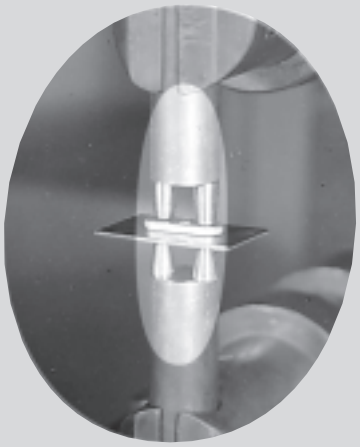
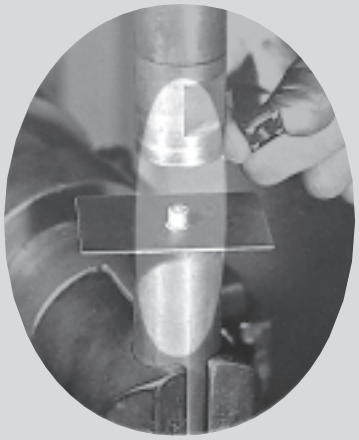


OHIO



Weld Data Guide

For Engineering Fastener Foundations

What's Inside?

The Ohio Nut and Bolt Company
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OHIO Weld Data Guide

Basic Recommendations

The three basic requirements for producing a good resistance weld involve **heat**, **time** and **pressure**. The proper relationship and control of each of these elements will contribute to an optimum weld.

Heat

Heat balance is extremely important to good welds. Proper heat balance is attained when the fastener and the part to which it is being welded, are brought to the welding temperature at the same time. Heat or current balance occurs when the distribution of heat between the fastener and the component part is equal.

Some variables which affect the heat:

1. The weld time is too long.
2. The welding current is too high.
3. Low electrode pressure.
4. The electrode diameter is too small.
5. Improper electrode alignment.
6. Improper adjustments in changing metal thickness.
7. Unclean sheet or component part.

Adjusting the heat or current with a regulator changes the ratio of primary to secondary voltage. Most Ohio Weld products require from 5,000 to 20,000 secondary amperes to produce enough heat to make the weld. Set the heat regulator at a point where current will not cause flashing or sparking when the weld occurs. A current meter will determine accurate short circuit secondary ampere readings. This is an accurate method for determining correct current settings.

Time

Time, expressed in cycles, is an important factor enabling a good weld. One cycle represents 1/60 of a second. The weld time should be as short as possible and the weld should occur in one hit. Repeated hits add nothing to the strength or appearance of the weld and may damage the work. An average weld takes from three to fifteen cycles. There are three groups of time in resistance welding and they are all important.

Squeeze Time:
The interval between the application of pressure and the application of welding current.

Weld Time:
The time which the current flows through the work during the weld process.

Hold Time:
The time that pressure remains on the electrodes after the end of the welding current.

Pressure

Pressure plays a key part in obtaining optimum welds. Pressure assures good electrical contact of the welded part of the sheet. In projection welding, pressure also forces the projection into the sheet after the metal reaches fusion temperature. Extreme pressure will cause projections to flatten out before reaching weld heat. Not enough pressure causes flashing, spitting, burning and discoloration.

Required Equipment

All standard OHIO Weld Products, except those with ring projections, require from 300 to 1,200 pounds pressure at the electrodes. A force gauge checks the pressure at the electrodes.

The selection of the proper type and size of welder depends on the work the welder is to perform. OHIO Weld Fasteners can be welded with the simplest type of press or rocker-arm welder. Production requirements may call for large automated machines. KVA (Kilovolt Amperes) determines welder size. Many OHIO Projection Weld Screws weld with press welders as small as 20 KVA, while others will require units as large as 200 KVA. For typical weld setups, consult the weld setting tables on **pages 4 - 11** in this section.

Standard Press Type Welding Machine

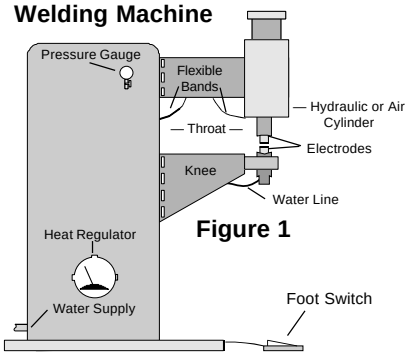

Figure 1

Projection welding uses a press welder (**figure 1**) because the air cylinder is directly over the electrodes and the travel is in a straight line. In addition, good alignment and equalized pressure is achieved at the tips.

Spot welding uses rocker-arm welders. Air cylinders, a motor and cam or foot treadle supply electrode force (**figure 2**). Machines are available from 10 KVA to 75 KVA or greater.

When welding OHIO Spot Weld Fasteners, manufacturing can use the same equipment, electrodes, and settings used in regular production welding. OHIO Spot Weld Screws and Nuts are welded with welders which range in size from 30 KVA to 75 KVA. For typical weld setups, consult the weld setting tables on **pages 4 - 11** in this section.

Standard Rocker–Arm Spot Welding Machine

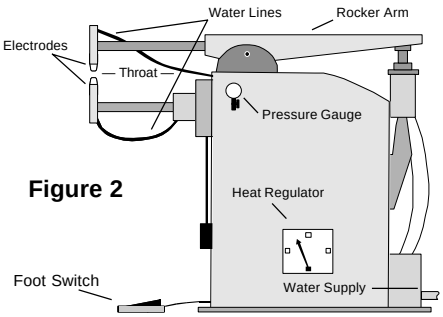

Figure 2

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Projection Welding

Figure 3

Projection welding utilizes relatively large electrodes to insure coverage of the entire projection area. The more bearing surface, the longer the electrode life **(figure 3)**. Electrodes should be located directly on the center line of pressure application to insure accurate alignment and good contact for quality welds.

In projection welding, heat is localized in the weld projections of the fastener. On OHIO parts, these carefully located projections cause the current to be concentrated in small areas as it flows between the fastener and the parent part. Welding occurs as the projections fuse with the surface of the part.

