





*Catalog 2017*

# TUFFALOY

## Resistance Welding Products

*Leader in the Industry Since 1937*

# QUOTE REQUEST SPECIALS AND CUSTOMS

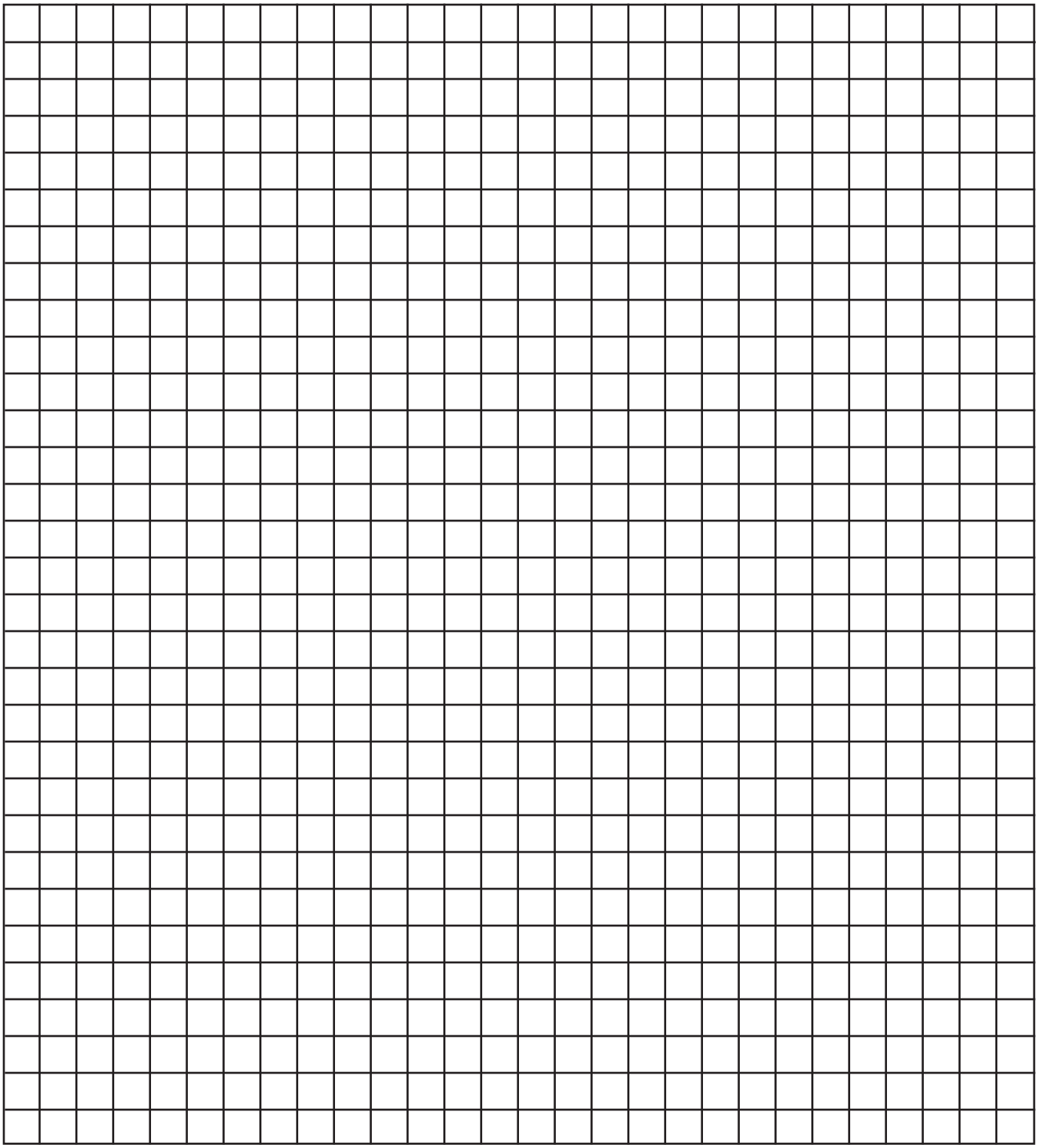
Contact Name: _____ Company: _____

Address: _____

Phone: _____ Fax: _____ Email: _____

Part Information: _____ Material/Alloy: _____

Part Number or Description: _____



Please send a photo of part laying on the grid area of this completed page to – customerservice@tuffaloy.com

# RESISTANCE WELDING PRODUCTS

The little **"TUFFALOY man"** is now over eighty years old. It was in 1937 that Welding Sales & Engineering Company of Detroit introduced a new line of resistance welding alloys tradenamed TUFFALOY. What began as just a part of a general line of welding equipment soon became their main business, as electrode holders and other resistance welding accessories were added to the TUFFALOY product line. Today this now-familiar name represents the most innovative and respected resistance welding alloy and accessory company in the field.

Even a catalog as comprehensive as this one does not fully show everything TUFFALOY is capable of supplying. We have the ability to answer needs that we have yet to hear about. So, if you don't find the answers in these pages, tell us what you're looking for. Let us work with you in finding solutions.

