
FEMALE CAPS AND ADAPTOR SHANKS



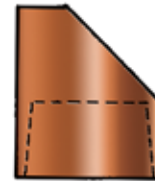
"A" NOSE



"B" NOSE



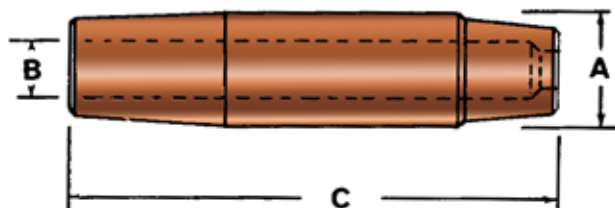
"C" NOSE



"D" NOSE

CAP NO.	A	B	C
F A 2 4	1/2	3/16	25/32
F B 2 4	1/2	3/16	25/32
F C 2 4	1/2	31/64	25/32
F D 2 4	1/2	3/16	25/32
F A 2 5	5/8	1/4	55/64
F B 2 5	5/8	3/16	55/64
F C 2 5	5/8	5/8	55/64
F D 2 5	5/8	1/4	55/64
F A 2 6	3/4	9/32	1
F B 2 6	3/4	1/4	1
F C 2 6	3/4	3/4	1
F D 2 6	3/4	9/32	1

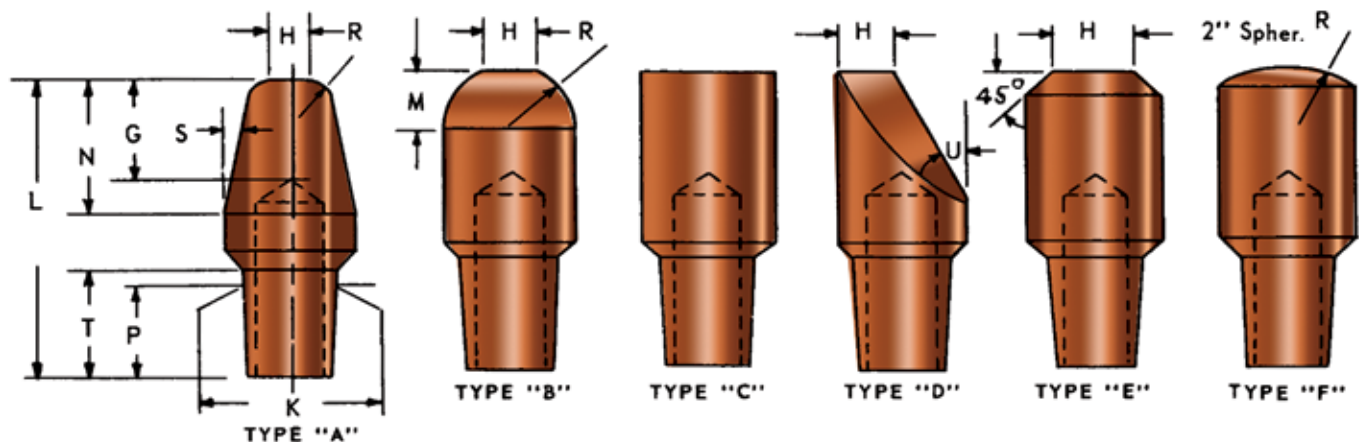
CODE
 CAP DIAMETER IN 1/8"
 CLASS MATERIAL
 NOSE SHAPE
 CAP DESIGNATION



SHANK No.	A	B
S 2 4 08 TO S 2416	1/2	9/32"
S 2 5 08 TO S 2517	5/8	5/16"
S 2 6 08 TO S 2620	3/4	3/8"

CODE
 8/4 OR 2" LONG
 6/8 OR 3/4 DIAMETER
 CLASS 2 MATERIAL
 SHANK DESIGNATION

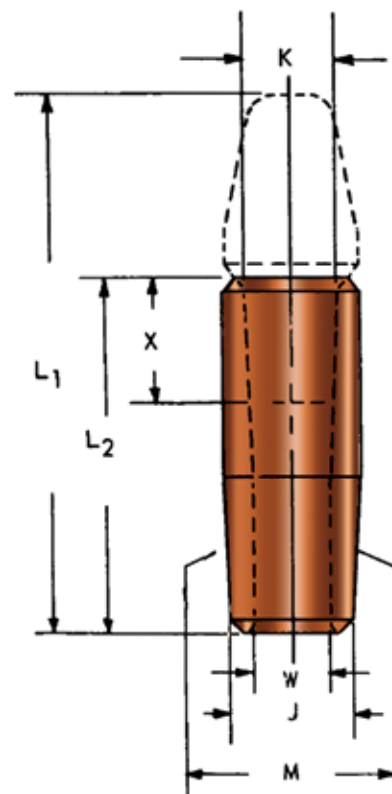
MALE CAPS AND ADAPTOR SHANKS



CAP ELECTRODES

CAP NO.	MAJ. DIA.	L ±.010	N	M	T	G ±1/32	P	K +.000 -.001	DRILL ±.010	H ±1/64	S	U	R
A, B, C, D, E, or F24	.482	1-1/8	3/8	1/4	3/8	1/2	.285	.375	9/32	3/16	18°15'	30°	.15
A, B, C, D, E, or F25	.625	1-1/4	1/2	3/8	1/2	9/16	.390	.415	5/16	1/4	15°30'	30°	.21
A, B, C, D, E, or F26	.750	1-5/8	3/4	3/8	5/8	5/8	.500	.501	3/8	9/32	13°30'	45°	.25
A, B, C, D, E, or F27	.875	1-5/8	3/4	3/8	5/8	11/16	.500	.613	1/2	5/16	15°	45°	.31

FEMALE ADAPTOR SHANKS



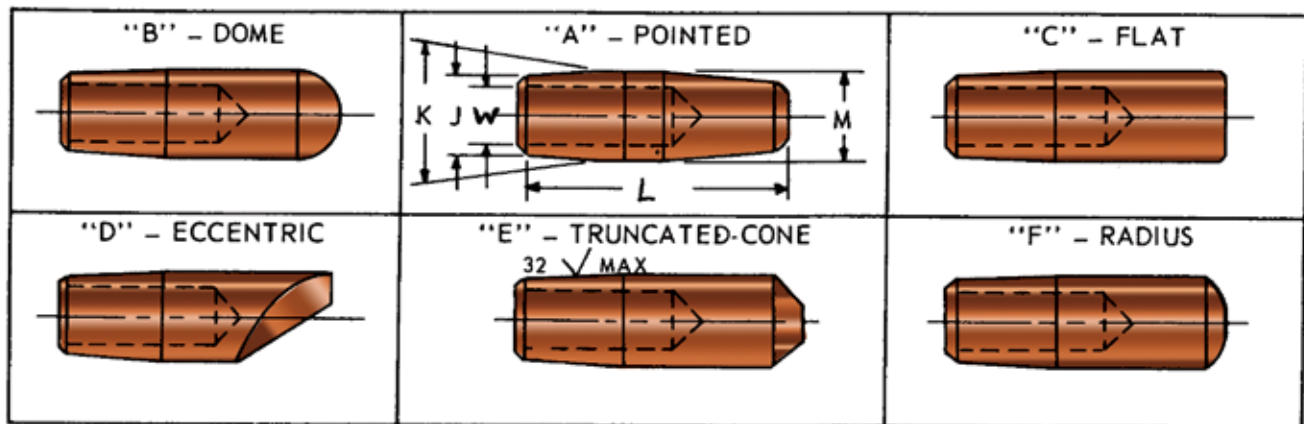
SHANK NUMBER	L ₁	L ₂	MAJ. DIA.	RWMA Taper	K +.000 -.001	X MIN.	W ±.010	J MINOR Taper Dia.	M DIA. AT 1/2"
G2405	2	1-1/4	.482	4	.374	13/32	9/32	.438±.001	.463±.001
G2406	2-1/4	1-1/2							
G2407	2-1/2	1-3/4							
G2408	2-3/4	2							
G2409	3	2-1/4							
G2410	3-1/4	2-1/2							
G2411	3-1/2	2-3/4							
G2412	3-3/4	3							
G2413	4	3-1/4							
G2414	4-1/4	3-1/2							
G2415	4-1/2	3-3/4	.625	5	.414	17/32	3/8	.588±.001	.613±.001
G2416	4-3/4	4							
G2505	2	1-1/4							
G2506	2-1/4	1-1/2							
G2507	2-1/2	1-3/4							
G2508	2-3/4	2							
G2509	3	2-1/4							
G2510	3-1/4	2-1/2							
G2511	3-1/2	2-3/4							
G2512	3-3/4	3							
G2513	4	3-1/4	.750	6	.500	21/32	7/16	.706±.001	.731±.001
G2514	4-1/4	3-1/2							
G2515	4-1/2	3-3/4							
G2516	4-3/4	4							
G2608	3	2							
G2610	3-1/2	2-1/2							
G2612	4	3							
G2614	4-1/2	3-1/2							
G2616	5	4							
G2708	3	2	.875	7	.612	21/32	1/2	819±.001	.844±.001
G2712	4	3							
G2716	5	4							

1 - All chamfers .06 x 45°

2 - First digit (2) indicates RWMA Class II Alloy. For Class I or Class III substitute numbers 1 or 3. Use G for Class 20.



STRAIGHT ELECTRODES WITH TAPERED SHANKS

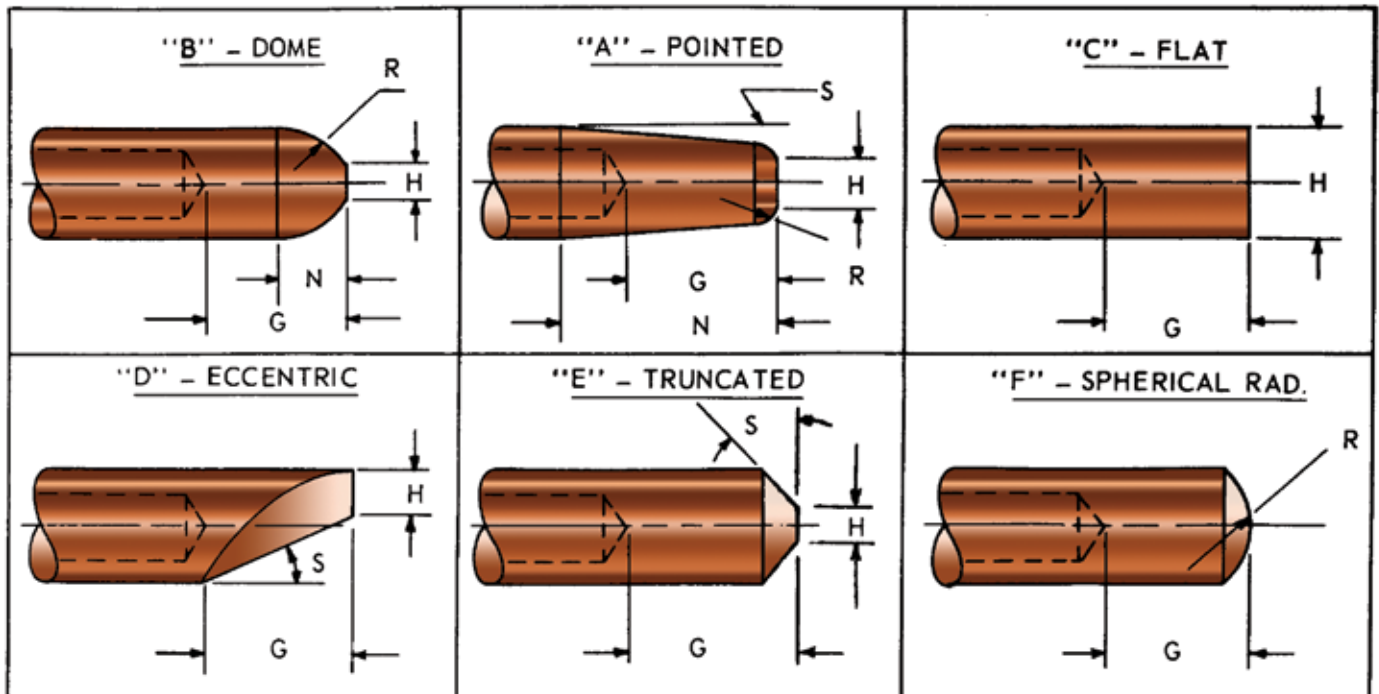


CODE LETTERS A, B, C, D, E or F, INDICATE NOSE SHAPE.
USE THE ONE APPROPRIATE LETTER IN YOUR PART NO. e.g. A2405, B2405, F2405, etc.