The face of the electrode should be of sufficient diameter to completely cover the surface of the part being welded. The more bearing surface that can be obtained, the greater the electrode life. There are many suitable copper alloys available for projection welding; however, it is best to use a material with a minimum Rockwell B 75 and with as high an electrical conductivity as possible. Electrode life can be lengthened in high production by brazing a pad of RWMA Class 12 copper alloy approximately 1/4" thick to the surface of the regular electrode material. For details about the Ohio Electrodes available, see page 12 of this section.

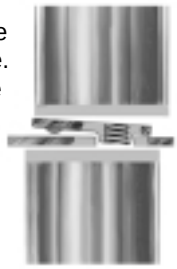

Figure 4

Electrodes For Projection Welding

To insure accurate alignment for good contact and quality welds, electrodes for projection welding should be located directly on the center line of pressure application. In addition to producing faulty welds, misaligned electrodes can result in damage to the electrode face **(figure 4)**. Another major contribution to a bad weld is nonparallel electrode faces. They cause unbalanced pressure on electrodes which results in expulsion of weld metal during the weld cycle. This damages threads and can burn electrode insulation when welding screws through the parent metal. In addition, nonparallel faces cause weld nuts to skid against parent metal during weld, resulting in a burned pilot with distorted threads and possible misalignment with mating parts **(figure 5).**

Figure 5

Spot Welding

The spot welding principle involves placing the two pieces to be welded between two copper or copper alloy welding tips. An electric current of sufficient strength is passed through the entire area under the electrode tip, welding the pieces together **(figure 6)**. This differs from projection welding in that the heat concentration depends on the size and shape of the electrode tip rather than on the size, shape and the number of projections used.

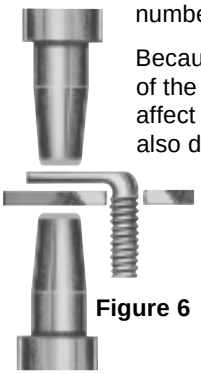

Figure 6

Because the size and shape of the electrode tip directly affect the size of the weld, it also determines the strength of the weld in shear. Thus, control weld size and strength by maintaining a uniform tip contact area. Tip diameters must be changed for each thickness of metal to be welded. See weld settings tables on pages 4 – 11 in this section for recommended sizes for OHIO Fasteners.

In spot welding, indentations and discolorations appear in the weld area. This is caused by metal being drawn up to form the weld nugget or growth between the fastener and the part. It is possible to reduce this indentation (and discoloration) by using a flat electrode on the side where minimization of these marks is desired.

An important advantage of spot welding is it can be utilized to attach fasteners where the assembly itself is being welded. This eliminates extra setup time and adds to the flexibility of the basic welding equipment.

Faulty welds can be eliminated or minimized by avoiding some of the easily overlooked pitfalls in resistance welding.

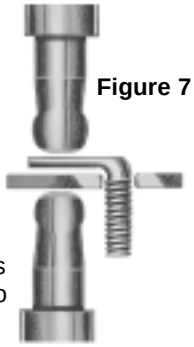

Figure 7

Some of the basic requirements are that the material to be welded is of good welding quality and is free of oil, dirt and foreign matter of all kinds.

Spot welding electrodes must be kept dressed to proper size. Mushroomed tips (**figure 7**) prevent necessary localizing of heat for proper welding. Projection welding electrodes must be kept aligned for optimum and uniform pressure.

On through the hole applications, allow sufficient clearance between part and parent material to prevent shunting of current into material. When using jigs, fixtures and stops for locating devices are insulated form the electrode body.

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Electrodes For Spot Welding

In spot welding, the heat concentration depends on the size and shape or the electrode tips. The weld is made by passing current through the entire area under the electrode tip. The smaller electrode tip diameters erode or mushroom much faster than projection weld electrodes. They must be dressed regularly to maintain proper contact **(figure 6)**. Follow the recommendations on pages 5 – 12 in this section.

Troubleshooting

Faulty welds can be traced to a variety of factors such as the weld setup, electrodes, the control system, the selection of fasteners, the machine, the operator or the process itself. The following check list can be helpful in isolating trouble areas

1. The weld setup; incorrect heat, time or pressure.
2. The electrodes (faulty design, lack of insulation, need for dressing).
3. The welding machine (mechanical, electrical, water or air inadequacies).
4. The electronic controls tube failures, etc.
5. The parts being welded (poor design, wrong material and projection design or location).
6. The metal to which the parts are welded (Is it good welding quality?).
7. Jigs, fixtures and the feeding devices (are they effective?).
8. The operator (the human element).

Most welding difficulties are caused by two of these elements - poor electrode designs and improper weld setup. **Figures 8, 9, and 10** illustrate the results of welds made with improper electrodes. **Figures 8 and 9** also show indentations made by electrodes which did not cover the entire head of the weld screw, which is mandatory in projection welding.

Since the projections are fairly close to the perimeter of the screw head, both of these welds failed to fuse all of the projections resulting in weak welds. In **figure 10**, you can see the weld spatter in the screw threads caused by poor or complete lack of insulation. Whenever the screw or nut is welded through a hole in a sheet, the lower electrode must be insulated.

Figures 11 and 12 show the results of improper weld setups. In **figure 11** there is expulsion at the projections and a great deal or discoloration, both usually caused by inadequate electrode pressure or excessive current. In **figure 12**, the operator attempted to offset the lack of pressure by increasing the heat. You can see the expulsion and discoloration has increased. In addition, the area around the weld has been made over heated, weakening the sheet at the weld point.

Maintenance Tips

Maintain a standby supply of electrodes at the welder to minimize downtime due to electrode change.

— Do —

Projection Weld Electrodes

Dress electrodes periodically on a lathe.
Use a RWMA, Group A, Class 3 copper on the sheet side.

— Do —

Spot Weld Electrodes

Dress electrodes periodically on a lathe with an approved tip dresser.
Change tip diameters to adjust to each thickness of metal to be welded.

— Don't —

Use a file to dress electrodes
Store electrodes where face damage can result.
Use a pipe wrench to remove the electrodes.