Call your TUFFALOY distributor or TUFFALOY
Customer Services at **1-800-521-3722**
or **864-879-0763**. (Fax: **864-877-2212**)

Visit our Internet site at:
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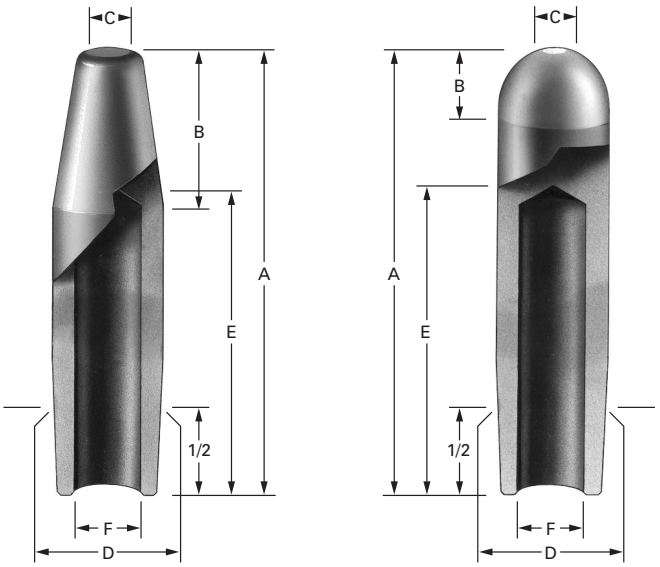
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# TUFFALOY STANDARD STRAIGHT TIPS

Straight tips from TUFFALOY are distinguished for their high conductivity and resistance to deformation, which are the two major requirements of resistance welding tips. Modern manufacturing methods and constant scientific quality control make the difference, starting with the alloying of pure copper, through bar extrusion, and the conversion of this high-quality bar stock into welding tips.

TUFFALOY ensures conformity to all standard dimensions. Before shipment, all tips must pass inspection by gage for uniform length, taper, and outline of point.