ELECTRODE NUMBER RWMA CLASS II ALLOY* POINTED, DOME, ETC.	L OVERALL LENGTH TOL. $\pm .010$	M MAJOR DIA.	T RWMA TAPER	W W.H. DIA.	J MINOR TAPER DIA.	K TAPER A 1/2"
A, B, C, D, E or F2405 A, B, C, D, E or F2406 A, B, C, D, E or F2407 A, B, C, D, E or F2408 A, B, C, D, E or F2409 A, B, C, D, E or F2410 A, B, C, D, E or F2411 A, B, C, D, E or F2412 A, B, C, D, E or F2413 A, B, C, D, E or F2414 A, B, C, D, E or F2415 A, B, C, D, E or F2416	1-1/4 1-1/2 1-3/4 2 2-1/4 2-1/2 2-3/4 3 3-1/4 3-1/2 3-3/4 4	.482 $\pm .002$	4	9/32 $\pm .010$.438 $\pm .001$.463 $\pm .001$
A, B, C, D, E or F2505 A, B, C, D, E or F2506 A, B, C, D, E or F2507 A, B, C, D, E or F2508 A, B, C, D, E or F2509 A, B, C, D, E or F2510 A, B, C, D, E or F2511 A, B, C, D, E or F2512 A, B, C, D, E or F2513 A, B, C, D, E or F2514 A, B, C, D, E or F2515 A, B, C, D, E or F2516	1-1/4 1-1/2 1-3/4 2 2-1/4 2-1/2 2-3/4 3 3-1/4 3-1/2 3-3/4 4	.625 $\pm .003$	5	3/8 $\pm .010$.588 $\pm .001$.613 $\pm .001$
A, B, C, D, E or F2606 A, B, C, D, E or F2608 A, B, C, D, E or F2610 A, B, C, D, E or F2612 A, B, C, D, E or F2614 A, B, C, D, E or F2616	1-1/2 2 2-1/2 3 3-1/2 4	.750 $\pm .003$	6	7/16 $\pm .010$.706 $\pm .001$.731 $\pm .001$
A, B, C, D, E or F2706 A, B, C, D, E or F2708 A, B, C, D, E or F2710 A, B, C, D, E or F2712 A, B, C, D, E or F2714 A, B, C, D, E or F2716	1-1/2 2 2-1/2 3 3-1/2 4	.875 $\pm .003$	7	1/2 $\pm .010$.819 $\pm .001$.844 $\pm .001$

*NOTE - First digit of electrode number (2) indicates RWMA Class II Alloy
For Class I substitute number 1 - Class III substitute 3

ELECTRODE NOSE CONFIGURATIONS



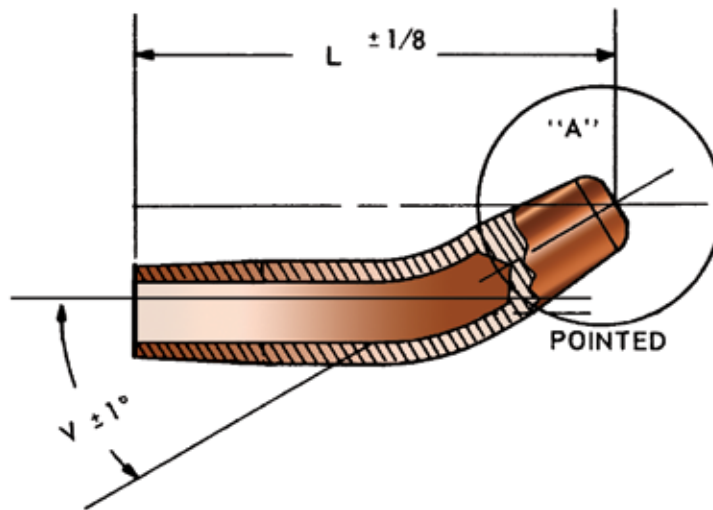
NOSE STYLE	RWMA TAPER	MAJOR DIA.	G DIST. TO FACE $\pm 1/32$	H DIA. FLAT $\pm 1/64$	N NOSE LENGTH	R RADIUS	S ANGLE $\pm 30'$
A Pointed	4	.482	1/2	3/16	3/4	.16	8°
B Dome				3/16	1/4	.16	—
C Flat				31/64	—	—	—
D Eccentric				3/16	—	—	30°*
E Truncated				3/16	—	—	45°
F Radius				—	—	2"	—
A Pointed	5	.625	3/4	1/4	7/8	.22	6°
B Dome				1/4	3/8	.22	—
C Flat				5/8	—	—	—
D Eccentric				1/4	—	—	30°*
E Truncated				1/4	—	—	45°
F Radius				—	—	2"	—
A Pointed	6	.750	3/4	9/32	1"	.28	6°
B Dome				9/32	3/8	.28	—
C Flat				3/4	—	—	—
D Eccentric				9/32	—	—	30°
E Truncated				9/32	—	—	45°
F Radius				—	—	2"	—
A Pointed	7	.875	3/4	5/16	1-1/8	.34	6°
B Dome				5/16	3/8	.34	—
C Flat				7/8	—	—	—
D Eccentric				5/16	—	—	30°
E Truncated				5/16	—	—	45°
F Radius				—	—	2"	—

*Use 40° for electrodes under 1-1/2" long



STANDARD SINGLE BEND ELECTRODES

COLD FORMED FROM STANDARD STRAIGHT ELECTRODES
STANDARD RWMA TAPERED SHANK



CODE

First two digits before letter indicates Angle V

Letter indicates nose style (A, B, C, etc.)

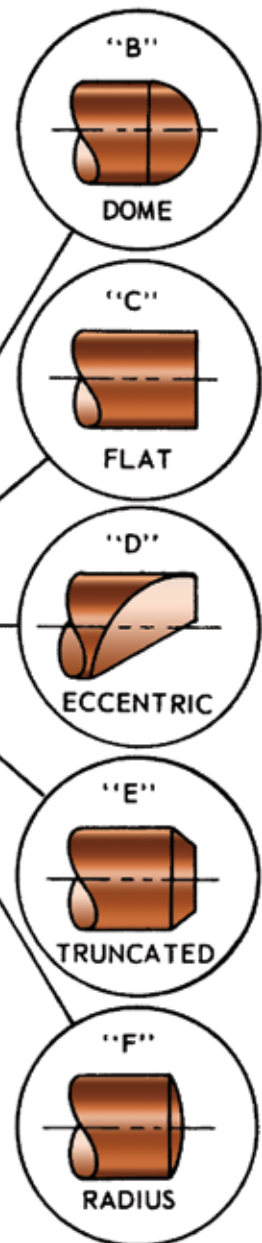
1st digit following letter indicates Alloy Class 2 only

2nd digit following letter indicates RWMA Taper (4, or 5)

3rd and 4th digits following letter $\times 1/4$ = overall length (L) after forming
to nearest $1/4$ "

2 digits following Dash $\times 1/16$ = Offset distance (O)

Single Bends supplied without tube

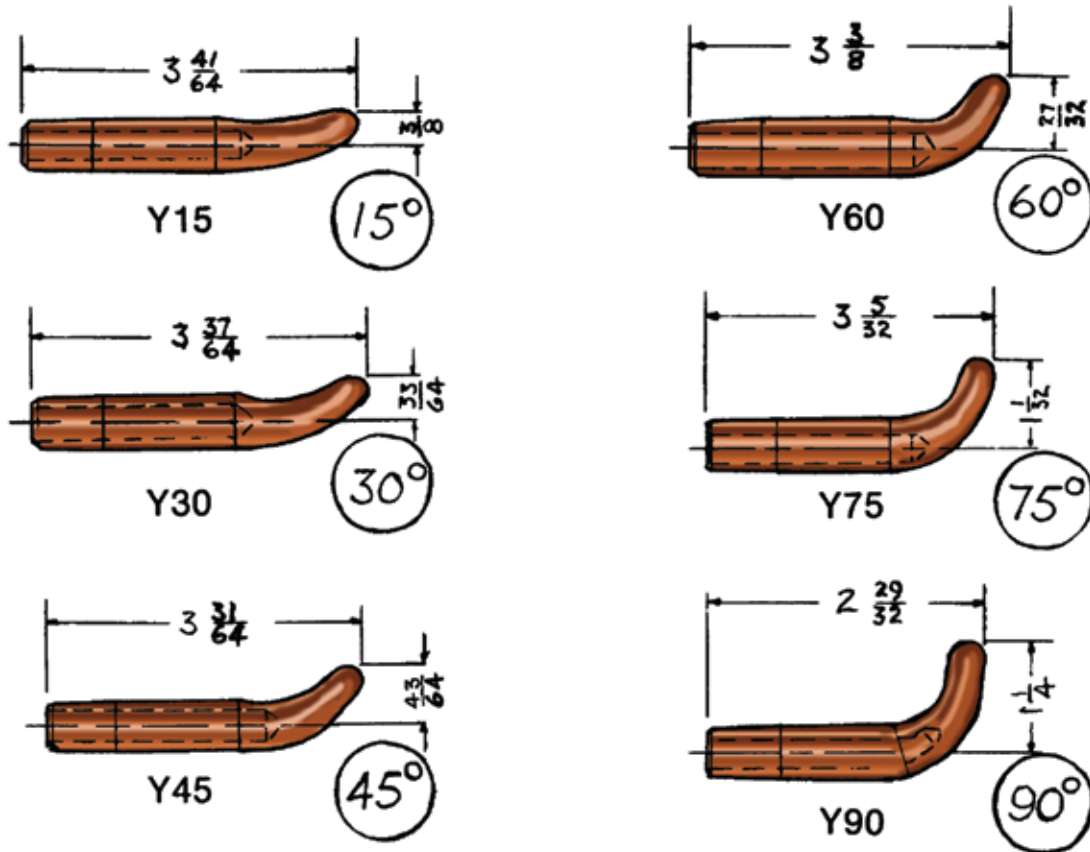


EXAMPLES

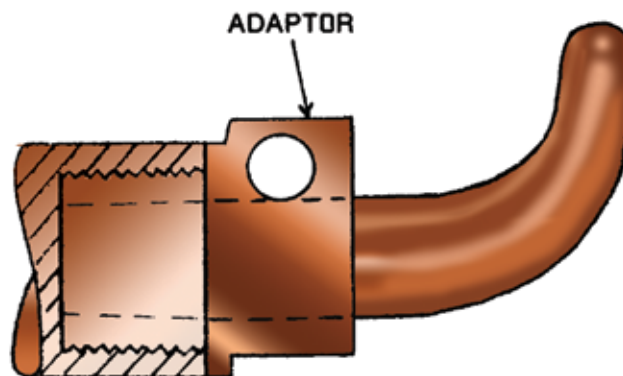
ELECTRODE NUMBER	ANGLE V	NOSE STYLE	RWMA TAPER	L O.A.L.	O OFFSET	T WATER TUBE DIA.
15B2410-07	15°	B Dome	4	2-1/2	7/16	.182
25C2511-08	25°	C Flat	5	2-3/4	1/2	.245
30D2512-10	30°	D Eccentric	5	3	5/8	.245
45F2513-12	45°	F Radius	5	3-1/4	3/4	.245



RADIUS BEND ELECTRODES



#5 TAPER ONLY

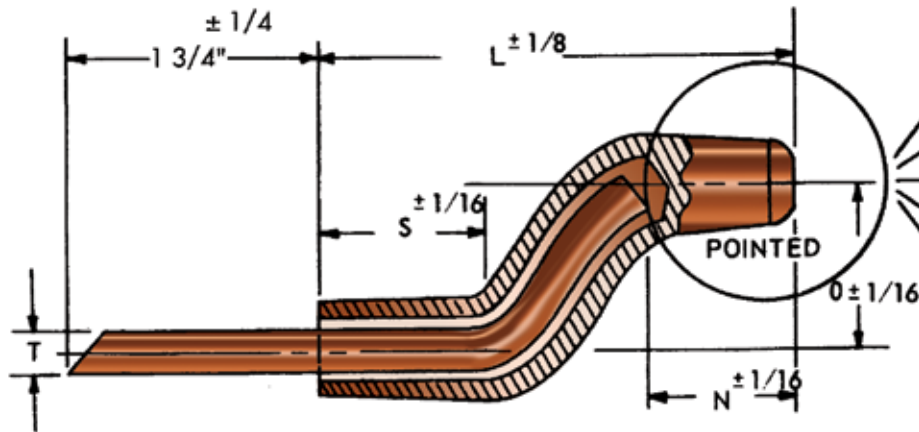


Radius Bend Electrodes are cold bent from 5/8 diameter RWMA Class 2 Bar Stock and are furnished with a 5/16 diameter water hole. They are used with an adapter that screws into a holder and clamps to the electrode. This arrangement affords a rigid assembly.