General Tips

1. To assure perfect alignment, both the faces and the axis of the electrodes must be parallel. To check this insert a piece of carbon paper and a sheet of white paper between the electrodes and apply pressure with the weld cycles turned off. The resulting impression on the plain paper will indicate the alignment of the electrodes.
2. Utilize a water jacket whenever possible and locate it as close as possible to the welding surface.
3. Keep material to be welded free form oil, dirt and other foreign matter.
4. Follow welder size and setting recommendations made by **The Ohio Nut and Bolt Company**


Figure 8

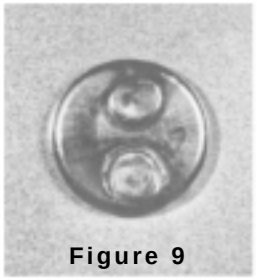
Figure 9

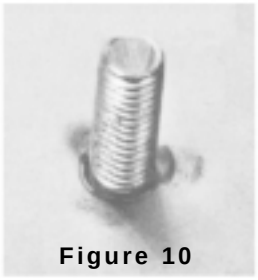
Figure 10

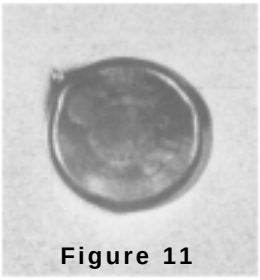
Figure 11

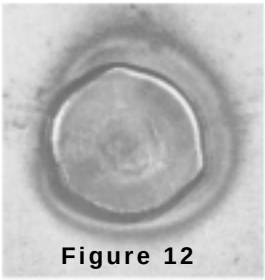
Figure 12

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OHIO

Low Carbon

These are typical weld setups for use with C 1010 Low Carbon cold rolled sheets in a thickness range from .025 to .187. Material to be welded should be free from oil, dirt or rust. Specific weld setups for other thicknesses and materials are available upon request.

Weld Data Guide

Part Type	Thread Size		Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode. Dia.		Approx. KVA Size
	Inch	Metric	From	To	From	To	From	To	Part Side	Sheet Side	Welder
BT / BTM	#8	M4	700	1,000	4	7	9,000	14,000	0.500	0.500	50
	#10	M5	700	1,000	4	7	9,000	14,000	0.500	0.500	50
	1/4-20	M6	800	1,200	5	9	10,000	15,000	0.500	0.500	75
	5/16-18	M8	1,000	1,300	8	10	12,000	17,000	0.625	0.625	75
ND / NDM	#6	M3.5	550	800	6	10	12700	19500	0.250	0.250	30
	#8	M4	550	800	6	10	12700	19500	0.250	0.250	30
	#10	M5	550	800	6	10	12700	19500	0.250	0.250	30
	1/4-20	M6	800	1,300	8	15	14,000	20,000	0.312	0.312	50
	5/16-18	M8	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
	3/8-16	M10	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
PN / PNM	#6	M3.5	300	1,000	3	10	7300	15,000	0.625	0.625	30
	#8	M4	300	1,000	3	10	7300	15,000	0.625	0.625	30
	#10	M5	300	1,000	3	10	7300	15,000	0.625	0.625	30
	1/4-20	M6	700	1,300	3	10	8500	16,000	0.813	0.813	50
	5/16-18	M8	1,000	1,500	6	12	10,000	17,000	1.000	1.000	75
	3/8-16	M10	1,000	1,500	6	12	10,000	17,000	1.125	1.125	75
QN / QNM	#6	M3.5	400	900	3	8	8,000	16,000	0.625	0.625	30
	#8	M4	400	900	3	8	8,000	16,000	0.625	0.625	30
	#10	M5	400	900	3	8	8,000	16,000	0.625	0.625	30
	1/4-20	M6	800	1,200	4	10	13,000	20,000	0.813	0.813	50
	5/16-18	M8	900	1,500	5	15	15,000	24,000	1.000	1.000	75
	3/8-16	M10	900	1,500	5	15	15,000	24,000	1.000	1.000	75
	1/2-13	M12	1,000	3,500	6	16	20,000	35,000	1.250	1.250	100
RD / RDM	#6	M3/M3.5	600	800	3	7	9,000	12,000	0.625	0.625	20
	#8	M4	600	800	3	7	9,000	12,000	0.625	0.625	20
	#10	M5	600	800	3	7	9,000	12,000	0.625	0.625	20
	1/4-20	M6	600	900	6	10	9,000	14,000	0.875	0.875	30
	5/16-18	M8	800	1,300	4	12	13,000	22,000	0.813	0.813	50
RH / RHM	#6	M3.5	700	1,000	3	12	10,000	16,000	0.625	0.625	30
	#8	M4	700	1,000	3	12	10,000	16,000	0.625	0.625	30
	#10	M5	800	1,100	4	16	12,000	18,000	0.750	0.750	50
	1/4-20	M6	900	1,200	6	18	13,000	20,000	1.000	1.000	75
	5/16-18	M8	1,000	1,500	10	20	14,000	22,000	1.000	1.000	75
	3/8-16	M10	1,000	1,500	10	20	14,000	22,000	1.000	1.000	75