## 'A' POINTED NOSE

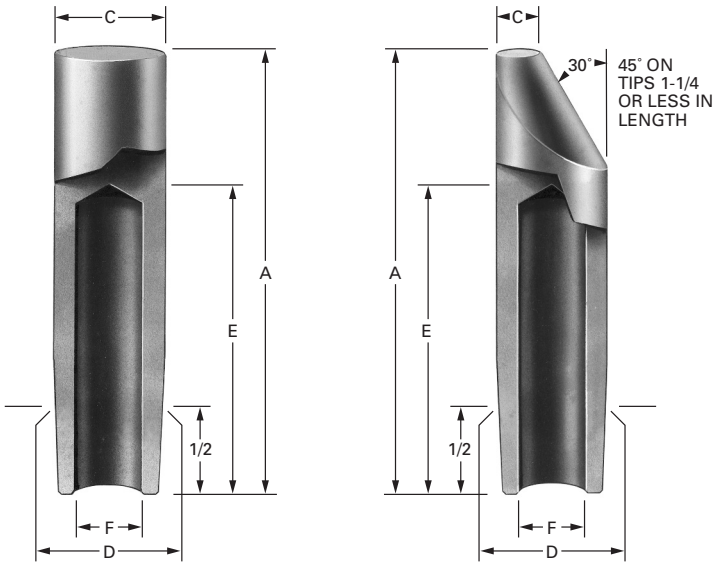
## 'B' DOME NOSE

| A Overall Length | C Welding Face Dia. | D Gauging Dia. | E Water Hole Depth | F Water Hole Dia. | 'A' POINTED NOSE | | | | | 'B' DOME NOSE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | RWMA CLASS 1 | | RWMA CLASS 2 | | | RWMA CLASS 1 | | RWMA CLASS 2 | |
| | | | | | B Nose Length | Description | Part No. | Description | Part No. | B Nose Length | Description | Part No. | Description | Part No. |
| **NO. 4 RW TAPER - 1/2" DIAMETER** | | | | | | | | | | | | | | |
| 1 | 3/16 | .463 | 1/2 | 9/32 | 3/8 | A-1404 | 131-1404 | A-2404 | 132-2404 | 1/4 | B-1404 | 133-1404 | B-2404 | 134-2404 |
| 1-1/4 | 3/16 | .463 | 3/4 | 9/32 | 3/4 | A-1405 | 131-1405 | A-2405 | 132-2405 | 1/4 | B-1405 | 133-1405 | B-2405 | 134-2405 |
| 1-1/2 | 3/16 | .463 | 1 | 9/32 | 3/4 | A-1406 | 131-1406 | A-2406 | 132-2406 | 1/4 | B-1406 | 133-1406 | B-2406 | 134-2406 |
| 1-3/4 | 3/16 | .463 | 1-1/4 | 9/32 | 3/4 | A-1407 | 131-1407 | A-2407 | 132-2407 | 1/4 | B-1407 | 133-1407 | B-2407 | 134-2407 |
| 2 | 3/16 | .463 | 1-1/2 | 9/32 | 3/4 | A-1408 | 131-1408 | A-2408 | 132-2408 | 1/4 | B-1408 | 133-1408 | B-2408 | 134-2408 |
| 2-1/4 | 3/16 | .463 | 1-3/4 | 9/32 | 3/4 | A-1409 | 131-1409 | A-2409 | 132-2409 | 1/4 | B-1409 | 133-1409 | B-2409 | 134-2409 |
| 2-1/2 | 3/16 | .463 | 2 | 9/32 | 3/4 | A-1410 | 131-1410 | A-2410 | 132-2410 | 1/4 | B-1410 | 133-1410 | B-2410 | 134-2410 |
| 2-3/4 | 3/16 | .463 | 2-1/4 | 9/32 | 3/4 | A-1411 | 131-1411 | A-2411 | 132-2411 | 1/4 | B-1411 | 133-1411 | B-2411 | 134-2411 |
| 3 | 3/16 | .463 | 2-1/2 | 9/32 | 3/4 | A-1412 | 131-1412 | A-2412 | 132-2412 | 1/4 | B-1412 | 133-1412 | B-2412 | 134-2412 |
| 3-1/4 | 3/16 | .463 | 2-3/4 | 9/32 | 3/4 | A-1413 | 131-1413 | A-2413 | 132-2413 | 1/4 | B-1413 | 133-1413 | B-2413 | 134-2413 |
| 3-1/2 | 3/16 | .463 | 3 | 9/32 | 3/4 | A-1414 | 131-1414 | A-2414 | 132-2414 | 1/4 | B-1414 | 133-1414 | B-2414 | 134-2414 |
| 3-3/4 | 3/16 | .463 | 3-1/4 | 9/32 | 3/4 | A-1415 | 131-1415 | A-2415 | 132-2415 | 1/4 | B-1415 | 133-1415 | B-2415 | 134-2415 |
| 4 | 3/16 | .463 | 3-1/2 | 9/32 | 3/4 | A-1416 | 131-1416 | A-2416 | 132-2416 | 1/4 | B-1416 | 133-1416 | B-2416 | 134-2416 |
| **NO. 5 RW TAPER - 5/8" DIAMETER** | | | | | | | | | | | | | | |
| 1-1/4 | 1/4 | .613 | 3/4 | 3/8 | 1/2 | A-1505 | 131-1505 | A-2505 | 132-2505 | 3/8 | B-1505 | 133-1505 | B-2505 | 134-2505 |
| 1-1/2 | 1/4 | .613 | 3/4 | 3/8 | 7/8 | A-1506 | 131-1506 | A-2506 | 132-2506 | 3/8 | B-1506 | 133-1506 | B-2506 | 134-2506 |
| 1-3/4 | 1/4 | .613 | 1 | 3/8 | 7/8 | A-1507 | 131-1507 | A-2507 | 132-2507 | 3/8 | B-1507 | 133-1507 | B-2507 | 134-2507 |
| 2 | 1/4 | .613 | 1-1/4 | 3/8 | 7/8 | A-1508 | 131-1508 | A-2508 | 132-2508 | 3/8 | B-1508 | 133-1508 | B-2508 | 134-2508 |
| 2-1/4 | 1/4 | .613 | 1-1/2 | 3/8 | 7/8 | A-1509 | 131-1509 | A-2509 | 132-2509 | 3/8 | B-1509 | 133-1509 | B-2509 | 134-2509 |
| 2-1/2 | 1/4 | .613 | 1-3/4 | 3/8 | 7/8 | A-1510 | 131-1510 | A-2510 | 132-2510 | 3/8 | B-1510 | 133-1510 | B-2510 | 134-2510 |
| 2-3/4 | 1/4 | .613 | 2 | 3/8 | 7/8 | A-1511 | 131-1511 | A-2511 | 132-2511 | 3/8 | B-1511 | 133-1511 | B-2511 | 134-2511 |
| 3 | 1/4 | .613 | 2-1/4 | 3/8 | 7/8 | A-1512 | 131-1512 | A-2512 | 132-2512 | 3/8 | B-1512 | 133-1512 | B-2512 | 134-2512 |
| 3-1/4 | 1/4 | .613 | 2-1/2 | 3/8 | 7/8 | A-1513 | 131-1513 | A-2513 | 132-2513 | 3/8 | B-1513 | 133-1513 | B-2513 | 134-2513 |
| 3-1/2 | 1/4 | .613 | 2-3/4 | 3/8 | 7/8 | A-1514 | 131-1514 | A-2514 | 132-2514 | 3/8 | B-1514 | 133-1514 | B-2514 | 134-2514 |
| 3-3/4 | 1/4 | .613 | 3 | 3/8 | 7/8 | A-1515 | 131-1515 | A-2515 | 132-2515 | 3/8 | B-1515 | 133-1515 | B-2515 | 134-2515 |
| 4 | 1/4 | .613 | 3-1/4 | 3/8 | 7/8 | A-1516 | 131-1516 | A-2516 | 132-2516 | 3/8 | B-1516 | 133-1516 | B-2516 | 134-2516 |
| **NO. 6 RW TAPER - 3/4" DIAMETER** | | | | | | | | | | | | | | |
| 2 | 9/32 | .731 | 1-1/4 | 7/16 | 1 | A-1608 | 131-1608 | A-2608 | 132-2608 | 3/8 | B-1608 | 133-1608 | B-2608 | 134-2608 |
| 2-1/2 | 9/32 | .731 | 1-3/4 | 7/16 | 1 | A-1610 | 131-1610 | A-2610 | 132-2610 | 3/8 | B-1610 | 133-1610 | B-2610 | 134-2610 |
| 3 | 9/32 | .731 | 2-1/4 | 7/16 | 1 | A-1612 | 131-1612 | A-2612 | 132-2612 | 3/8 | B-1612 | 133-1612 | B-2612 | 134-2612 |
| 3-1/2 | 9/32 | .731 | 2-3/4 | 7/16 | 1 | A-1614 | 131-1614 | A-2614 | 132-2614 | 3/8 | B-1614 | 133-1614 | B-2614 | 134-2614 |
| 4 | 9/32 | .731 | 3-1/4 | 7/16 | 1 | A-1616 | 131-1616 | A-2616 | 132-2616 | 3/8 | B-1616 | 133-1616 | B-2616 | 134-2616 |
| **NO. 7 RW TAPER - 7/8" DIAMETER** | | | | | | | | | | | | | | |
| 2 | 5/16 | .844 | 1-1/4 | 1/2 | 1-1/8 | A-1708 | 131-1708 | A-2708 | 132-2708 | 3/8 | B-1708 | 133-1708 | B-2708 | 134-2708 |
| 2-1/2 | 5/16 | .844 | 1-3/4 | 1/2 | 1-1/8 | A-1710 | 131-1710 | A-2710 | 132-2710 | 3/8 | B-1710 | 133-1710 | B-2710 | 134-2710 |
| 3 | 5/16 | .844 | 2-1/4 | 1/2 | 1-1/8 | A-1712 | 131-1712 | A-2712 | 132-2712 | 3/8 | B-1712 | 133-1712 | B-2712 | 134-2712 |
| 3-1/2 | 5/16 | .844 | 2-3/4 | 1/2 | 1-1/8 | A-1714 | 131-1714 | A-2714 | 132-2714 | 3/8 | B-1714 | 133-1714 | B-2714 | 134-2714 |
| 4 | 5/16 | .844 | 3-1/2 | 1/2 | 1-1/8 | A-1716 | 131-1716 | A-2716 | 132-2716 | 3/8 | B-1716 | 133-1716 | B-2716 | 134-2716 |

The bright shiny look of TUFFALOY tips is the result of a passivation process that eliminates excessive oxidation. It reflects the deep-down quality built into these tips and into all TUFFALOY products.