STANDARD DOUBLE BEND ELECTRODES

COLD FORMED FROM STANDARD STRAIGHT ELECTRODES
STANDARD RWMA TAPERED SHANK



CODE

Letter indicates nose style A, B, C, etc. (Pointed, Dome, Flat, etc.)
1st digit indicates Alloy Class 2 only
2nd digit indicates RWMA Taper (4 or 5)
3rd and 4th digits x 1/4" = overall length (L) to closest 1/4" after forming
2 digits following Dash x 1/16" = offset Distance (O)
Double bend electrodes are supplied with water tubes
If tubes are not required add N/T to part# ∞ / A2408-11N/T



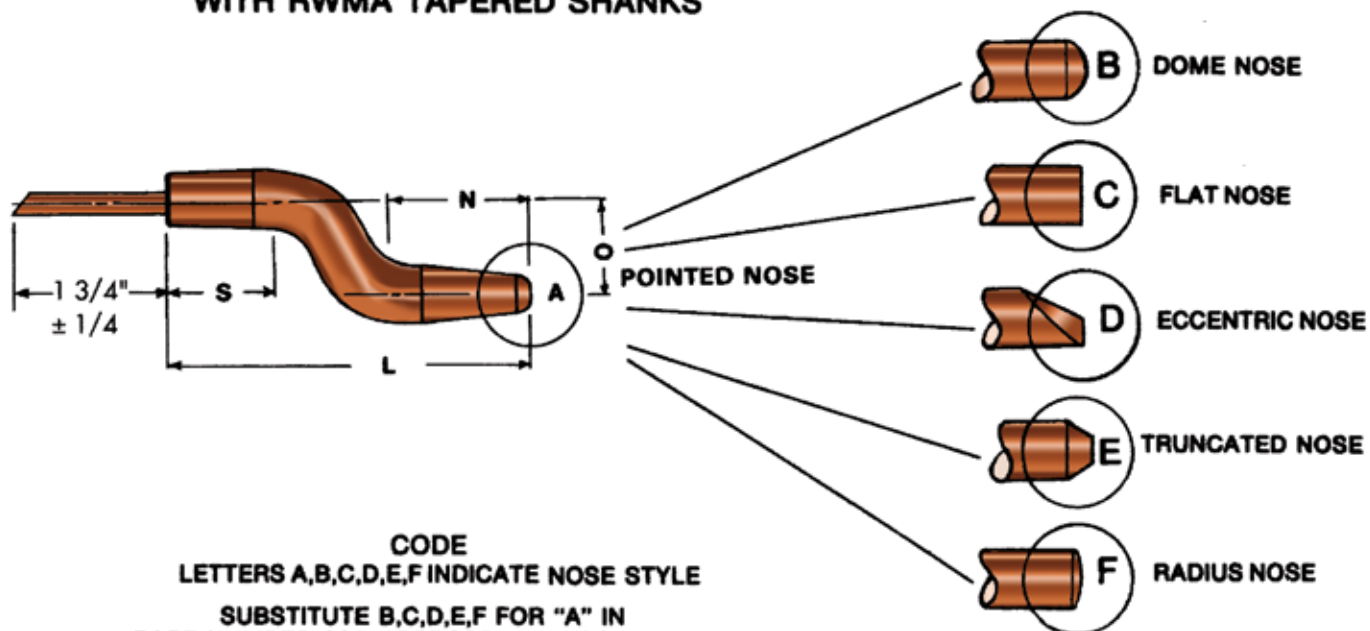
EXAMPLES

ELECTRODE NUMBER	NOSE STYLE	ALLOY CLASS	RWMA TAPER	L O.A.L.	O OFFSET	N NOSE LENGTH	S SHANK LENGTH	T WATER TUBE DIA.
B2410-09	B Dome	2	4	2-1/2	9/16	3/4	7/8	.182
C2511-12	C Flat	2	5	2-3/4	3/4	7/8	1	.245
D2512-16	D Eccentric	2	5	3	1	7/8	1-1/8	.245
F2513-20	F Radius	2	5	3-1/4	1-1/4	7/8	1-5/16	.245



SPECIAL DOUBLE BEND ELECTRODES

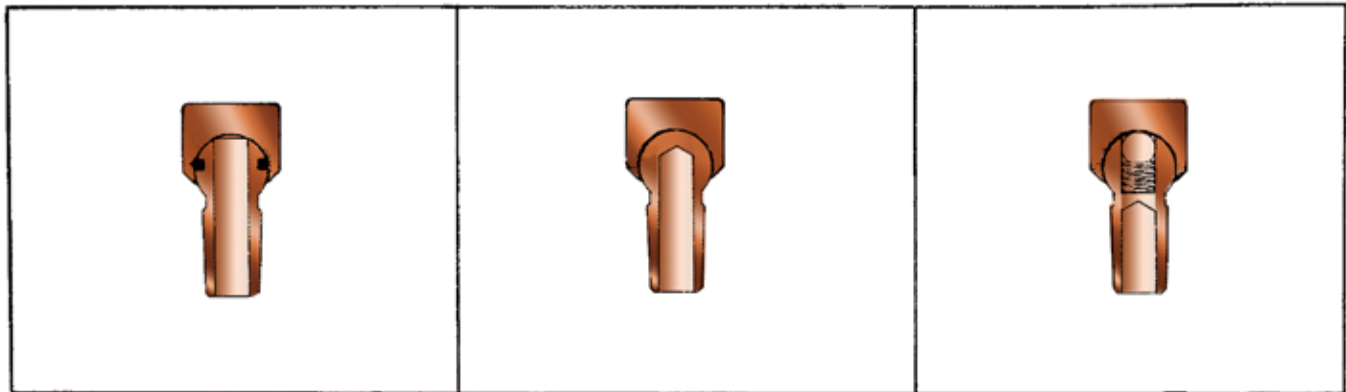
COLD FORMED FROM STANDARD STRAIGHT ELECTRODES
WITH RWMA TAPERED SHANKS



CODE
LETTERS A,B,C,D,E,F INDICATE NOSE STYLE
SUBSTITUTE B,C,D,E,F FOR "A" IN
PART NUMBER FOR APPROPRIATE NOSE STYLE

RWMA TAPER	MAJOR DIAMETER	CLASS 2 PART NO.	O	L	N	S
4	.482	XA2500	$\frac{1}{4}$	1-39/64	$\frac{3}{4}$	$\frac{3}{4}$
		XA2501		2-55/64	$\frac{3}{4}$	2
		XA2502		3-55/64	3	$\frac{3}{4}$
		XA2503	$\frac{1}{2}$	1-61/64	$\frac{3}{4}$	$\frac{3}{4}$
		XA2504		3-13/64	$\frac{3}{4}$	2
		XA2505		3-45/64	$2\frac{1}{2}$	$\frac{3}{4}$
		XA2506	$\frac{3}{4}$	$2\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
		XA2507		$3\frac{1}{2}$	$\frac{3}{4}$	2
		XA2508		$3\frac{1}{2}$	2	$\frac{3}{4}$
		XA2509	1	$2\frac{1}{2}$	$\frac{3}{4}$	1
		XA2510		$3\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{4}$
		XA2511		$3\frac{1}{2}$	1 $\frac{1}{2}$	1
		XA2512	$1\frac{1}{4}$	2-11/16	$\frac{3}{4}$	1
		XA2513		3-3/16	$\frac{3}{4}$	$1\frac{1}{2}$
		XA2514		3-3/16	1 $\frac{1}{2}$	1
5	.625	XA2515	$\frac{1}{4}$	2-9/64	1	1
		XA2516		3-9/64	$1\frac{1}{4}$	2
		XA2517		4-9/64	3	$1\frac{1}{4}$
		XA2518	$\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{1}{4}$	1
		XA2519		$3\frac{1}{4}$	$1\frac{1}{4}$	2
		XA2520		4	$2\frac{1}{2}$	1
		XA2521	$\frac{3}{4}$	2-13/16	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2522		3-13/16	$1\frac{1}{4}$	2
		XA2523		3-13/16	$2\frac{1}{4}$	$1\frac{1}{4}$
		XA2524	1	$3\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2525		$3\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2526		$3\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2527	$1\frac{1}{4}$	3-3/16	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2528		3-7/16	$1\frac{1}{4}$	$1\frac{1}{4}$
		XA2529		3-7/16	$1\frac{1}{2}$	$1\frac{1}{4}$

SWIVEL ELECTRODES



"O" RING TYPE

"PO" SERIES

PO74
PO75
PO84
PO85
PO104
PO105



RWMA TAPER

EG 10 x 1/4 = 1 1/4 DIA. OF PAD.

SERIES

BLIND TYPE

"P" SERIES

P74
P75
P84
P85
P104
P105
P55CT

SPRING TYPE

"PS" SERIES

PS74
PS75
PS84
PS85
PS104
PS105

(ALL ELECTRODES ARE 2" LONG)

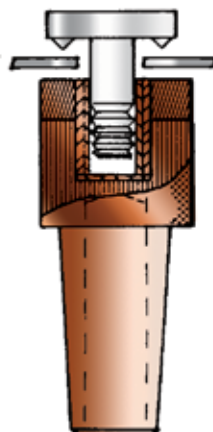
SPECIAL SWIVELS MADE TO ORDER (ie: male cap taper, female cap taper, etc.)

STUD AND NUT WELDING ELECTRODES

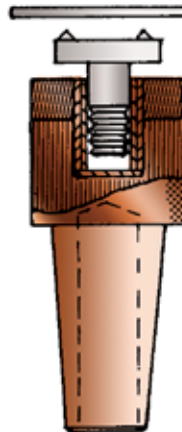
(MADE TO SPECIFIC REQUIREMENT)

- 1) WELDING A STUD THROUGH A HOLE IN SHEET METAL
- 2) WELDING A STUD DIRECTLY TO FACE OF SHEET METAL
- 3) WELDING A NUT TO SHEET METAL WITH AN ALIGNING ELECTRODE

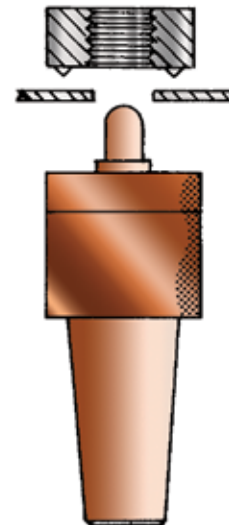
THESE ELECTRODES CAN BE MADE TO FIT ANY RWMA TAPER OR SPECIAL MOUNTING ARRANGEMENT TO SUIT CUSTOMERS APPLICATION.



1



2

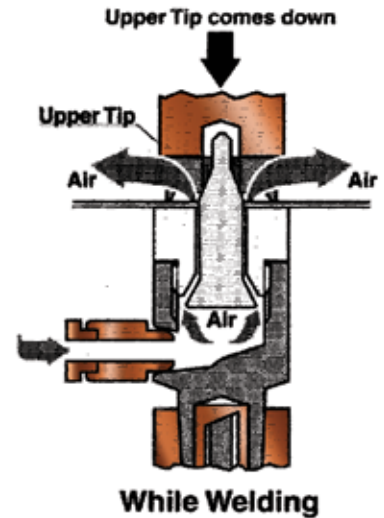
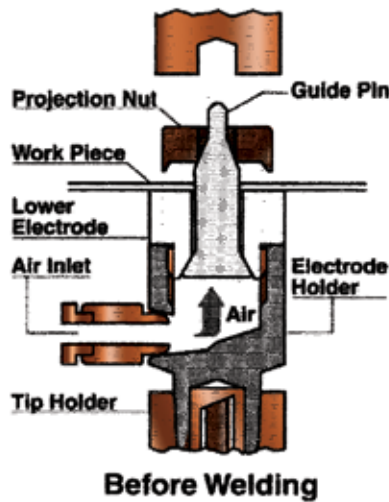


3

PROJECTION WELDING GUIDE PINS

Mechanism of Projection Welding Pins

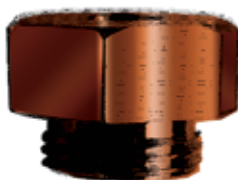
The air cooling system can increase the life of the electrode and pin.



Standard Type Guide Pin

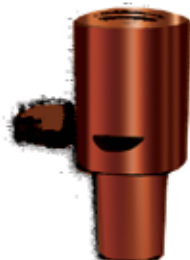
Model	Nut (mm)	ϕd (mm)	ϕA (mm)
WTP-M04	M4	4.8	12
WTP-M05	M5	5.8	12
WTP-M06	M6	6.8	12
WTP-M07	M8	7.8	12
WTP-M08	M8	8.8	12
WTP-M09	M8	9.8	12
WTP-M10	M10	10.8	16
WTP-M11	M10	11.8	16
WTP-M12	M12	12.8	16
WTP-M13	M12	13.8	16

Lower Electrode Class 2 is standard, other materials available upon request



Model	Nut (mm)	I/D	O/D	THREAD (mm)
WCN-M04	M4	5.0	25	M18:P=1.5
WCN-M05	M5	6.0	25	M18:P=1.5
WCN-M06	M6	7.0	25	M18:P=1.5
WCN-M07	M8	8.0	25	M18:P=1.5
WCN-M08	M8	9.0	25	M18:P=1.5
WCN-M09	M8	10.0	25	M18:P=1.5
WCN-M10	M10	11.0	30	M22:P=1.5
WCN-M11	M10	12.0	30	M22:P=1.5
WCN-M12	M12	13.0	30	M22:P=1.5
WCN-M13	M12	14.0	30	M22:P=1.5

Electrode Holder Class 2 is standard, other materials available upon request



Model	Taper	O/D	THREAD (mm)
WN H-A4	MT#1	25	M18:P=1.5
WN H-A5	MT#2	25	M18:P=1.5
WN H-B5	MT#2	30	M22:P=1.5



STUD & WELD NUT HEADS

Standard Weld Nut Pins

Nose Styles

Information required to order a standard weld nut pin:

Series _____ (Select series 2, 3 or 4)
 Nose _____ (Select nose style A, B, C or D)
 E _____ " (Stamping hole dia. minus .005")
 F _____ " (Nut hole dia. minus .005")
 G _____ " (Stamping thickness)
 H _____ " (Nut thickness, including projections)