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OHIO

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Weld Data Guide

Part Type	Thread Size		Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode. Dia.		Approx. KVA Size
	Inch	Metric	From	To	From	To	From	To	Part Side	Sheet Side	Welder
RN / RNM	#6	M3.5	500	1,000	3	10	8,000	12,000	0.625	1.000	30
	#8	M4	500	1,000	3	10	8,000	12,000	0.625	0.625	30
	#10	M5	500	1,000	3	10	8,000	12,000	0.625	0.625	30
	1/4-20	M6	700	1,300	4	12	9,000	16,000	0.813	0.813	50
	5/16-18	M8	900	1,500	5	14	10,000	18,000	1.000	1.000	75
	3/8-16	M10	900	1,500	5	14	10,000	18,000	1.000	1.000	75
	1/2-13	M12	1,000	1,700	6	16	11,000	20,000	1.125	1.125	75
SF	5/16-18	—	1,500	3,000	10	25	30,000	50,000	1.125	1.125	200
	3/8-16	—	1,500	3,000	10	25	30,000	50,000	1.125	1.125	200
	1/2-13	—	2,200	3,700	15	25	30,000	50,000	1.125	1.125	200
SN / SNM	#6	M3.5	550	800	6	10	12700	19500	0.218	0.250	30
	#8	M4	550	800	6	10	12700	19500	0.022	0.250	30
	#10	M5	550	800	6	10	12700	19500	0.250	0.250	30
	1/4-20	M6	800	1,300	8	15	14,000	20,000	0.312	0.312	50
	5/16-18	M8	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
	3/8-16	M10	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
TP	#6	—	550	800	6	10	12700	19500	0.250	0.250	30
	#8	—	550	800	6	10	12700	19500	0.250	0.250	30
	#10	—	550	800	6	10	12700	19500	0.250	0.250	30
	1/4-20	—	800	1,300	8	15	14,000	20,000	0.312	0.312	50
	5/16-18	—	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
	3/8-16	—	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
WF / WFM	#6	M3.5	700	950	3	8	8,000	14500	0.625	1.000	30
	#8	M4	700	950	3	8	8,000	14500	0.625	0.625	30
	#10	M5	800	1,050	6	12	9,000	15200	0.750	0.750	50
	1/4-20	M6	900	1,100	7	14	10,000	16100	1.000	1.000	75
	5/16-18	M8	1,000	1,200	8	15	12,000	18,000	1.000	1.000	75
	3/8-16	M10	1,000	1,200	8	15	12,000	18,000	1.000	1.000	75
WP / WPM	#6	M3.5	400	900	3	8	8,000	16,000	0.625	0.625	30
	#8	M4	400	900	3	8	8,000	16,000	0.625	0.625	30
	#10	M5	450	950	3	10	11,000	16,000	0.625	0.625	50
	1/4-20	M6	600	1,000	4	11	12,000	17,000	0.625	0.625	75
	5/16-18	M8	800	1,100	5	12	13,000	18,000	0.750	0.750	75

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	Inch	Metric	From	To	From	To	From	To	Part Side	Sheet Side	Welder
WS / WSM 	#6	M3.5	400	900	3	8	8,000	16,000	0.625	0.625	30
	#8	M4	400	900	3	8	8,000	16,000	0.625	0.625	30
	#10	M5	450	950	3	10	11,000	16,000	0.625	0.625	50
	1/4-20	M6	600	1,000	4	11	12,000	17,000	0.625	0.625	75
	5/16-18	M8	800	1,100	5	12	13,000	18,000	0.750	0.750	75
	3/8-16	M10	900	1,200	6	13	14,000	19,000	0.875	0.875	75
WT / WTM 	#6	M3.5	800	1,000	4	9	9,000	15,000	0.625	0.625	30
	#8	M4	800	1,000	4	9	9,000	15,000	0.625	0.625	30
	#10	M5	900	1,200	7	13	10,000	16,000	0.750	0.750	50
	1/4-20	M6	1,000	1,300	8	15	11,000	17,000	1.000	1.000	75
WW / WWM 	#6	M3.5	700	1,200	5	9	13,000	20,000	0.625	0.625	75
	#8	M4	900	1,800	6	10	18,000	30,000	0.625	0.625	75
	#10	M5	1,200	2,000	7	15	20,000	40,000	0.750	0.750	100
	1/4-20	M6	1,600	3,000	8	20	25,000	50,000	1.000	1.000	150
	5/16-18	M8	1,800	3,200	10	25	30,000	60,000	1.000	1.000	200
	3/8-16	M10	1,800	3,200	10	25	30,000	60,000	1.000	1.000	200
XN / XNM 	#6	M3.5	350	800	5	10	9700	17800	0.218	0.250	20
	#8	M4	350	800	5	10	9700	17800	0.218	0.250	20
	#10	M5	350	800	5	10	9700	17800	0.218	0.250	20
	1/4-20	M6	350	800	5	10	9700	17800	0.250	0.250	20
	5/16-18	M8	800	1,300	8	15	14,000	20,000	0.312	0.312	50
	3/8-16	M10	800	1,300	8	15	14,000	20,000	0.312	0.312	50
DW 	1/4-20	—	700	1,100	3	8	8,000	15,000	0.500	0.500	50
	5/16-18	—	800	1,200	4	12	9,000	16,000	0.625	0.625	75
GW / GWM 	#6	M3.5	200	800	3	5	3,000	7500	0.500	0.500	20
	#8	M4	300	800	3	5	3700	8500	0.500	0.500	20
	#10	M5	400	850	3	7	6,000	12300	0.500	0.500	20
	1/4-20	M6	700	950	3	8	8,000	14500	0.500	0.500	30
	5/16-18	M8	800	1,050	8	12	9,000	15200	0.625	0.625	50
	3/8-16	M10	900	1,150	7	14	10,000	16100	0.750	0.750	50
HW / HWM 	#6	M3.5	300	900	3	7	4,000	13,000	0.500	0.500	20
	#8	M4	300	900	3	7	4,000	13,000	0.500	0.500	20
	#10	M5	300	900	3	7	4,000	13,000	0.500	0.500	20
	1/4-20	M6	700	1,000	3	12	10,000	16,000	0.625	0.625	30
	5/16-18	M8	800	1,100	4	16	12,000	18,000	0.750	0.750	50
	3/8-16	M10	900	1,200	6	18	13,000	20,000	0.875	0.875	50
	1/2-13	M12	1,000	1,500	10	20	14,000	22,000	1.000	1.000	75

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Low Carbon

These are typical weld setups for use with C 1010 Low Carbon cold rolled sheets in a thickness range from .025 to .187. Material to be welded should be free from oil, dirt or rust. Specific weld setups for other thicknesses and materials are available upon request.