Only RWMA Class 1 (TUFFALOY 88) and Class 2 (TUFFALOY 77) tips are listed here. Class 3 alloy (TUFFALOY 55) tips are also available. For recommended uses of these alloys, see page 49.

To order Class 3 alloy tips, change description code to indicate it: see "Key to Description", page 6.

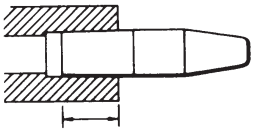



## 'C' FLAT NOSE

## 'D' OFFSET NOSE

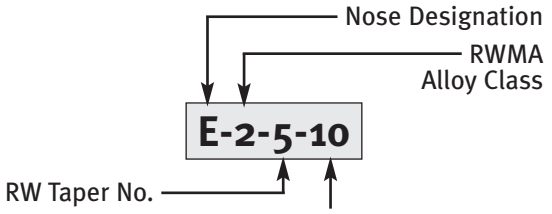
| A Overall Length | D Gauging Dia. | E Water Hole Depth | F Water Hole Dia. | C Welding Face Dia. | RWMA CLASS 1 Description | RWMA CLASS 1 Part No. | RWMA CLASS 2 Description | RWMA CLASS 2 Part No. | C Welding Face Dia. | RWMA CLASS 1 Description | RWMA CLASS 1 Part No. | RWMA CLASS 2 Description | RWMA CLASS 2 Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NO. 4 RW TAPER - 1/2" DIAMETER** | | | | | | | | | | | | | |
| 1 | .463 | 1/2 | 9/32 | 1/2 | C-1404 | 135-1404 | C-2404 | 136-2404 | 3/16 | D-1404 | 137-1404 | D-2404 | 138-2404 |
| 1-1/4 | .463 | 3/4 | 9/32 | 1/2 | C-1405 | 135-1405 | C-2405 | 136-2405 | 3/16 | D-1405 | 137-1405 | D-2405 | 138-2405 |
| 1-1/2 | .463 | 1 | 9/32 | 1/2 | C-1406 | 135-1406 | C-2406 | 136-2406 | 3/16 | D-1406 | 137-1406 | D-2406 | 138-2406 |
| 1-3/4 | .463 | 1-1/4 | 9/32 | 1/2 | C-1407 | 135-1407 | C-2407 | 136-2407 | 3/16 | D-1407 | 137-1407 | D-2407 | 138-2407 |
| 2 | .463 | 1-1/2 | 9/32 | 1/2 | C-1408 | 135-1408 | C-2408 | 136-2408 | 3/16 | D-1408 | 137-1408 | D-2408 | 138-2408 |
| 2-1/4 | .463 | 1-3/4 | 9/32 | 1/2 | C-1409 | 135-1409 | C-2409 | 136-2409 | 3/16 | D-1409 | 137-1409 | D-2409 | 138-2409 |
| 2-1/2 | .463 | 2 | 9/32 | 1/2 | C-1410 | 135-1410 | C-2410 | 136-2410 | 3/16 | D-1410 | 137-1410 | D-2410 | 138-2410 |
| 2-3/4 | .463 | 2-1/4 | 9/32 | 1/2 | C-1411 | 135-1411 | C-2411 | 136-2411 | 3/16 | D-1411 | 137-1411 | D-2411 | 138-2411 |
| 3 | .463 | 2-1/2 | 9/32 | 1/2 | C-1412 | 135-1412 | C-2412 | 136-2412 | 3/16 | D-1412 | 137-1412 | D-2412 | 138-2412 |
| 3-1/4 | .463 | 2-3/4 | 9/32 | 1/2 | C-1413 | 135-1413 | C-2413 | 136-2413 | 3/16 | D-1413 | 137-1413 | D-2413 | 138-2413 |
| 3-1/2 | .463 | 3 | 9/32 | 1/2 | C-1414 | 135-1414 | C-2414 | 136-2414 | 3/16 | D-1414 | 137-1414 | D-2414 | 138-2414 |
| 3-3/4 | .463 | 3-1/4 | 9/32 | 1/2 | C-1415 | 135-1415 | C-2415 | 136-2415 | 3/16 | D-1415 | 137-1415 | D-2415 | 138-2415 |
| 4 | .463 | 3-1/2 | 9/32 | 1/2 | C-1416 | 135-1416 | C-2416 | 136-2416 | 3/16 | D-1416 | 137-1416 | D-2416 | 138-2416 |
| **NO. 5 RW TAPER - 5/8" DIAMETER** | | | | | | | | | | | | | |
| 1-1/4 | .613 | 3/4 | 3/8 | 5/8 | C-1505 | 135-1505 | C-2505 | 136-2505 | 1/4 | D-1505 | 137-1505 | D-2505 | 138-2505 |
| 1-1/2 | .613 | 3/4 | 3/8 | 5/8 | C-1506 | 135-1506 | C-2506 | 136-2506 | 1/4 | D-1506 | 137-1506 | D-2506 | 138-2506 |