NOSE A



NOSE B

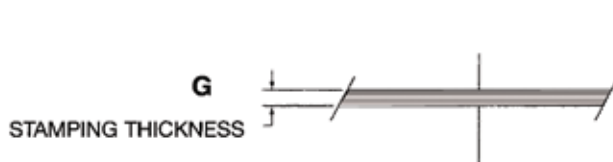
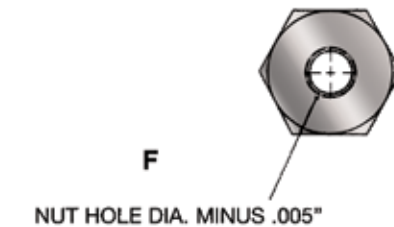
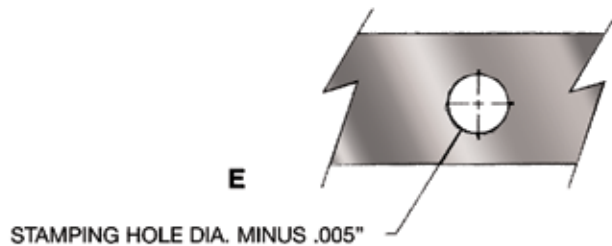


NOSE C



NOSE D

Application Sizes



NOTE: NUT THICKNESS INCLUDES PROJECTIONS

Standard Weld Nut Heads

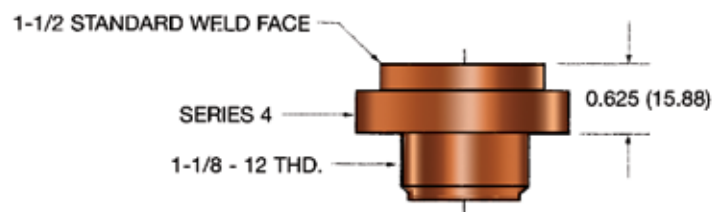
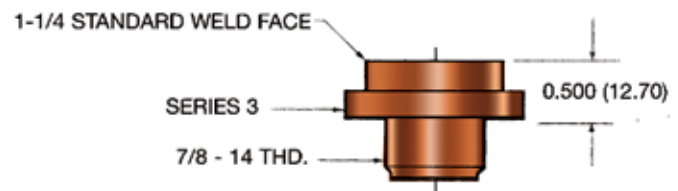
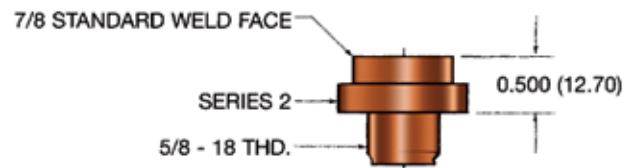
Information required to order heads for stud welding applications:

Stud Diameter or Thread Size _____
 Required Weld Face Diameter _____
 Series # _____

NOTE

Series Number	Max. Hole in Stamping*
2 (200 Series)	0.377 (9.58) ID
3 (300 Series)	0.627 (15.93) ID
4 (400 Series)	0.752 (19.10) ID

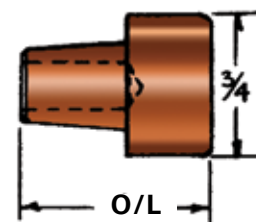
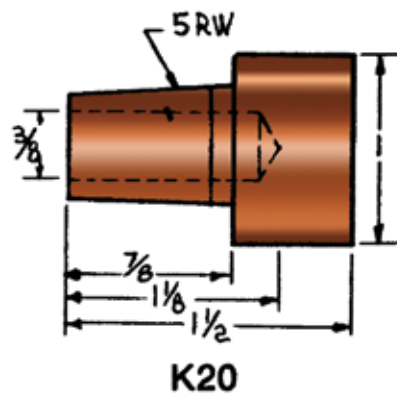
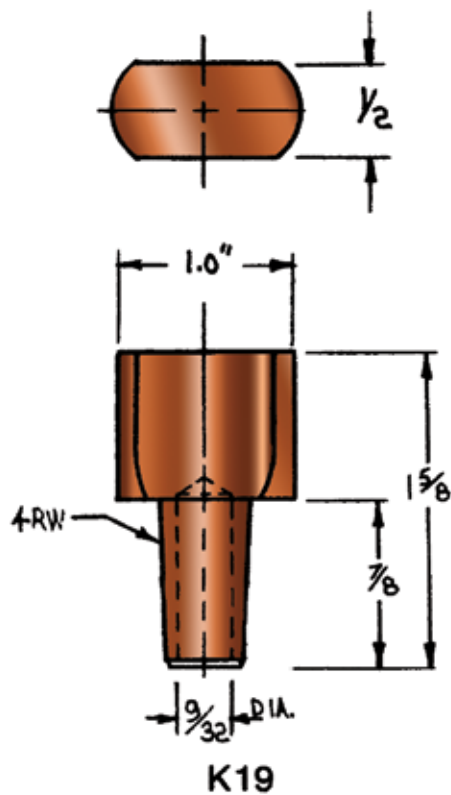
* Special weld nut electrodes are available for larger IDs and areas with clearance restrictions.



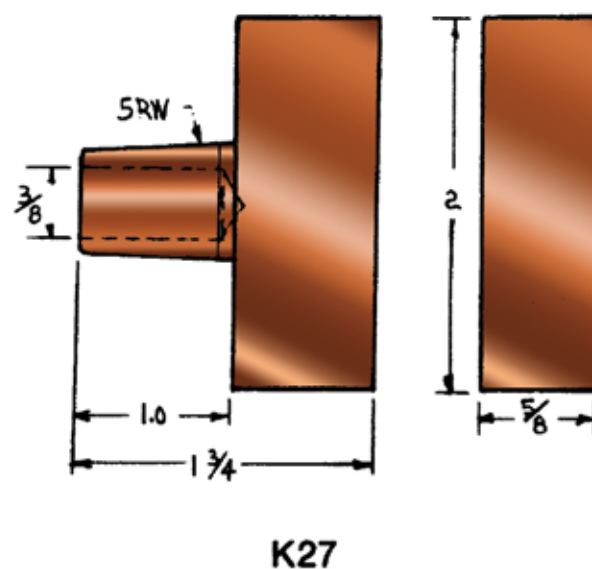
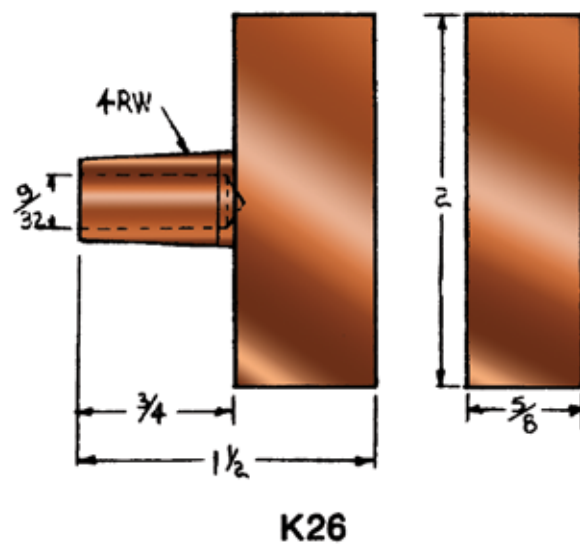
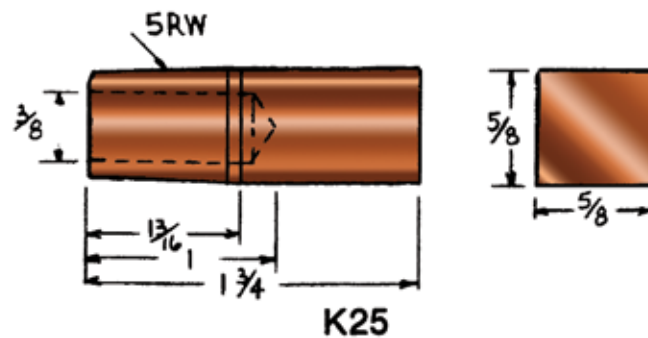
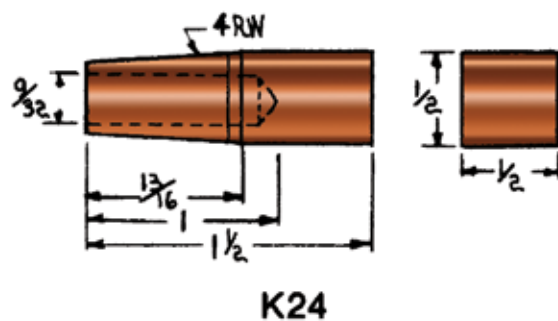
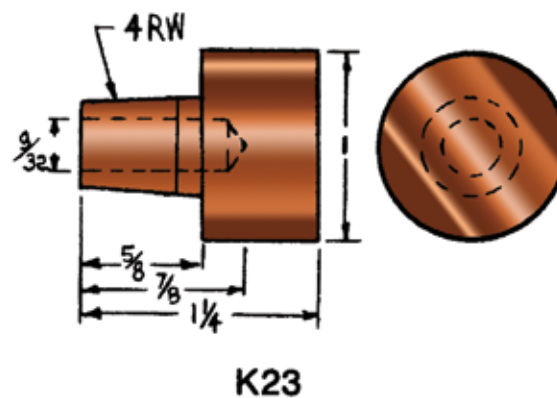


IRREGULAR ELECTRODES

FULL SIZE



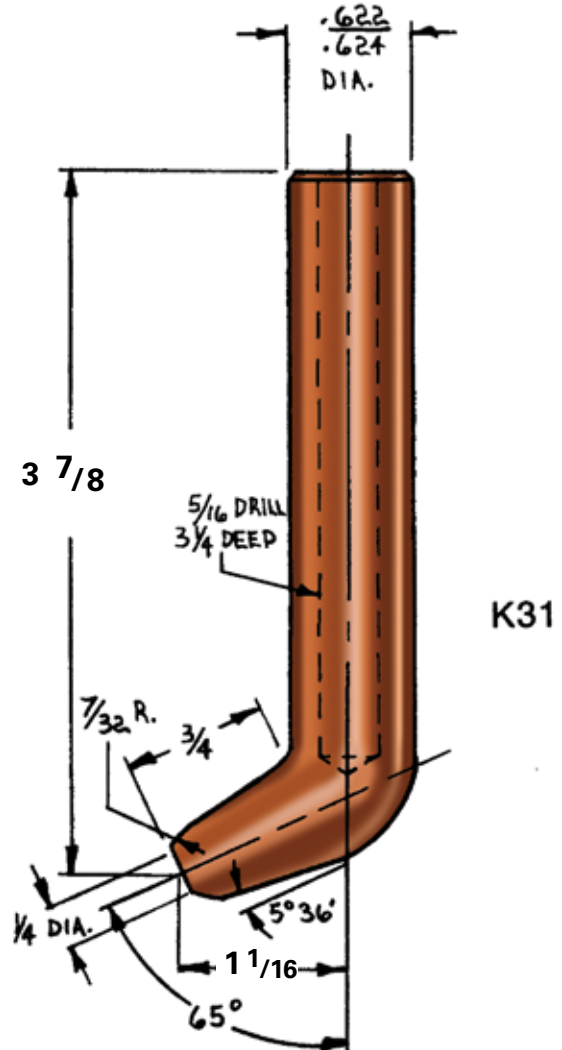
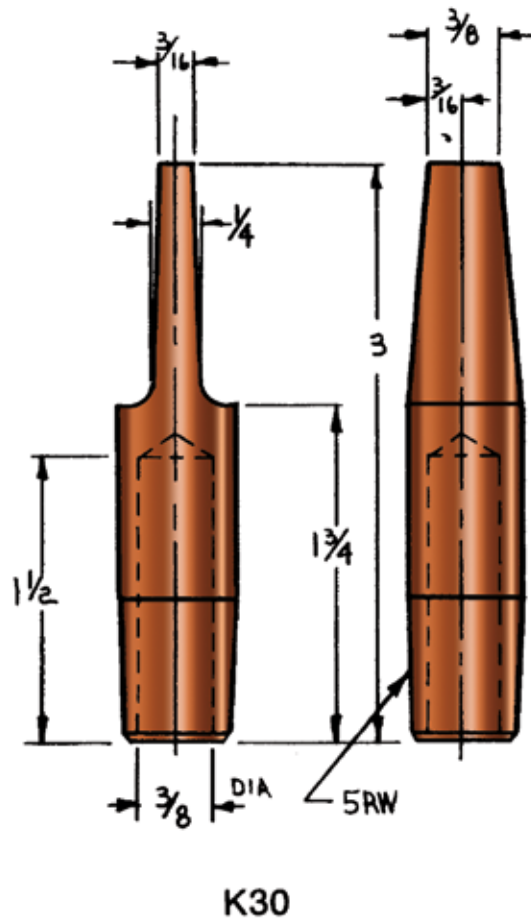
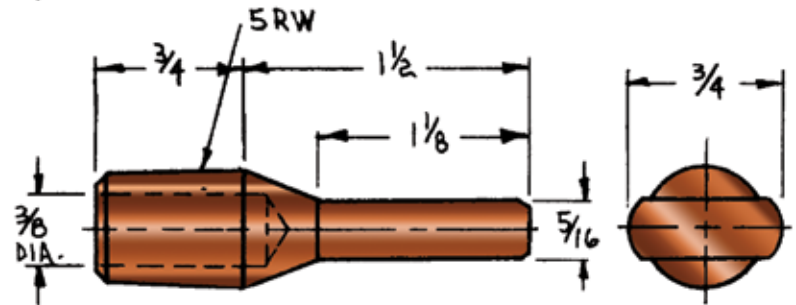
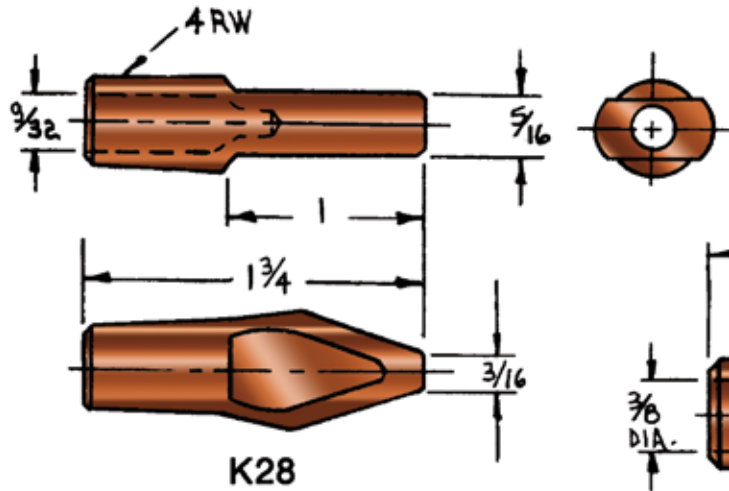
K21-4RW 1-1/4 O/L
K22-5RW 1-1/2 O/L