Weld Data Guide

Part Type	Thread Size		Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode. Dia.		Approx. KVA Size
	Inch	Metric	From	To	From	To	From	To	Part Side	Sheet Side	Welder
PD	#6	—	250	800	3	6	5,000	11,000	0.437	0.437	20
	#8	—	350	800	3	7	6,000	12,000	0.500	0.500	20
	#10	—	900	1,200	4	8	8,000	13,000	0.500	0.500	30
	1/4-20	—	900	1,500	5	9	9,000	14,000	0.625	0.625	50
	5/16-18	—	900	1,500	6	15	12,000	17,000	0.875	0.875	75
	3/8-16	—	1,000	1,600	7	18	13,000	21,000	1.000	1.000	75
RW / RWM	#6	M3.5	300	600	4	6	8500	13,000	0.500	0.500	20
	#8	M4	500	1,200	2	5	9,000	17,000	0.500	0.500	50
	#10	M5	900	1,200	2	5	14,000	22,000	0.500	0.500	75
	1/4-20	M6	900	1,500	5	15	15500	24,000	0.625	0.625	100
	5/16-18	M8	1,600	1,800	11	20	21,000	25,000	0.750	0.750	150
	3/8-16	M10	2,200	2,600	11	15	27,000	35,000	0.875	0.875	150
SS / SSM	#6	M3.5	300	700	4	10	8,000	14,000	0.218	0.250	20
	#8	M4	300	700	4	10	8,000	14,000	0.218	0.250	20
	#10	M5	300	700	4	10	8,000	14,000	0.250	0.250	20
	1/4-20	M6	500	900	6	12	12,000	18,000	0.281	0.312	50
	5/16-18	M8	800	1,300	8	15	14,000	20,000	0.375	0.375	75
	3/8-16	M10	1,000	2,000	10	25	15,000	25,000	0.375	0.375	75
KL	0.190	—	300	700	4	10	8,000	14,000	0.250	0.250	30
											
PC	0.375	—	500	900	4	9	8,000	12,000	0.375	0.375	50
	0.750	—	900	1,400	5	10	10,000	18,000	0.750	0.750	75
	1.000	—	1,000	1,500	5	15	12,000	20,000	1.000	1.000	75
PG / PGM	0.117	3mm	200	800	3	5	3,000	7500	0.500	0.500	20
	0.144	—	300	800	3	5	3,700	8,500	1.000	1.000	20
	0.163	4mm	400	850	3	6	6,000	12300	0.500	0.500	20
	0.190	5mm	600	900	3	7	7,000	13200	0.500	0.500	30
	0.218	—	700	950	3	8	8,000	14500	0.500	0.500	30
	0.250	6mm	700	950	3	8	8,000	14500	0.500	0.500	30
	0.277	—	800	1,050	6	12	9,000	15200	0.625	0.625	50
	0.335	8mm	900	1,150	7	14	10,000	16100	0.750	0.750	50
	0.375	10mm	900	1,150	7	14	10,000	16100	0.750	0.750	50

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Low Carbon

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Weld Data Guide

Part Type	Thread Size		Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode. Dia.		Approx. KVA Size
	Inch	Metric	From	To	From	To	From	To	Part Side	Sheet Side	Welder
PH / PHM	0.117	3mm	300	900	3	7	4,000	13,000	0.500	0.500	20
	0.144	—	300	900	3	7	4,000	13,000	0.500	0.500	20
	0.163	4mm	400	900	3	8	6,000	14,000	0.500	0.500	20
	0.190	5mm	600	1,000	3	10	9,000	15,000	0.500	0.500	30
	0.218	—	700	1,000	3	12	10,000	16,000	0.625	0.625	30
	0.250	6mm	700	1,000	3	12	10,000	16,000	0.625	0.625	30
	0.277	—	800	1,100	4	16	12,000	18,000	0.750	0.750	50
	0.335	8mm	900	1,200	6	18	13,000	20,000	0.875	0.875	50
	0.375	10mm	900	1,200	6	18	13,000	20,000	0.875	0.875	50
	0.500	12mm	1,000	1,500	10	20	14,000	22,000	1.000	1.000	75
SP	0.117	—	300	700	4	10	8,000	14,000	0.250	0.250	20
	0.144	—	300	700	4	10	8,000	14,000	0.250	0.250	20
	0.163	—	300	700	4	10	8,000	14,000	0.250	0.250	20
	0.190	—	300	700	4	10	8,000	14,000	0.250	0.250	20
	0.218	—	500	900	6	12	12,000	18,000	0.312	0.312	50
	0.250	—	600	1,000	8	15	12,000	18,000	0.312	0.312	50
	0.277	—	800	1,300	10	25	14,000	20,000	0.375	0.375	75

Stainless Steel

These are typical weld setups for use with 18-8 stainless steel sheets in thickness range as indicated. Material to be welded should be free from oil, dirt or film. Welding of stainless steel usually requires a shorter weld time with higher pressure and higher secondary volts than when welding low carbon steel. Modern controls are helpful in attaining good results when welding stainless steel.

Part Type	Thread Size	Base Material Gage	Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode Dia.		Approx. KVA Size
			From	To	From	To	From	To	Part Side	Sheet Side	Welder
BTZ	#10	20 to 13	750	900	3	8	7,300	11,000	0.500	0.500	50
											
PNZ	#8	24 to 14	750	900	4	6	6,800	8,500	0.625	0.625	30
	#10	24 to 14	750	900	4	6	6,800	8,500	0.625	0.625	30
	1/4–20	24 to 13	850	1,500	3	6	4,500	13,500	1.250	1.250	50–75
	5/16–18	20 to 11	1,400	1,600	4	8	10,500	13,500	1.250	1.250	75
	3/8–16	20 to 11	1,400	1,600	4	8	10,500	13,500	1.250	1.250	75
PNZ Metric	M4	24 to 14	750	900	4	6	6,800	8,500	0.625	0.625	30
	M5	24 to 14	750	900	4	6	6,800	8,500	0.625	0.625	30
	M6	24 to 13	850	1,500	3	6	4,500	13,500	1.250	1.250	50–75
	M8	20 to 11	1,400	1,600	4	8	10,500	13,500	1.250	1.250	75