| 1-3/4 | .613 | 1 | 3/8 | 5/8 | C-1507 | 135-1507 | C-2507 | 136-2507 | 1/4 | D-1507 | 137-1507 | D-2507 | 138-2507 |
| 2 | .613 | 1-1/4 | 3/8 | 5/8 | C-1508 | 135-1508 | C-2508 | 136-2508 | 1/4 | D-1508 | 137-1508 | D-2508 | 138-2508 |
| 2-1/4 | .613 | 1-1/2 | 3/8 | 5/8 | C-1509 | 135-1509 | C-2509 | 136-2509 | 1/4 | D-1509 | 137-1509 | D-2509 | 138-2509 |
| 2-1/2 | .613 | 1-3/4 | 3/8 | 5/8 | C-1510 | 135-1510 | C-2510 | 136-2510 | 1/4 | D-1510 | 137-1510 | D-2510 | 138-2510 |
| 2-3/4 | .613 | 2 | 3/8 | 5/8 | C-1511 | 135-1511 | C-2511 | 136-2511 | 1/4 | D-1511 | 137-1511 | D-2511 | 138-2511 |
| 3 | .613 | 2-1/4 | 3/8 | 5/8 | C-1512 | 135-1512 | C-2512 | 136-2512 | 1/4 | D-1512 | 137-1512 | D-2512 | 138-2512 |
| 3-1/4 | .613 | 2-1/2 | 3/8 | 5/8 | C-1513 | 135-1513 | C-2513 | 136-2513 | 1/4 | D-1513 | 137-1513 | D-2513 | 138-2513 |
| 3-1/2 | .613 | 2-3/4 | 3/8 | 5/8 | C-1514 | 135-1514 | C-2514 | 136-2514 | 1/4 | D-1514 | 137-1514 | D-2514 | 138-2514 |
| 3-3/4 | .613 | 3 | 3/8 | 5/8 | C-1515 | 135-1515 | C-2515 | 136-2515 | 1/4 | D-1515 | 137-1515 | D-2515 | 138-2515 |
| 4 | .613 | 3-1/4 | 3/8 | 5/8 | C-1516 | 135-1516 | C-2516 | 136-2516 | 1/4 | D-1516 | 137-1516 | D-2516 | 138-2516 |
| **NO. 6 RW TAPER - 3/4" DIAMETER** | | | | | | | | | | | | | |
| 2 | .731 | 1-1/4 | 7/16 | 3/4 | C-1608 | 135-1608 | C-2608 | 136-2608 | 9/32 | D-1608 | 137-1608 | D-2608 | 138-2608 |
| 2-1/2 | .731 | 1-3/4 | 7/16 | 3/4 | C-1610 | 135-1610 | C-2610 | 136-2610 | 9/32 | D-1610 | 137-1610 | D-2610 | 138-2610 |
| 3 | .731 | 2-1/4 | 7/16 | 3/4 | C-1612 | 135-1612 | C-2612 | 136-2612 | 9/32 | D-1612 | 137-1612 | D-2612 | 138-2612 |
| 3-1/2 | .731 | 2-3/4 | 7/16 | 3/4 | C-1614 | 135-1614 | C-2614 | 136-2614 | 9/32 | D-1614 | 137-1614 | D-2614 | 138-2614 |
| 4 | .731 | 3-1/4 | 7/16 | 3/4 | C-1616 | 135-1616 | C-2616 | 136-2616 | 9/32 | D-1616 | 137-1616 | D-2616 | 138-2616 |
| **NO. 7 RW TAPER - 7/8" DIAMETER** | | | | | | | | | | | | | |
| 2 | .844 | 1-1/4 | 1/2 | 7/8 | C-1708 | 135-1708 | C-2708 | 136-2708 | 5/16 | D-1708 | 137-1708 | D-2708 | 138-2708 |
| 2-1/2 | .844 | 1-3/4 | 1/2 | 7/8 | C-1710 | 135-1710 | C-2710 | 136-2710 | 5/16 | D-1710 | 137-1710 | D-2710 | 138-2710 |
| 3 | .844 | 2-1/4 | 1/2 | 7/8 | C-1712 | 135-1712 | C-2712 | 136-2712 | 5/16 | D-1712 | 137-1712 | D-2712 | 138-2712 |
| 3-1/2 | .844 | 2-3/4 | 1/2 | 7/8 | C-1714 | 135-1714 | C-2714 | 136-2714 | 5/16 | D-1714 | 137-1714 | D-2714 | 138-2714 |
| 4 | .844 | 3-1/2 | 1/2 | 7/8 | C-1716 | 135-1716 | C-2716 | 136-2716 | 5/16 | D-1716 | 137-1716 | D-2716 | 138-2716 |

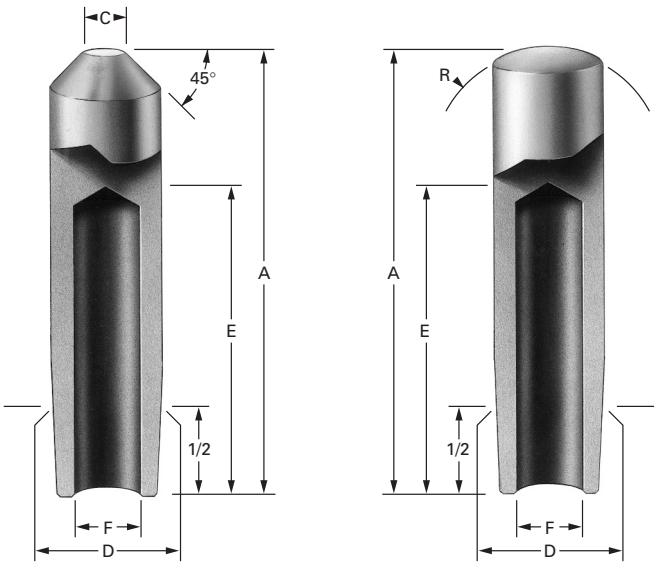
## TAPER ENGAGEMENT



| TIP SIZE | LENGTH |
|---|---|
| 4 RW | 1/2-in. |
| 5 RW | 3/4-in. |
| 6 RW | 7/8-in. |
| 7 RW | 1-1/8-in. |