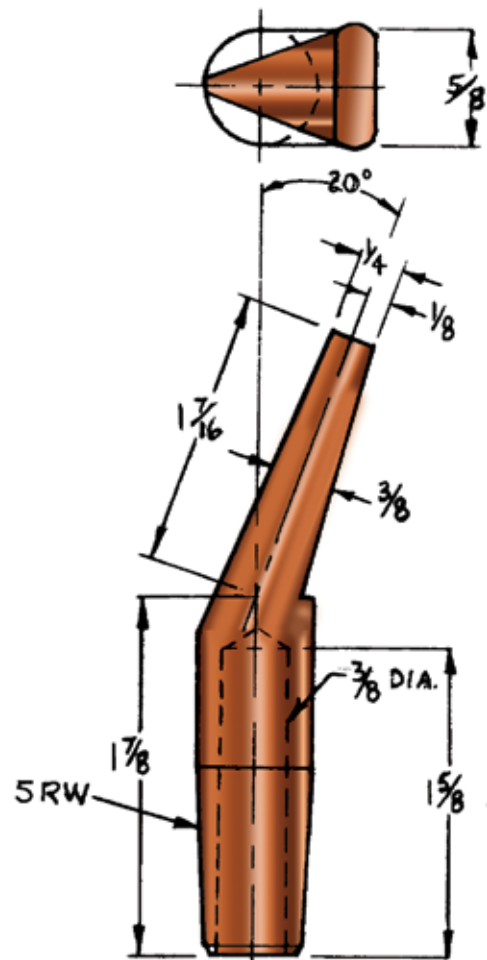
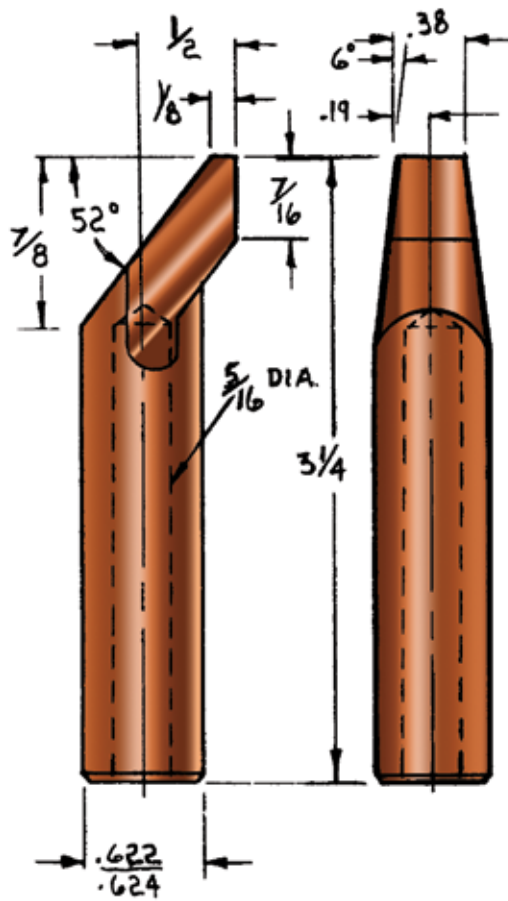
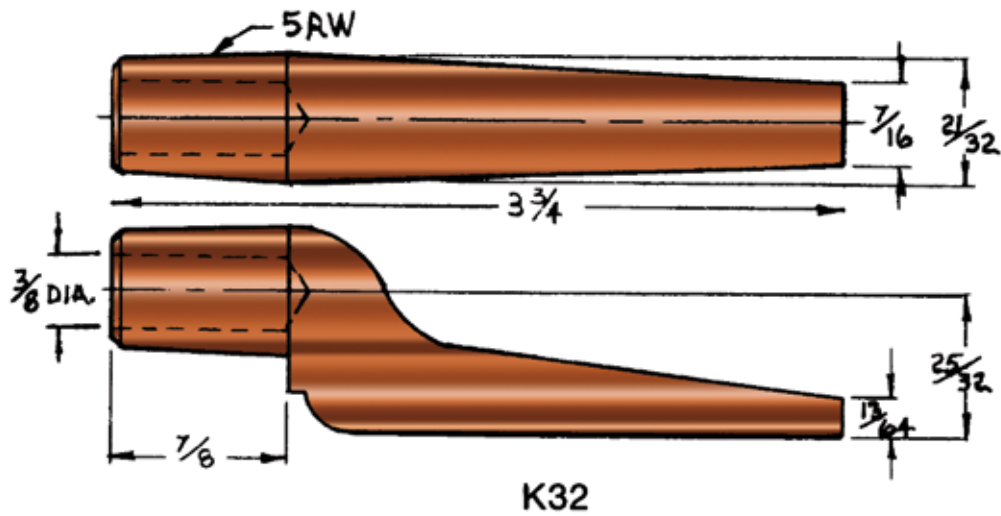


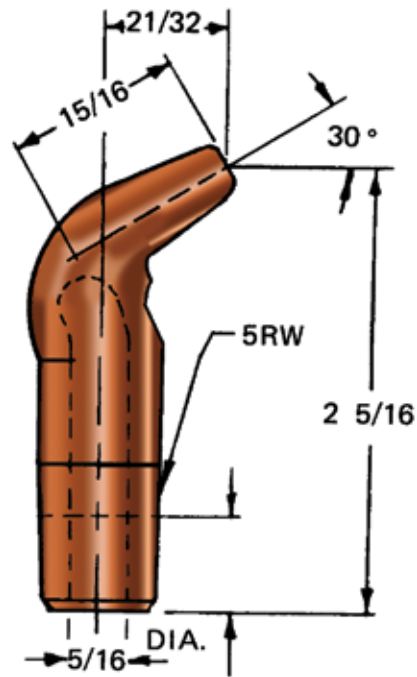


IRREGULAR ELECTRODES

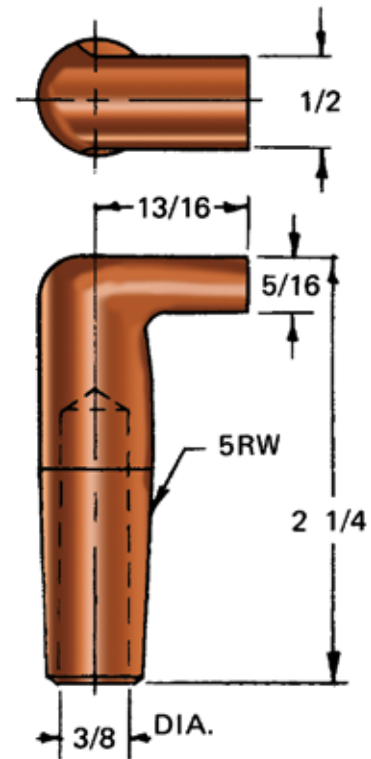
FULL SIZE



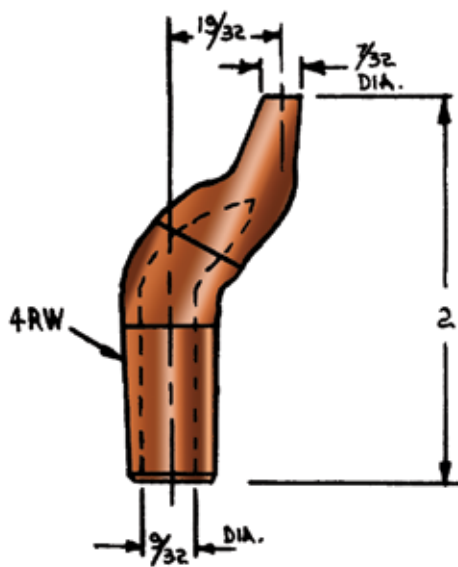




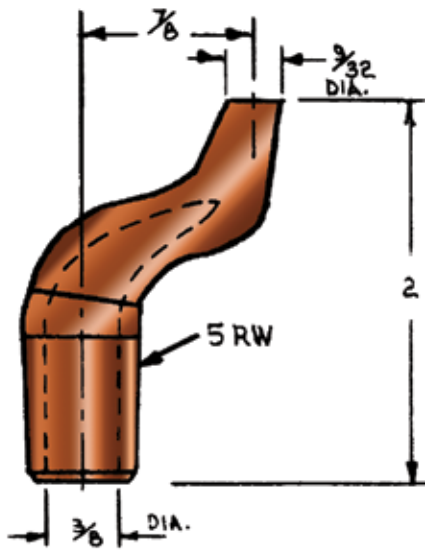
K35



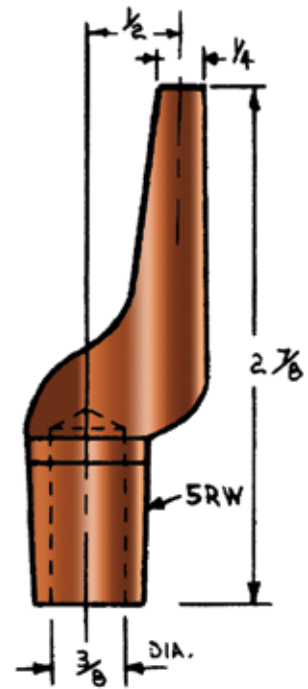
K37



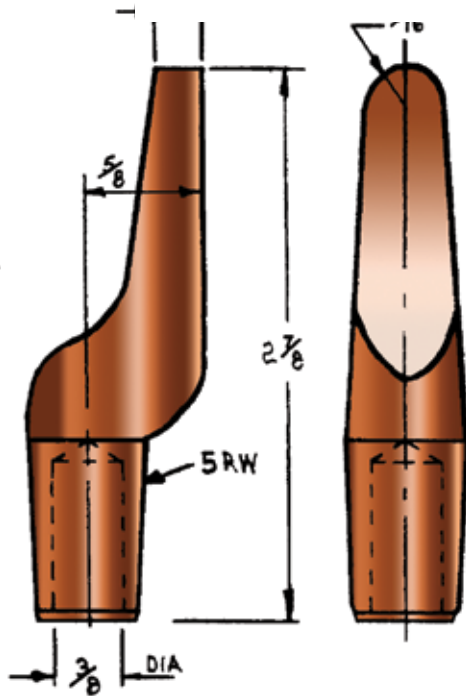
K39



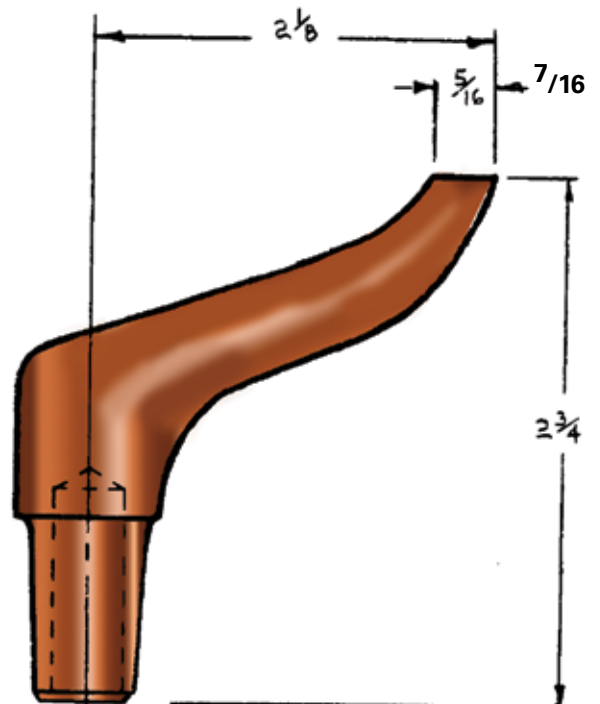
K40



K41



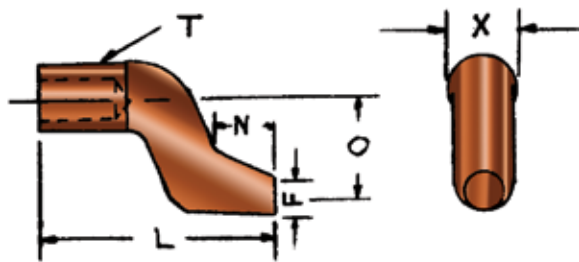
K42



K43-4RW
K44-5RW

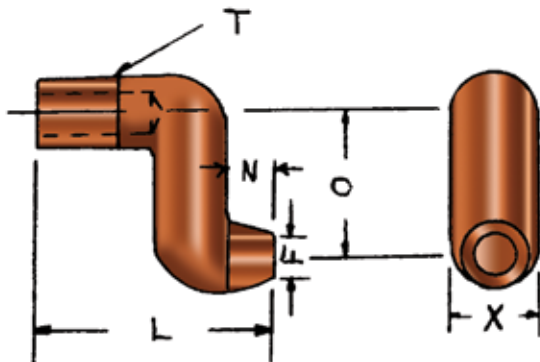


IRREGULAR WELDING ELECTRODES



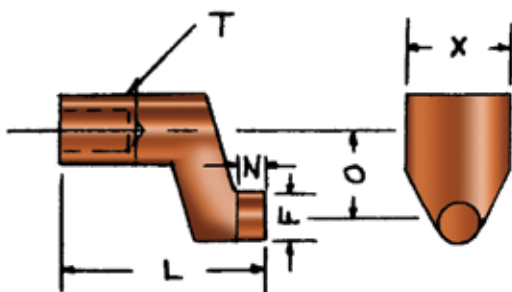
Offset Electrodes with Tapered Shanks

Part No.	L Overall Length	T Taper	N Nose Length	O Offset	F Welding Face Dia.
K45	2	No. 4	$\frac{3}{8}$	$1\frac{1}{32}$	$\frac{1}{4}$
K46		No. 5	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{5}{16}$
K47	$2\frac{3}{4}$	No. 7			$\frac{1}{2}$