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Weld Data Guide

Part Type	Thread Size	Base Material Gage	Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode Dia.		Approx. KVA Size Welder
			From	To	From	To	From	To	Part Side	Sheet Side	
RHZ	#6	24 to 14	750	900	4	10	7,800	12,500	0.625	0.625	30
	#8	24 to 14	750	900	4	10	7,800	12,500	0.625	0.625	30
	#10	24 to 14	850	1,500	4	8	7,500	18,000	0.750	0.750	75
	1/4–20	20 to 11	850	1,600	8	14	10,500	16,000	1.000	1.000	75
	5/16–18	20 to 11	1,500	1,600	7	15	10,750	16,000	1.000	1.000	100
	3/8–16	18 to 11	1,500	1,600	7	15	10,750	16,000	1.000	1.000	100
RNZ	#8	24 to 14	700	800	4	6	6,500	9,000	0.625	0.625	30
	#10	24 to 14	700	800	4	6	6,500	9,000	0.625	0.625	30
	1/4–20	20 to 11	850	1,500	3	6	11,500	13,500	0.813	0.813	30
	5/16–18	20 to 11	1,400	1,600	4	8	11,000	14,000	1.000	1.000	100
	3/8–16	20 to 11	1,400	1,600	4	8	11,000	14,000	1.000	1.000	100
RNZ Metric	M4	24 to 14	700	800	4	6	6,500	9,000	0.625	0.625	30
	M5	24 to 14	700	800	4	6	6,500	9,000	0.625	0.625	30
	M6	20 to 11	850	1,500	3	6	11,500	13,500	0.813	0.813	30
	M8	20 to 11	1,400	1,600	4	8	11,000	14,000	1.000	1.000	100
SNZ	#8	24 to 14	750	900	4	8	7,200	10,500	0.218	0.250	30
	#10	24 to 14	750	900	4	8	7,200	10,500	0.218	0.250	30
	1/4–20	24 to 13	850	1,250	2	8	10,000	11,000	0.250	0.250	40
	5/16–18	20 to 11	850	1,500	4	10	10,800	13,000	0.312	0.375	50
	3/8–16	20 to 11	850	1,500	4	10	10,800	13,000	0.312	0.375	75
SNZ Metric	M4	24 to 14	750	900	4	8	7,200	10,500	0.218	0.250	30
	M5	24 to 14	750	900	4	8	7,200	10,500	0.218	0.250	30
	M6	24 to 13	850	1,250	2	8	10,000	11,000	0.250	0.250	40
	M8	20 to 11	850	1,500	4	10	10,800	13,000	0.312	0.375	50
WFZ	#6	20 to 14	750	850	3	6	7,800	11,000	0.625	0.625	30
	#8	20 to 14	750	850	3	6	7,800	11,000	0.625	0.625	30
	#10	20 to 13	750	900	3	8	8,800	12,000	0.750	0.750	50
	1/4–20	20 to 11	1,350	1,600	3	8	11,300	18,000	1.000	1.000	75
	5/16–18	16 to 11	1,400	1,600	4	10	10,800	18,000	1.000	1.000	100
	3/8–16	16 to 11	1,400	1,600	4	10	10,800	18,000	1.000	1.000	100
WTZ	#6	24 to 13	750	900	4	7	7,000	10,300	0.625	0.625	30
	#8	24 to 13	750	900	4	9	7,000	10,300	0.625	0.625	30
	#10	24 to 11	700	900	4	9	7,800	13,000	1.000	1.000	50
	1/4–20	20 to 11	1,300	1,600	4	9	11,600	14,500	1.000	1.000	100

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Stainless Steel

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Weld Data Guide

Part Type	Thread Size	Base Material Gage	Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode Dia.		Approx. KVA Size Welder
			From	To	From	To	From	To	Part Side	Sheet Side	
WWZ	#6	24 to 13	850	1,600	4	8	11,700	18,000	0.625	0.625	50
	#8	24 to 13	850	1,600	4	8	11,700	18,000	0.625	0.625	50
	#10	24 to 11	1,400	1,800	6	12	14,000	30,000	1.000	1.000	100–150
	1/4–20	20 to 11	2,900	4,400	5	10	27,500	33,000	1.250	1.250	200
	5/16–18	18 to 11	3,500	4,400	7	12	33,300	35,000	1.250	1.250	200
	3/8–16	18 to 11	3,500	4,400	7	12	33,300	35,000	1.250	1.250	200
GWZ	#6	24 to 14	750	900	2	6	4,000	9,000	0.500	0.500	20
	#8	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	#10	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	1/4–20	20 to 14	750	850	4	12	8,000	12,200	0.500	0.500	50
	5/16–18	20 to 11	1,400	1,600	4	8	11,200	18,300	0.750	0.750	100
	3/8–16	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	100
GWZ Metric	M4	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	M5	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	M6	20 to 14	750	850	4	12	8,000	12,200	0.500	0.500	50
	M8	20 to 11	1,400	1,600	4	8	11,200	18,300	0.750	0.750	100
	M10	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	100
HWZ	#6	24 to 14	750	900	2	6	4,000	9,000	0.500	0.500	20
	#8	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	#10	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	1/4–20	20 to 14	750	850	4	12	8,000	12,200	0.500	0.500	50
	5/16–18	20 to 11	1,400	1,600	4	8	11,200	18,300	0.750	0.750	100
	3/8–16	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	100
	1/2–13	16 to 11	1,400	1,800	4	10	10,700	16,500	1.000	1.000	100–150
HWZ Metric	M4	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	M5	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	M6	20 to 14	750	850	4	12	8,000	12,200	0.500	0.500	50
	M8	20 to 11	1,400	1,600	4	8	11,200	18,300	0.750	0.750	100
	M10	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	100
PDZ	#6	24 to 14	800	900	4	8	3,500	7,700	0.500	0.500	30
	#8	24 to 14	800	900	4	8	3,500	7,700	0.500	0.500	30
	#10	20 to 14	800	950	3	8	2,700	10,300	0.625	0.625	30
	1/4–20	20 to 13	850	1,500	4	8	6,700	10,300	0.750	0.750	50
	5/16–18	20 to 13	1,500	1,650	3	8	9,500	12,000	0.875	0.875	50