## KEY TO DESCRIPTION




## 'E' TRUNCATED CONE

## 'F' RADIUS FACED

| A Overall Length | D Gauging Dia. | E Water Hole Depth | F Water Hole Dia. | C Welding Face Dia. | RWMA CLASS 1 Description | RWMA CLASS 1 Part No. | RWMA CLASS 2 Description | RWMA CLASS 2 Part No. | R Nose Radius | RWMA CLASS 1 Description | RWMA CLASS 1 Part No. | RWMA CLASS 2 Description | RWMA CLASS 2 Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NO. 4 RW TAPER - 1/2" DIAMETER** | | | | | | | | | | | | | |
| 1 | .463 | 1/2 | 9/32 | 3/16 | E-1404 | 140-1404 | E-2404 | 140-2404 | 2 | F-1404 | 141-1404 | F-2404 | 141-2404 |
| 1-1/4 | .463 | 3/4 | 9/32 | 3/16 | E-1405 | 140-1405 | E-2405 | 140-2405 | 2 | F-1405 | 141-1405 | F-2405 | 141-2405 |
| 1-1/2 | .463 | 1 | 9/32 | 3/16 | E-1406 | 140-1406 | E-2406 | 140-2406 | 2 | F-1406 | 141-1406 | F-2406 | 141-2406 |
| 1-3/4 | .463 | 1-1/4 | 9/32 | 3/16 | E-1407 | 140-1407 | E-2407 | 140-2407 | 2 | F-1407 | 141-1407 | F-2407 | 141-2407 |
| 2 | .463 | 1-1/2 | 9/32 | 3/16 | E-1408 | 140-1408 | E-2408 | 140-2408 | 2 | F-1408 | 141-1408 | F-2408 | 141-2408 |
| 2-1/4 | .463 | 1-3/4 | 9/32 | 3/16 | E-1409 | 140-1409 | E-2409 | 140-2409 | 2 | F-1409 | 141-1409 | F-2409 | 141-2409 |
| 2-1/2 | .463 | 2 | 9/32 | 3/16 | E-1410 | 140-1410 | E-2410 | 140-2410 | 2 | F-1410 | 141-1410 | F-2410 | 141-2410 |
| 2-3/4 | .463 | 2-1/4 | 9/32 | 3/16 | E-1411 | 140-1411 | E-2411 | 140-2411 | 2 | F-1411 | 141-1411 | F-2411 | 141-2411 |
| 3 | .463 | 2-1/2 | 9/32 | 3/16 | E-1412 | 140-1412 | E-2412 | 140-2412 | 2 | F-1412 | 141-1412 | F-2412 | 141-2412 |
| 3-1/4 | .463 | 2-3/4 | 9/32 | 3/16 | E-1413 | 140-1413 | E-2413 | 140-2413 | 2 | F-1413 | 141-1413 | F-2413 | 141-2413 |
| 3-1/2 | .463 | 3 | 9/32 | 3/16 | E-1414 | 140-1414 | E-2414 | 140-2414 | 2 | F-1414 | 141-1414 | F-2414 | 141-2414 |
| 3-3/4 | .463 | 3-1/4 | 9/32 | 3/16 | E-1415 | 140-1415 | E-2415 | 140-2415 | 2 | F-1415 | 141-1415 | F-2415 | 141-2415 |
| 4 | .463 | 3-1/2 | 9/32 | 3/16 | E-1416 | 140-1416 | E-2416 | 140-2416 | 2 | F-1416 | 141-1416 | F-2416 | 141-2416 |
| **NO. 5 RW TAPER - 5/8" DIAMETER** | | | | | | | | | | | | | |
| 1-1/4 | .613 | 3/4 | 3/8 | 1/4 | E-1505 | 140-1505 | E-2505 | 140-2505 | 2 | F-1515 | 141-1505 | F-2505 | 141-2505 |
| 1-1/2 | .613 | 3/4 | 3/8 | 1/4 | E-1506 | 140-1506 | E-2506 | 140-2506 | 2 | F-1506 | 141-1506 | F-2506 | 141-2506 |
| 1-3/4 | .613 | 1 | 3/8 | 1/4 | E-1507 | 140-1507 | E-2507 | 140-2507 | 2 | F-1507 | 141-1507 | F-2507 | 141-2507 |
| 2 | .613 | 1-1/4 | 3/8 | 1/4 | E-1508 | 140-1508 | E-2508 | 140-2508 | 2 | F-1508 | 141-1508 | F-2508 | 141-2508 |
| 2-1/4 | .613 | 1-1/2 | 3/8 | 1/4 | E-1509 | 140-1509 | E-2509 | 140-2509 | 2 | F-1509 | 141-1509 | F-2509 | 141-2509 |
| 2-1/2 | .613 | 1-3/4 | 3/8 | 1/4 | E-1510 | 140-1510 | E-2510 | 140-2510 | 2 | F-1510 | 141-1510 | F-2510 | 141-2510 |
| 2-3/4 | .613 | 2 | 3/8 | 1/4 | E-1511 | 140-1511 | E-2511 | 140-2511 | 2 | F-1511 | 141-1511 | F-2511 | 141-2511 |
| 3 | .613 | 2-1/4 | 3/8 | 1/4 | E-1512 | 140-1512 | E-2512 | 140-2512 | 2 | F-1512 | 141-1512 | F-2512 | 141-2512 |
| 3-1/4 | .613 | 2-1/2 | 3/8 | 1/4 | E-1513 | 140-1513 | E-2513 | 140-2513 | 2 | F-1513 | 141-1513 | F-2513 | 141-2513 |
| 3-1/2 | .613 | 2-3/4 | 3/8 | 1/4 | E-1514 | 140-1514 | E-2514 | 140-2514 | 2 | F-1514 | 141-1514 | F-2514 | 141-2514 |
| 3-3/4 | .613 | 3 | 3/8 | 1/4 | E-1515 | 140-1515 | E-2515 | 140-2515 | 2 | F-1515 | 141-1515 | F-2515 | 141-2515 |
| 4 | .613 | 3-1/4 | 3/8 | 1/4 | E-1516 | 140-1516 | E-2516 | 140-2516 | 2 | F-1516 | 141-1516 | F-2516 | 141-2516 |
| **NO. 6 RW TAPER - 3/4" DIAMETER** | | | | | | | | | | | | | |
| 2 | .731 | 1-1/4 | 7/16 | 9/32 | E-1608 | 140-1608 | E-2608 | 140-2608 | 4 | F-1608 | 141-1608 | F-2608 | 141-2608 |
| 2-1/2 | .731 | 1-3/4 | 7/16 | 9/32 | E 1610 | 140-1610 | E-2610 | 140-2610 | 4 | F-1610 | 141-1610 | F-2610 | 141-2610 |
| 3 | .731 | 2-1/4 | 7/16 | 9/32 | E-1612 | 140-1612 | E-2612 | 140-2612 | 4 | F-1612 | 141-1612 | F-2612 | 141-2612 |
| 3-1/2 | .731 | 2-3/4 | 7/16 | 9/32 | E-1614 | 140-1614 | E-2614 | 140-2614 | 4 | F-1614 | 141-1614 | F-2614 | 141-2614 |
| 4 | .731 | 3-1/4 | 7/16 | 9/32 | E-1616 | 140-1616 | E-2616 | 140-2616 | 4 | F-1616 | 141-1616 | F-2616 | 141-2616 |
| **NO. 7 RW TAPER - 7/8" DIAMETER** | | | | | | | | | | | | | |
| 2 | .844 | 1-1/4 | 1/2 | 5/16 | E-1708 | 140-1708 | E-2708 | 140-2708 | 6 | F-1708 | 141-1708 | F 2708 | 141-2708 |
| 2-1/2 | .844 | 1-3/4 | 1/2 | 5/16 | E-1710 | 140-1710 | E-2710 | 140-2710 | 6 | F-1710 | 141-1710 | F-2710 | 141-2710 |
| 3 | .844 | 2-1/4 | 1/2 | 5/16 | E-1712 | 140-1712 | E-2712 | 140-2712 | 6 | F-1712 | 141-1712 | F-2712 | 141-2712 |
| 3-1/2 | .844 | 2-3/4 | 1/2 | 5/16 | E-1714 | 140-1714 | E-2714 | 140-2714 | 6 | F-1714 | 141-1714 | F-2714 | 141-2714 |
| 4 | .844 | 3-1/2 | 1/2 | 5/16 | E-1716 | 140-1716 | E-2716 | 140-2716 | 6 | F-1716 | 141-1716 | F-2716 | 141-2716 |