$\frac{1}{4}$ " Offset Electrodes with Tapered Shanks

Part No.	L Overall Length	T Taper	N Nose Length	O Offset	X Thick-ness	F Welding Face Dia.
K48	2	No. 4	$\frac{3}{8}$	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{8}$
K49	$2\frac{3}{4}$		$\frac{3}{8}$			
K50	2	No. 5	$\frac{3}{8}$			
K51	$2\frac{3}{4}$		$\frac{3}{8}$		$\frac{3}{8}$	$\frac{1}{2}$
K52	$2\frac{3}{4}$	No. 7	$\frac{3}{8}$			
K53	$2\frac{3}{4}$		$\frac{3}{8}$			



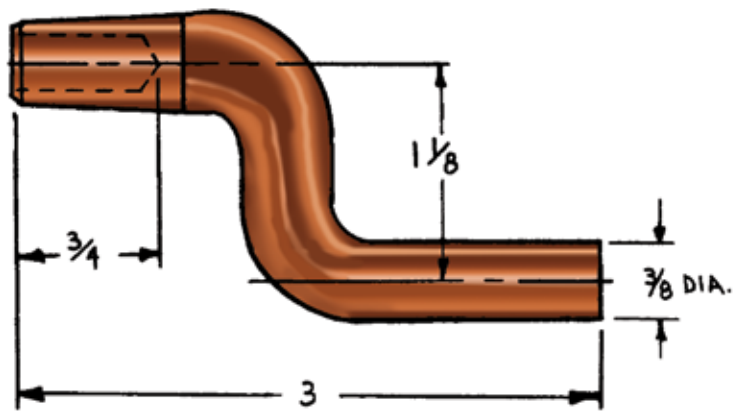
$2\frac{3}{32}$ " Offset Electrodes with Tapered Shanks

Part No.	L Overall Length	T Taper	N Nose Length	O Offset	X Thick-ness	F Welding Face Dia.
K54	$1\frac{3}{4}$	No. 4	$\frac{1}{4}$	$2\frac{5}{32}$	$\frac{3}{8}$	$\frac{7}{16}$
K56		No. 5				

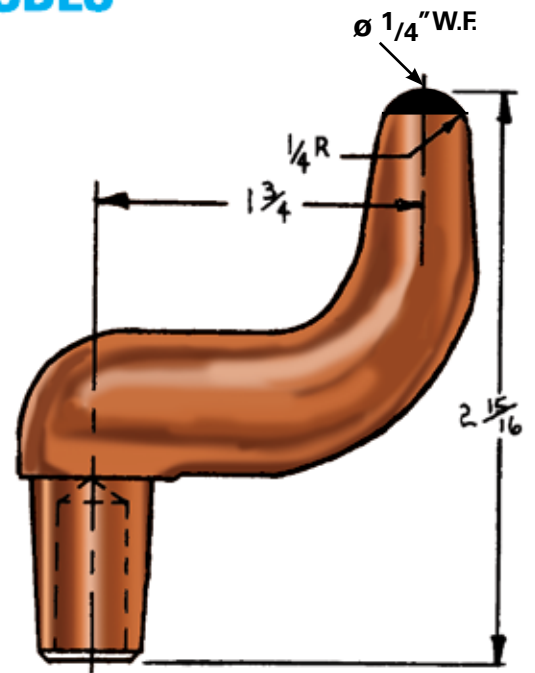


IRREGULAR ELECTRODES

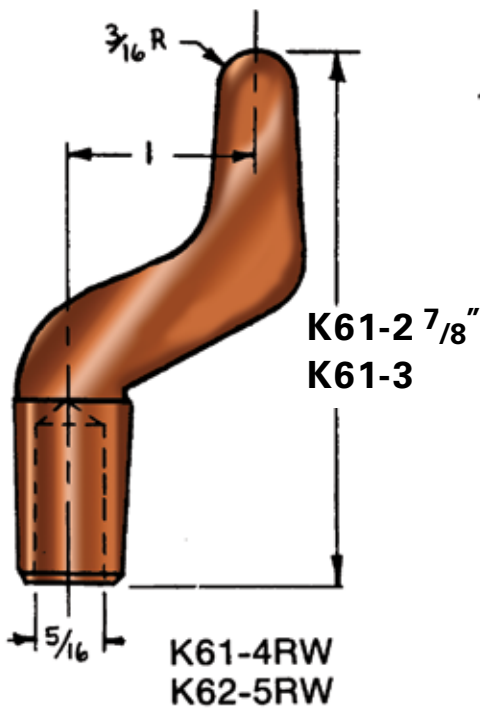
FULL SIZE



K57-4RW
K58-5RW

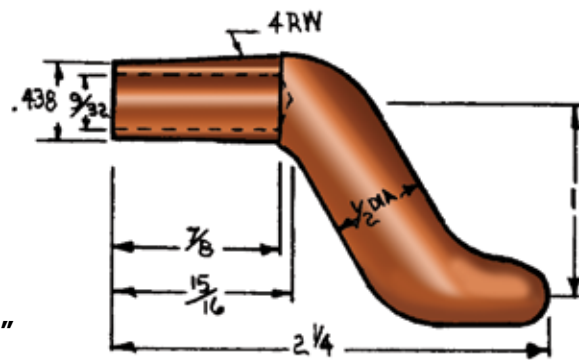


K59-4RW
K60-5RW

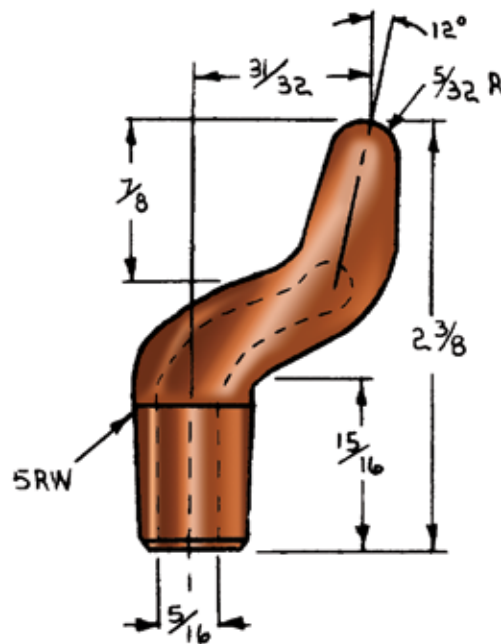


K61-2 7/8"
K61-3

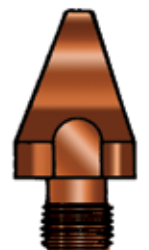
K61-4RW
K62-5RW



K63

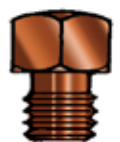


K65



3/8 - 24 THD.

K66

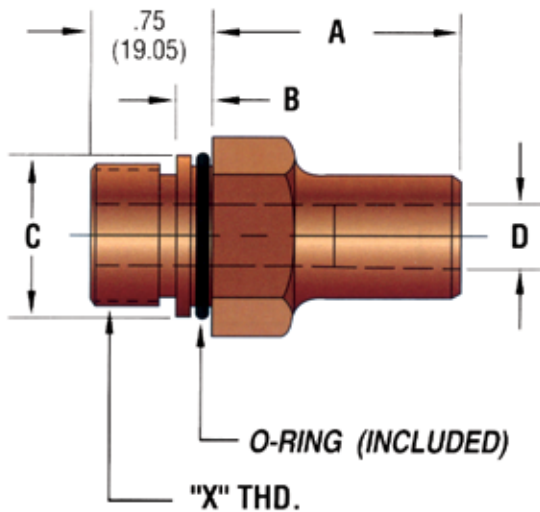


3/8 - 16 THD.

K67



HEX ADAPTORS - STRAIGHT THREAD



TAPER NO.	D	Minimum A		
		7/8-14	1-12	1-1/4-12
#4RW	0.463 (11.76)	0.25	0.25	0.25
#5RW	0.625 (15.88)	0.25	0.25	0.25
#6RW	0.750 (19.05)	1.13	0.25	0.25
#7RW	0.875 (22.35)	1.38	1.25	0.25

THREAD	"X"	B	C	HEX	O-RING
7/8-14	87	0.25 (6.35)	1 (25.40)	1-1/4	D-117
1-12	10	0.25 (6.35)	1.13 (28.58)	1-1/4	D-119
1-1/4-12	12	0.25 (6.35)	1.38 (34.93)	1-1/2	D-123

FIGURE 4-10

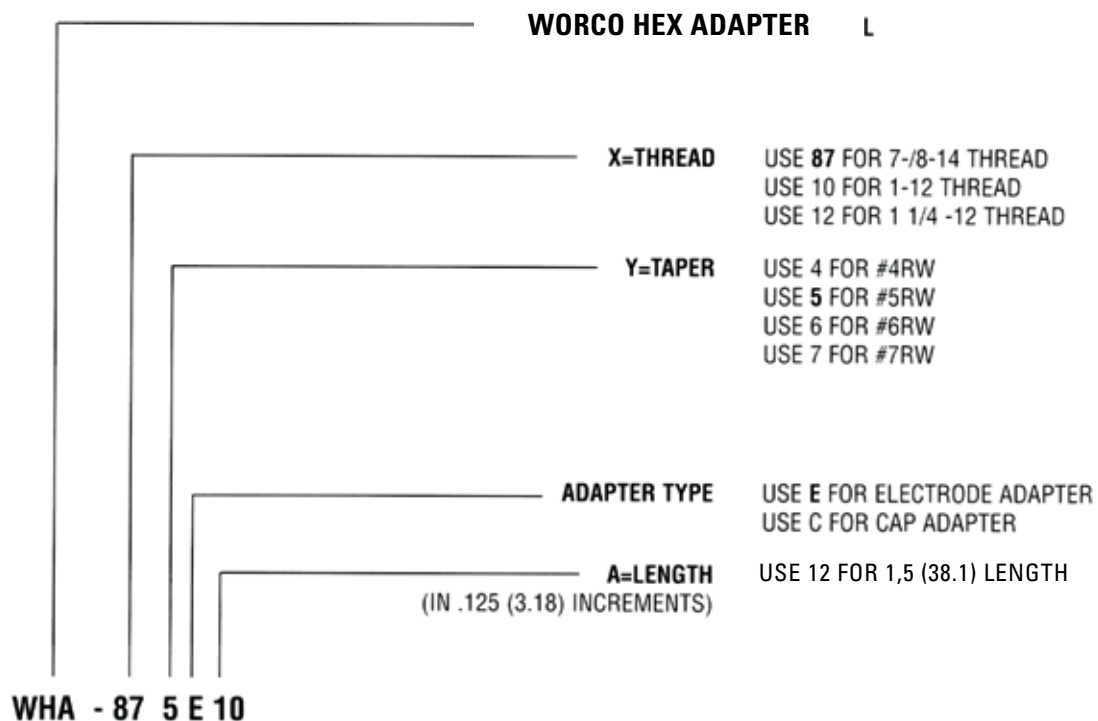
• Dimensions Shown Are: inches (mm).

EXAMPLE:

WHA - 875E12

HEX ADAPTER, 7/8-14 THD., #5 RW TAPER, ELECTRODE ADAPTER, LENGTH = 1.5 (38.10)

EXAMPLE EXPLANATION CODING





"M" ELECTRODE ADAPTORS

MALE PIPE THREAD TO FEMALE RWMA TAPER



EXTENDED LENGTH AVAILABLE

M 4 14 4
M 4 14 5
M 5 14 4
M 5 14 5
M 6 14 6

CODE

6 RWMA TAPER

THREADS PER INCH

E.G. 3/4 PIPE THREAD

ADAPTOR DESIGNATION

MALE STRAIGHT THREAD TO FEMALE RWMA TAPER



M 5 18 4
M 5 18 5
M 6 10 5
M 7 14 4
M 7 14 5
M 8 14 4
M 8 14 5
M 8 14 6

CODE

6 RWMA TAPER

THREADS PER INCH

8/8 or 1" THREAD SIZE

ADAPTOR DESIGNATION

MALE RWMA TAPER TO FEMALE RWMA TAPER



M 5 4
M 7 5

CODE

5 RWMA FEMALE TAPER

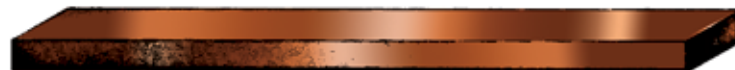
7 RWMA MALE TAPER

ADAPTOR DESIGNATION

REFRACTORY METALS

Refractory Metals are a group of metal compositions whose elements consist of Tungsten, Molybdenum, and their Carbides, combined with Copper. Combinations of these elements produce metals of high wear resistance and high strength at elevated temperatures. They also provide good thermal and electrical conductivity. They are suitable as die inserts and facings for projection, flash, and butt-welding, and some electrical contact applications: RWMA Class 11, Class 13, and Class 14 are the most common classifications in this category. For additional information on refractory metals for welding, refer to page 2.