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Weld Data Guide

Part Type	Thread Size	Base Material Gage	Pressure Range in LBS.		Weld Cycles		Current in Secondary Amps.		Recommended Electrode Dia.		Approx. KVA Size Welder
			From	To	From	To	From	To	Part Side	Sheet Side	
RWZ	#6	24 to 14	850	1,400	2	6	5,700	12,500	0.500	0.500	50–75
	#8	24 to 14	850	1,400	3	6	10,800	13,500	0.500	0.500	50–75
	#10	20 to 14	800	1,000	3	6	12,100	14,400	0.500	0.500	50–75
	1/4–20	18 to 11	2,700	3,400	3	6	23,500	28,500	1.000	1.000	150
	5/16–18	18 to 11	3,300	4,200	5	8	27,500	30,000	1.250	1.250	150
	3/8–16	18 to 11	3,500	4,200	6	10	29,500	32,500	1.250	1.250	200
SSZ	#6	24 to 14	700	850	2	6	5,300	6,500	0.219	0.219	20
	#8	24 to 14	700	850	2	8	5,500	6,700	0.219	0.312	20
	#10	24 to 14	700	850	2	8	5,500	6,700	0.219	0.312	20
	1/4–20	20 to 13	700	900	4	8	6,600	8,500	0.250	0.312	30
	5/16–18	18 to 11	850	1,500	3	8	8,400	14,800	0.312	0.375	50
	3/8–16	18 to 11	1,450	1,550	7	12	10,900	19,400	0.312	0.375	75
PGZ	0.119	24 to 14	750	900	2	6	4,000	9,000	0.500	0.500	20
	0.144	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	0.163	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	0.190	24 to 14	800	1,100	5	10	9,500	13,200	0.500	0.500	50
	0.250	20 to 13	750	1,000	4	12	8,000	12,200	0.625	0.625	50
	0.335	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	75–100
	0.375	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	75–100
PHZ	0.119	24 to 14	750	900	2	6	4,000	9,000	0.500	0.500	20
	0.144	24 to 14	750	900	2	8	6,000	9,000	0.500	0.500	20
	0.163	20 to 14	750	850	4	10	7,700	11,300	0.500	0.500	30
	0.190	24 to 14	800	1,100	5	10	9,500	13,200	0.500	0.500	50
	0.218	20 to 13	750	1,000	5	12	8,000	12,200	0.625	0.625	50
	0.250	20 to 13	750	1,000	4	12	8,000	12,200	0.625	0.625	50
	0.277	20 to 11	750	1,000	5	12	8,000	12,200	0.625	0.625	50
	0.335	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	75–100
	0.375	20 to 11	1,400	1,700	4	10	11,300	19,000	1.000	1.000	75–100
	0.500	16 to 11	1,400	1,800	4	10	11,000	16,500	1.000	1.000	100–150
SPZ	0.119	24 to 14	700	850	2	6	5,300	6,500	0.219	0.219	20
	0.144	24 to 14	700	850	2	8	5,500	6,700	0.219	0.312	20
	0.163	24 to 14	700	850	2	8	5,500	6,700	0.219	0.312	20
	0.190	24 to 14	700	850	2	8	5,500	6,700	0.219	0.312	20
	0.218	20 to 13	700	900	4	8	6,600	8,500	0.250	0.312	30
	0.250	20 to 13	850	1,450	4	8	6,400	13,900	0.250	0.312	50
	0.277	18 to 11	850	1,500	3	8	8,400	14,800	0.250	0.375	50–75

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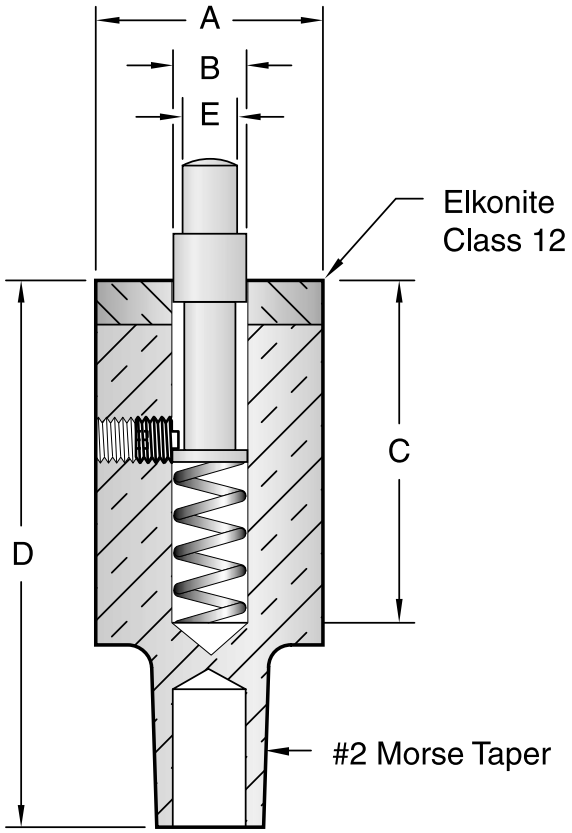
Nut Electrode Inch						
Thread Size	Part Numbers	(A) Electrode Diameter	(B) Sheet Locator	(C) Hole Depth	(D) Overall Length	(E) Nut Locator
#6	ELM 0035 N	0.625	0.203	1.750	3.000	.102
#8	ELM 0040 N	0.625	0.218	1.750	3.000	.125
#10	EL 0190 N	0.625	0.250	1.750	3.000	.158
1/4-20	ELM 0060 N	1.250	0.312	1.750	3.250	.188
5/16-18	EL 0312 N	1.250	0.342	2.125	3.250	.245
3/8-16	EL 0375 N	1.250	0.406	2.125	3.250	.300

Nut Electrode Metric						
Thread Size	Part Numbers	(A) Electrode Diameter	(B) Pin Diameter	(C) Hole Depth	(D) Overall Length	(E) Nut Locator
M3.5	ELM 0035 N	0.625	0.203	1.750	3.000	.102
M4	ELM 0040 N	0.625	0.218	1.750	3.000	.125
M5	ELM 0050 N	0.625	0.250	1.750	3.000	.158
M6	ELM 0060 N	1.250	0.312	2.125	3.250	.188
M8	ELM 0080 N	1.250	0.342	2.125	3.250	.255
M10	ELM 0100 N	1.250	0.406	2.125	3.250	.322