Tuffcap electrodes consist of two pieces: a shank and a replaceable cap. These two-part electrodes can offer major economies, because when the nose geometry is worn out, only the cap needs to be replaced. And it costs far less than a standard one-piece electrode. (A Tuffcap shank will normally outlast twenty caps.) Also, electrode inventory can be kept small because all nose designs will fit the same size shank.

TWO TYPES: TUFFALOY offers two kinds of Tuffcap electrodes. One uses a male cap that fits into the shank. The other has a female cap that fits over the shank.

FEMALE AND MALE CAPS are available in the widest range of sizes, alloys, and styles. They are made in both Class 1 and Class 2 alloy, and in sizes to fit- shanks sized 4 through 7 RW. Male caps are more effectively cooled than female caps.

ALL CAPS are made with the same nose designs in conformance with RWMA standards.

SHANKS are made of Class 2 alloy, either straight, or bent to provide an offset. Shanks other than those cataloged can be special ordered. Tuffcap, caps and shanks should be used only in a directly opposed, straight-line manner. They do not work as well as standard electrodes on heavily coated metal such as galvanized or tin-plate.

## TUFFTRODE-Z CAPS FOR COATED STEELS

To avoid electrode sticking problems common when welding galvanized and aluminized materials, these copper chrome-zirconium alloy caps are offered. They give the same performance as dispersion-strengthened caps but cost far less. They are Class 2 caps in mechanical and physical properties.

Both male and female caps are offered in all the standard nose designs.



Female Cap Type
Electrode Assembly

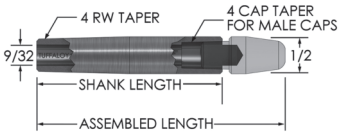
Male Cap Type
Electrode Assembly



*Size 5 RW straight and offset style shanks holding male type caps with swivel heads. These caps are cataloged on pages 8 & 15.*

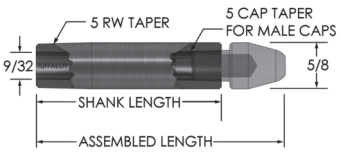
## STRAIGHT SHANKS FOR MALE CAPS (CLASS 2*)