REFRACTORY METAL BARS AND INSERTS



REFRACTORY FACED ELECTRODES ARE ILLUSTRATED BELOW



B 2408-11R



C 2408-11R



E 2408-11R

For Part No. Identification of electrodes, use page 11 and suffix the number with the appropriate class facing and the letter "R" for Refractory.

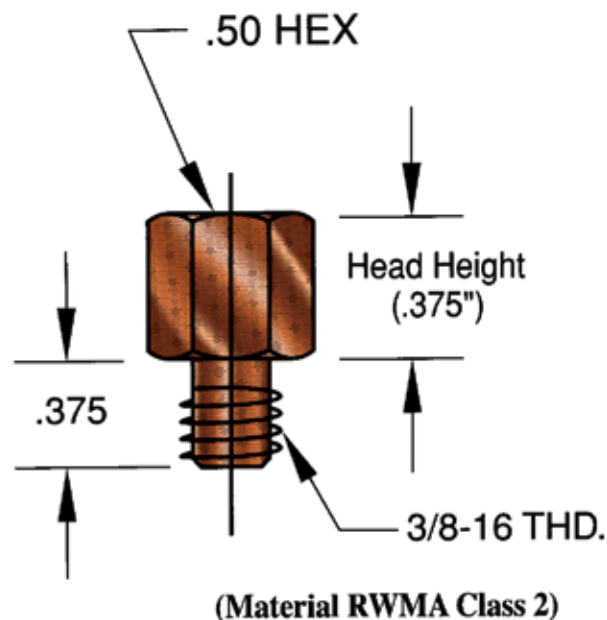


Hexagon Threaded Caps

WORCO standard hexagon threaded caps manufactured from RWMA Class 2 copper are available in 1/2" hex. with a 3/8-16 thread, and 5/8" hex. with a 7/16-14 thread. Nose configurations are A (pointed), C (flat), E (45 deg. truncated), and F (radius). Special threaded caps can be made to suit customer's exact requirements material, hex size, thread and nose configuration.

Sample part number	W	H	4	-	3	C	
							Nose Configuration
							(for A and E specify
							weld face diameter)
Hex. Size in 1/8" increments			—				
(4 = 1/2" hex.)							
							Head Height in 1/8"
							increments (3 = 3/8")

EXAMPLE — WH4-3C





BAR STOCK SIZES & WEIGHTS

Solid Rounds

Diameter	Class 2		Tolerance ± (Dia.)	Class 3		Tolerance ± (Dia.)
	lbs./in.	lbs./ft.		lbs./in.	lbs./ft.	
1/8"	.004	.05	.002			
3/16"	.009	.11	.002			
1/4"	.016	.19	.002			
5/16"	.024	.29	.002	.024	.29	.003
3/8"	.035	.42	.002	.034	.41	.003
7/16"	.048	.58	.002			
.482"	.058	.70	.002			
1/2"	.063	.76	.002	.062	.74	.003
5/8"	.079	.95	.002			
3/4"	.098	1.18	.002	.096	1.15	.004
7/8"	.142	1.70	.002	.140	1.68	.004
1"	.192	2.30	.002	.189	2.27	.004
1 1/8"	.252	3.02	.003	.248	2.98	.004
1 1/4"	.318	3.81	.004	.314	3.77	.005
1 1/2"	.393	4.72	.004	.388	4.66	.005
1 3/4"	.476	5.71	.004	.468	5.62	.005
2"	.566	6.79	.004	.559	6.71	.005
2 1/4"	.770	9.24	.004	.760	9.12	.005
2 1/2"	1.005	12.06	.004	.992	11.90	.005
2 3/4"	1.273	15.27	.004	1.257	15.08	.005
3"	1.572	18.86	.004	1.552	18.62	.005
3 1/4"	1.901	22.81	.006	1.877	22.52	.007
3 1/2"	2.262	27.14	.006	2.233	26.80	.007
3 3/4"	2.663	31.96	.006	2.623	31.48	.007
4"	3.042	36.50	.006	3.042	36.50	.006
4 1/4"	3.303	39.63	.060	3.261	39.13	.060
4 1/2"	3.774	45.29	.060	3.715	44.58	.060
4 3/4"				3.973	47.67	.060
5"	4.277	51.32	.080	4.222	50.66	.080
5 1/4"	4.811	57.73	.080	4.736	56.83	.080
5 1/2"				5.040	60.48	.080
5 3/4"	5.377	64.52	.080	5.308	63.67	.080
6"				6.519	78.23	.080

Rectangles

Size	Class 2		Thickness Tolerance ± (unless otherwise noted)		Class 3		Thickness Tolerance ± (unless otherwise noted)	
	lbs./in.	lbs./ft.	Thickness	Width	lbs./in.	lbs./ft.	Thickness	Width
1/4" x 1"	.080	.96	.006	.007	.079	.95	.007	.008
1/4" x 1 1/2"	.120	1.44	.007	.009	.118	1.42	.008	.010
1/4" x 2"	.160	1.92	.007	.009	.158	1.90	.008	.010
1/4" x 3"	.240	2.88	.007	.015	.237	2.84	.009	.015
3/8" x 3/4"	.090	1.08	.006	.007				
3/8" x 1"	.120	1.44	.006	.007				
3/8" x 1 1/4"					.180	2.16	.008	.010
1/2" x 1/2"	.080	.96	.005	.005	.079	.95	.006	.006
1/2" x 3/4"	.120	1.44	.006	.007	.118	1.42	.007	.008
1/2" x 1"	.160	1.92	.006	.007	.158	1.90	.007	.008
1/2" x 1 1/2"	.240	2.88	.007	.009	.237	2.84	.008	.010
1/2" x 2"	.320	3.84	.007	.009	.316	3.80	.008	.010
1/2" x 3"	.480	5.76	.007	.015	.474	5.69	.009	.007
5/8" x 5/8"	.125	1.50	.006	.006	.123	1.48	.007	.007
5/8" x 3/4"	.150	1.80	.006	.007				
5/8" x 1"	.200	2.40	.006	.007	.197	2.37	.007	.008
5/8" x 1 1/2"	.300	3.60	.007	.009	.296	3.55	.008	.010
5/8" x 2"					.395	4.74	.008	.010
3/4" x 3/4"	.180	2.16	.006	.006	.178	2.14	.007	.007
3/4" x 1"	.240	2.88	.006	.007	.237	2.84	.007	.008
3/4" x 1 1/2"	.360	4.32	.007	.009	.355	4.26	.008	.010
3/4" x 1 3/4"	.420	5.04	.007	.009				
3/4" x 2"	.480	5.76	.007	.009	.474	5.69	.008	.010
3/4" x 2 1/2"	.600	7.20	.008	.013	.622	7.94	.009	.013
3/4" x 3"	.720	8.64	.008	.015	.711	8.53	.009	.016
1" x 1"	.320	3.84	.006	.006	.316	3.79	.006	.006
1" x 1 1/4"	.400	4.80	.007	.009	.442	5.30	.007	.009
1" x 1 1/2"	.480	5.76	.007	.009	.474	5.69	.007	.009
1" x 2"	.640	7.68	.007	.009	.632	7.58	.007	.009
1" x 2 1/2"	.800	9.60	.008	.013				
1" x 3"	.960	11.52	.008	.015	.948	11.38	.008	.015
1 1/4" x 1 1/4"	.500	6.00	.007	.007	.494	5.92	.007	.007
1 1/4" x 1 1/2"	.600	7.20	.007	.009	.601	7.21	.007	.009
1 1/4" x 1 3/4"	.700	8.40	.007	.009				
1 1/4" x 2"	.800	9.60	.007	.009				
1 1/2" x 1 1/2"	.720	8.64	.007	.007	.711	8.53	.007	.007
1 1/2" x 2"	.960	11.52	.007	.009	.948	11.38	.007	.009
1 1/2" x 3"	1.440	17.28	.009	.015	1.422	17.06	.008	.015
1 3/4" x 2"	1.120	13.44	.007	.009	1.100	13.20	.007	.009
1 3/4" x 3"					1.659	19.91		
2" x 2"	1.280	15.36	.009	.009	1.264	15.17	.009	.009
2" x 3"					1.896	22.75		

Hexagon Rod

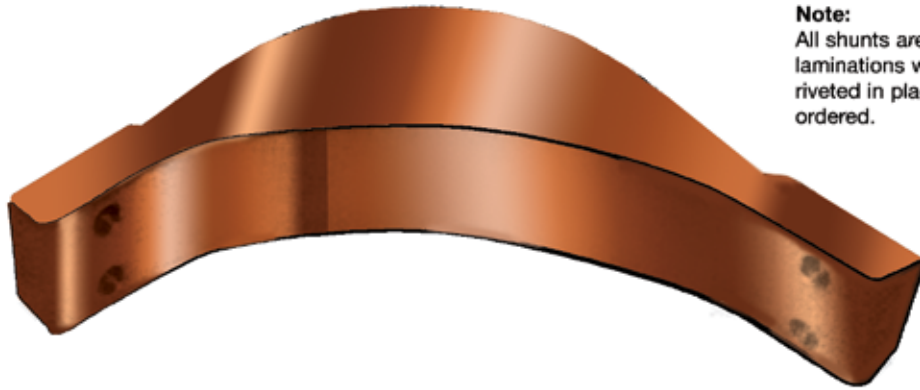
Size	Class 2		Tolerance ± (across flats)
	lbs./in.	lbs./ft.	
1/2"	.069	.837	.005
5/8"	.157	1.88	.005
3/4"	.183	2.20	.005
7/8"	.212	2.54	.005
1"	.276	3.33	.005
1 1/8"	.351	4.21	.006
1 1/4"	.433	5.20	.006
1 1/2"	.625	7.50	.006

Class 2 Forged and Machined Plate

Size	Pounds Per Square Inch	Estimated Pattern Weight / Lbs.	Thickness Tolerance
1" x 36" x 72"	.330	890	+1/16"-0"
1 1/2" x 36" x 72"	.490	1300	+1/16"-0"
2" x 36" x 72"	.650	1725	+1/16"-0"
2 1/2" x 36" x 72"	.810	2150	+1/16"-0"
3" x 36" x 72"	.970	2550	+1/16"-0"
4" x 36" x 72"	1.290	3400	+1/16"-0"



LAMINATED SHUNTS



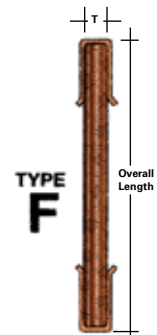
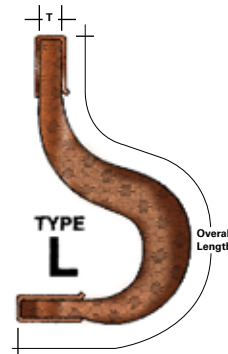
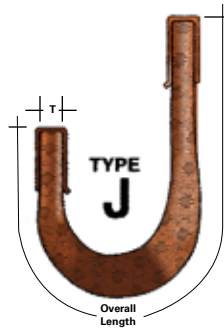
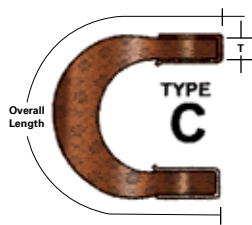
Note:

All shunts are made from .005" thick laminations with 1/16" copper clips riveted in place **unless** otherwise ordered.