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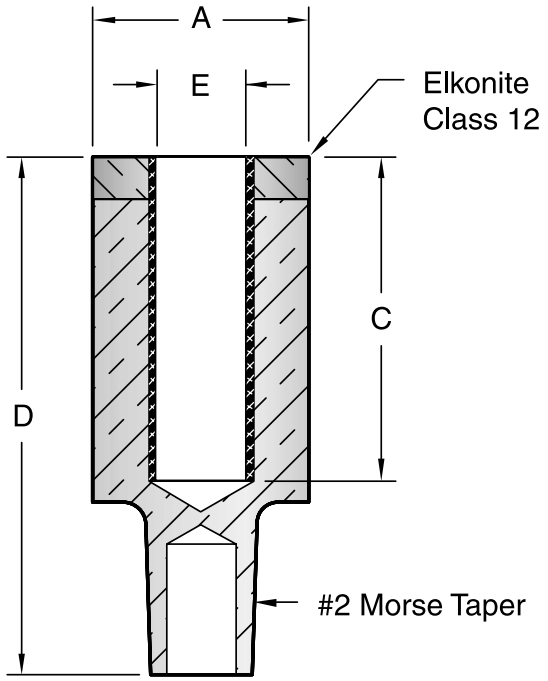
Screw Electrode Inch					
Thread Size	Part Numbers	(A) Electrode Diameter	(C) Hole Depth	(D) Overall Length	(E) Internal Diameter
#6	ELM 0035 S	0.625	1.750	3.000	.140
#8	EL 0164 S	0.625	1.750	3.000	.168
#10	EL 0190 S	0.625	1.750	3.000	.194
1/4-20	EL 0250 S	0.625	1.750	3.000	.255
5/16-18	ELM 0080 S	1.250	2.125	3.250	.321
3/8-16	EL 0375 S	1.250	2.125	3.250	.380
1/2-13	EL 0500 S	1.250	2.125	3.250	.510

Screw Electrode Metric					
Thread Size	Part Numbers	(A) Electrode Diameter	(C) Hole Depth	(D) Overall Length	(E) Internal Diameter
M3.5	ELM 0035 S	0.625	1.750	3.000	.140
M4	ELM 0040 S	0.625	1.750	3.000	.164
M5	ELM 0050 S	0.625	1.750	3.000	.201
M6	ELM 0060 S	0.625	1.750	3.000	.240
M8	ELM 0080 S	1.250	2.125	3.250	.321
M10	ELM 0100 S	1.250	2.125	3.250	.402
M12	ELM 0120 S	1.250	2.125	3.250	.482



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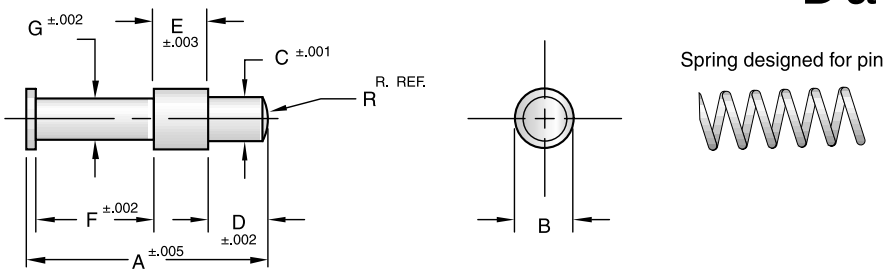
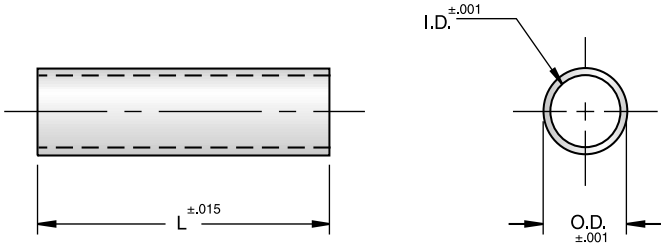
Electrode Pins & Springs



Part Number	For Electrode	A	B	C	D	E	F	G	R
EL - 3013	ELM 0035 N	1.234	.201	.102	.281	.250	.641	.081	.11
EL - 3023	ELM 0040 N	1.234	.217	.125	.281	.250	.641	.097	.12
EL - 3033	EL 0190 N	1.234	.248	.143	.281	.250	.641	.128	.14
EL - 3043	ELM 0050 N	1.234	.248	.158	.281	.250	.641	.128	.14
EL - 3053	ELM 0060 N	1.656	.311	.188	.406	.375	.812	.191	.18
EL - 3063	EL 0312 N	1.656	.340	.245	.406	.375	.812	.220	.25
EL - 3073	ELM 0080 N	1.656	.340	.255	.406	.375	.812	.220	.25
EL - 3083	EL 0375 N	1.656	.403	.300	.406	.375	.812	.283	.31
EL - 3093	ELM 0100 N	1.656	.403	.322	.406	.375	.812	.283	.31

Electrode Sleeves



Part Number	For Electrode	I. D.	O. D.	L
EL - 1013	ELM 0035 S	.140	.189	1.750
EL - 1023	ELM 0040 S	.164	.213	1.750
EL - 1033	EL 0164 S	.168	.221	1.750
EL - 1043	EL 0190 S	.194	.250	1.750
EL - 1053	ELM 0050 S	.201	.257	1.750
EL - 1063	ELM 0060 S	.240	.302	1.750
EL - 1073	EL 0250 S	.255	.316	1.750
EL - 1083	ELM 0080 S	.321	.406	2.125
EL - 1093	EL 0375 S	.380	.484	2.125
EL - 1103	ELM 0100 S	.402	.500	2.125
EL - 1113	ELM 0120 S	.482	.570	2.125
EL - 1123	EL 0500 S	.510	.610	2.125

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