Specify Hole Pattern at both ends

T Indicates thickness of laminations only

O.L. Indicates outside leaf length



Type of shunt

C, J, L, F or special

Length of Longest Sheet

Overall Length

Width of Laminations

Thickness

(less clip)

Pattern

1, 2, 3, 4, 5 or 6

Hole Size

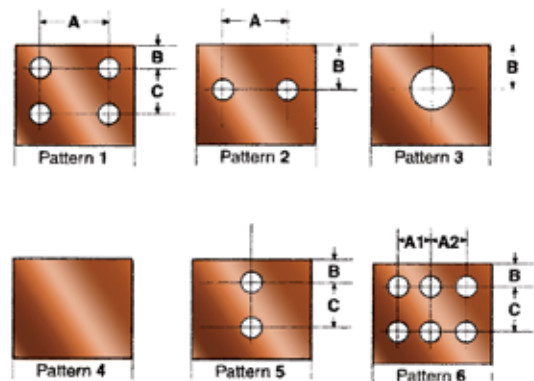
or Bolt Size

Hole Pattern Dimension

A _____
A2 _____
B _____
C _____

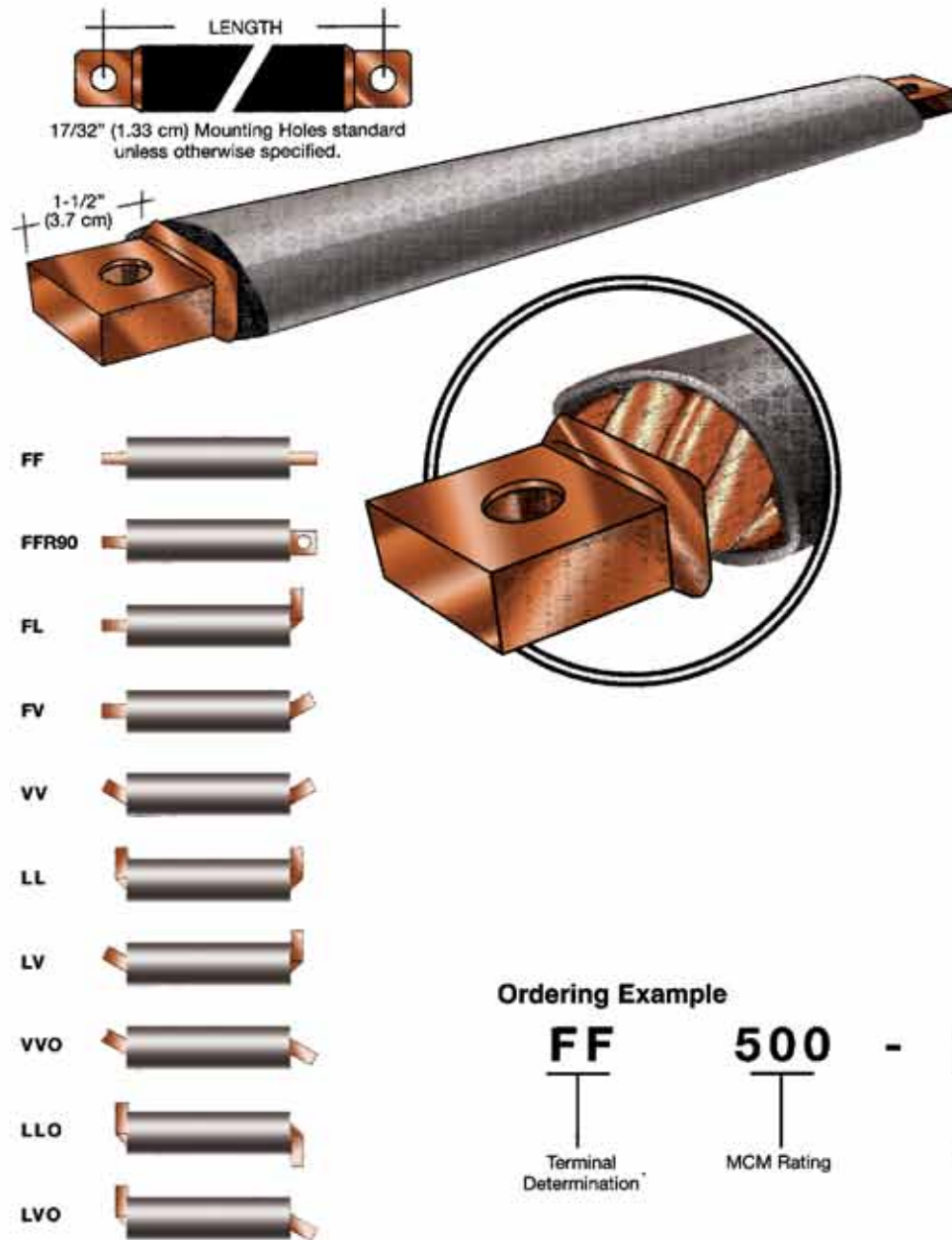
Note:

When ordering, please supply a drawing or sketch specifying shunt thickness, width, outside leaf length and exact hole diameter location.





AIR COOLED WELDING CABLES



Specify the MCM size, length and lug combination and quantity of cables desired



WELDING ACCESSORIES

<p>QUICK CONNECTOR WITH FEMALE CONNECTION</p>  <p>1/8" F.P.T. WEAC 12 1/4" F.P.T. WEAC 12B</p> <p>QUICK CONNECTOR PLUG</p>  <p>1/8" M.P.T. WEAC 14 1/4" M.P.T. WEAC 14B</p>	<p>WATER HOSE WEAC 26</p>  <p>3/8" INSIDE DIAMETER TO FIT NIPPLE WEAC 16</p> <p>HOSE CLAMP</p>  <p>WEAC 30</p>												
<p>WATER NIPPLE Standard 3/8" Hose</p>  <p>1/8" M.P.T. WEAC 16</p> <p>HOSE SPLICER</p>  <p>3/8" I.D. HOSE WEAC 18</p>	<p>FLEXIBLE WATER TUBE</p>  <p>FITTING EXTRA</p> <p>.280 O.D. WEAC 32 .250 O.D. WEAC 34 .280 O.D. WEAC 36</p>												
<p>TIP DRESSER WEAC 20</p> <p>To remove "mushroomed" effect from spot welding tips and bring dome and pointed tips back to approximately their original shape. This can be done on the job without removing tip from holder.</p> 	<p>WELD CAP EXTRACTOR #4 CAP WEAC 50, #5 CAP WEAC 51</p> 												
<p>RADIUS TIP FILE WEAC 24 Will dress any tip with minimum loss of material.</p>  <p>File Shape</p>  <p>Cutting Side Actual Width 1"</p>	<p>REAMERS</p> <table border="0"> <tr> <td>4 RWMA CAP TAPER</td> <td>WEAC 39A</td> </tr> <tr> <td>5 RWMA CAP TAPER</td> <td>WEAC 39B</td> </tr> <tr> <td>4 RWMA TAPER</td> <td>WEAC 40</td> </tr> <tr> <td>5 RWMA TAPER</td> <td>WEAC 42</td> </tr> <tr> <td>6 RWMA TAPER</td> <td>WEAC 43</td> </tr> <tr> <td>7 RWMA TAPER</td> <td>WEAC 44</td> </tr> </table> 	4 RWMA CAP TAPER	WEAC 39A	5 RWMA CAP TAPER	WEAC 39B	4 RWMA TAPER	WEAC 40	5 RWMA TAPER	WEAC 42	6 RWMA TAPER	WEAC 43	7 RWMA TAPER	WEAC 44
4 RWMA CAP TAPER	WEAC 39A												
5 RWMA CAP TAPER	WEAC 39B												
4 RWMA TAPER	WEAC 40												
5 RWMA TAPER	WEAC 42												
6 RWMA TAPER	WEAC 43												
7 RWMA TAPER	WEAC 44												
<p>SS - 30 WEAC 48 ANTI-SEIZE COMPOUND</p> <p>225 ML BRUSH - TOP CAN</p> 	<p>JUMPERS & SHUNTS MADE TO ORDER</p> <p>Specify - MCM size, length or provide old sample See pages 35 and 36</p> 												
<p>Micro Ohm Meter: The Micro Ohm Cable Tester (MOCT7550) measures from 3 to 2000 micro ohms and can be used to measure the resistance of secondary weld circuit components. These include kickless cables, water cooled jumpers, laminated shunts, air cooled jumpers, weld gun castings, weld tips joints, weld transformers, oxidation in joints, connectors, or any component that can increase in residence. This Meter is a tool that can be used for both preventive maintenance and for troubleshooting the secondary welding circuit.</p>	<p>PREMIUM CAP EXTRACTOR WEAC 45 (for #4/5 Male Caps)</p> 												



WELD FORCE GAUGES



**ALL STANDARD GAUGES READ DIRECTLY IN LB-FORCE OR KILOS-FORCE.
DIAL FACE MAY READ PSI, ACTUAL-Pounds Force**



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COMPARED TO
REPLACEMENT COSTS

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DUE TO QUICK
TURNAROUND ON
REPAIRS

REDUCED INVENTORY
REQUIREMENTS



BEFORE



AFTER

Typical orders include the repair of:

- *damaged male/female cap tapers
- *damaged threads
- *damaged contact pads
- *water tubes and leaks



Helpful Suggestion

DO'S	DON'TS
<ol style="list-style-type: none">1. Use the proper electrode material for the job you are doing.2. Use standard electrodes wherever possible.3. Use the most suitable tip diameter for the thickness of stock being welded.4. Use open sight drains to observe more readily the water flow through the holders.5. Connect the water inlet hose to the proper holder inlet so that the water flows through the center cooling tube first.6. Internally cool the spot welding tips with cool water flowing at a rate of at least 1/2 gallons per minute through each tip.7. Be sure the internal water cooling tube of the holder projects into the tip water hole to within 1/4" of the tip hole bottom.8. Adjust the internal water cooling tube of the holder to the proper height when changing to a different length tip.9. Be sure top of adjustable water cooling tube in holders is cut at an angle so as to avoid jamming tip down and shutting water off.10. Place a thin film of cup grease on the tip taper prior to inserting in the holder, to make it easier to remove.11. Use ejector type holders for easy removal of tips and to avoid damage to tip tapers.12. Keep the tip taper and holder taper clean, smooth and free of foreign deposits.13. Dress spot welding electrodes frequently enough to maintain the quality of the welds.14. Dress electrodes in a lathe to their original contour whenever possible.15. Use a rawhide or rubber mallet for striking holder or tips in aligning operations.16. Provide flood cooling on both sides of the seam welding wheel.17. Use properly designed knurling wheels to maintain proper seam welding wheel shape.	<ol style="list-style-type: none">1. Never use unidentified electrodes or electrode materials.2. Avoid special, offset or irregular tips when the job can be done with a standard straight tip.3. Don't use small tips on heavy gauge welding jobs or large tips on small work.4. Don't forget to turn on the cooling water full force before starting to weld.5. Never use water hose that will not fit the holder water connection nipples snugly.6. Do not allow water connections to become leaky, clogged or broken.7. Avoid using holders with leaking or deformed tapers.8. Never use electrode holders that do not have an adjustable internal water cooling tube.9. Do not permit adjustable water tube to be "frozen" by accumulation of deposits. A few drops of oil periodically will keep the tube free.10. Do not allow electrodes to remain idle in tapered holder seats for extended periods.11. Don't use pipe wrenches or similar tools in removing electrodes.12. Avoid using white lead or similar compounds to seal a leaking taper.13. Never permit a spot welding tip to mushroom enough to make dressing difficult.14. Never dress electrodes with a coarse file.15. Don't pound on the holder or tip with a steel hammer in aligning the welder arms.16. Avoid the use of seam welder wheels too thin to stand the heat or pressure of your job.17. Do not permit seam welding wheel to run off the corners of the work being welded.

CUSTOM MANUFACTURING

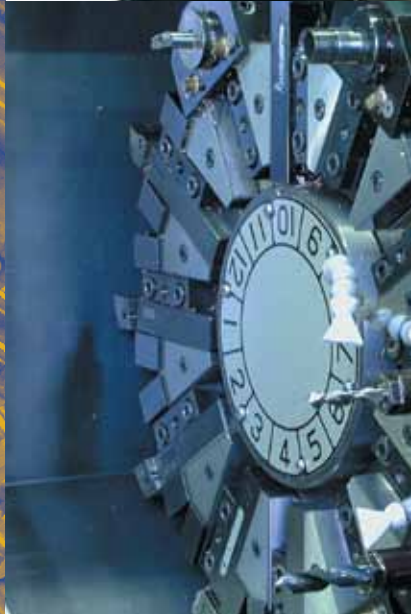
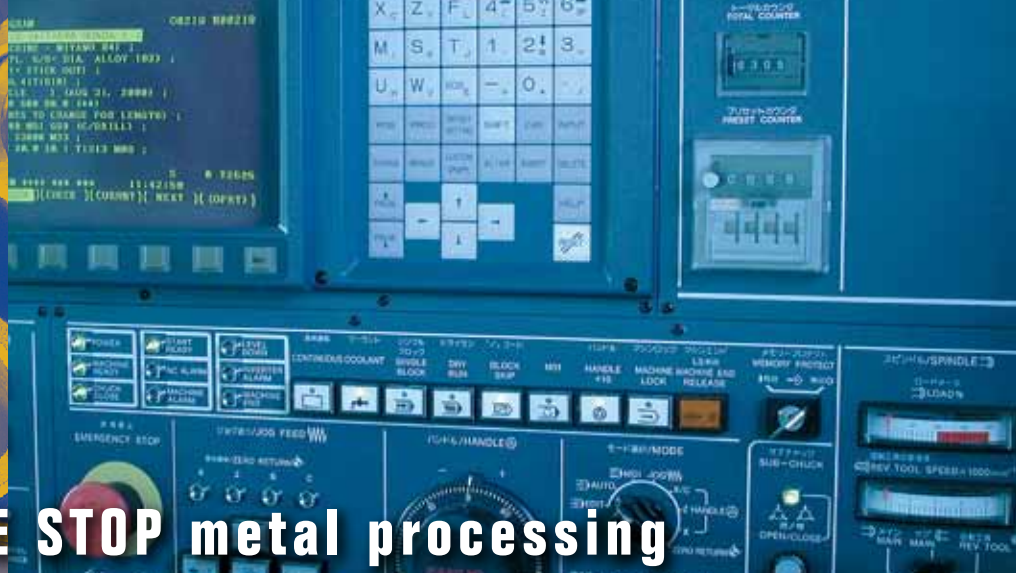


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