### SHANKS 4 RW TAPER



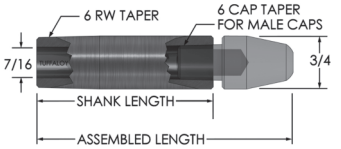

| Shank Length | Assembled Length | Description | Part No. |
|---|---|---|---|
| 1-1/4 | 2 | TG-2405 | 161-2405 |
| 1-1/2 | 2-1/4 | TG-2406 | 161-2406 |
| 1-3/4 | 2-1/2 | TG-2407 | 161-2407 |
| 2 | 2-3/4 | TG-2408 | 161-2408 |
| 2-1/4 | 3 | TG-2409 | 161-2409 |
| 2-1/2 | 3-1/4 | TG-2410 | 161-2410 |
| 2-3/4 | 3-1/2 | TG-2411 | 161-2411 |
| 3 | 3-3/4 | TG-2412 | 161-2412 |
| 3-1/4 | 4 | TG-2413 | 161-2413 |

### SHANKS 5 RW TAPER



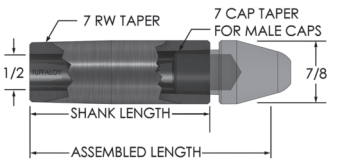

| Shank Length | Assembled Length | Description | Part No. |
|---|---|---|---|
| 1-1/4 | 2 | TG-2505 | 161-2505 |
| 1-1/2 | 2-1/4 | TG-2506 | 161-2506 |
| 1-3/4 | 2-1/2 | TG-2507 | 161-2507 |
| 2 | 2-3/4 | TG-2508 | 161-2508 |
| 2-1/4 | 3 | TG-2509 | 161-2509 |
| 2-1/2 | 3-1/4 | TG-2510 | 161-2510 |
| 2-3/4 | 3-1/2 | TG-2511 | 161-2511 |
| 3 | 3-3/4 | TG-2512 | 161-2512 |
| 3-1/4 | 4 | TG-2513 | 161-2513 |

### SHANKS 6 RW TAPER




| Shank Length | Assembled Length | Description | Part No. |
|---|---|---|---|
| 1-1/2 | 2-1/2 | TG-2606 | 161-2606 |
| 2 | 3 | TG-2608 | 161-2608 |
| 2-1/2 | 3-1/2 | TG-2610 | 161-2610 |
| 3 | 4 | TG-2612 | 161-2612 |

### SHANKS 7 RW TAPER




| Shank Length | Assembled Length | Description | Part No. |
|---|---|---|---|
| 1-1/2 | 2-1/2 | TG-2706 | 161-2706 |
| 2 | 3 | TG-2708 | 161-2708 |
| 2-1/2 | 3-1/2 | TG-2710 | 161-2710 |
| 3 | 4 | TG-2712 | 161-2712 |

**'E' NOSE 4 AND 5 CAP**

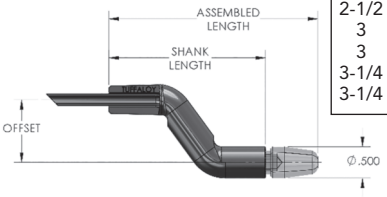


**'F' NOSE 4 AND 5 CAP**



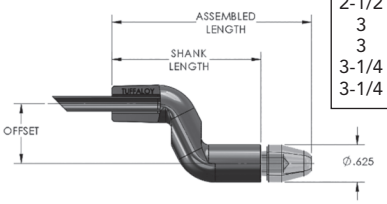
## BENT SHANKS FOR MALE CAPS (CLASS 2*)

### SHANKS 4 RW TAPER




| Shank Length | Off-set | Length | Description | Part No. |
|---|---|---|---|---|
| 2-1/2 | 1/2 | 3-1/4 | TG-2410-08 | 162-2410 |
| 2-1/2 | 3/4 | 3-1/4 | TG-2410-12 | 162-2420 |
| 2-1/2 | 1 | 3-1/4 | TG-2410-16 | 162-2430 |
| 3 | 1/2 | 3-3/4 | TG-2412-8 | 162-2450 |
| 3 | 1-1/4 | 3-3/4 | TG-2412-20 | 162-2460 |
| 3-1/4 | 1 | 4 | TG-2413-16 | 162-2470 |
| 3-1/4 | 1-1/4 | 4 | TG-2413-20 | 162-2480 |

### SHANKS 5 RW TAPER

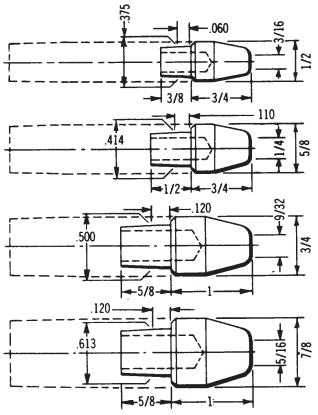



| | | | | |
|---|---|---|---|---|
| 2-1/4 | 1/4 | 3 | TG-2509-4 | 162-2505 |
| 2-1/2 | 1/2 | 3-1/4 | TG-2510-8 | 162-2510 |
| 2-1/2 | 3/4 | 3-1/4 | TG-2510-12 | 162-2520 |
| 2-1/2 | 1 | 3-1/4 | TG-2510-16 | 162-2530 |
| 3 | 1/2 | 3-3/4 | TG-2512-8 | 162-2550 |
| 3 | 1-1/4 | 3-3/4 | TG-2512-20 | 162-2560 |
| 3-1/4 | 1 | 4 | TG-2513-16 | 162-2570 |
| 3-1/4 | 1-1/4 | 4 | TG-2513-20 | 162-2580 |

* Class 3 Available

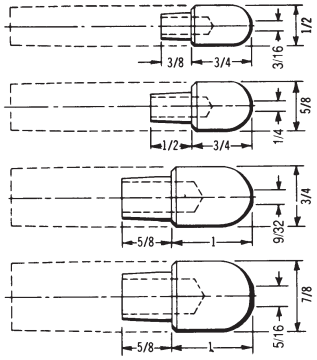
## MALE CAPS

### POINTED TIPS 'A'



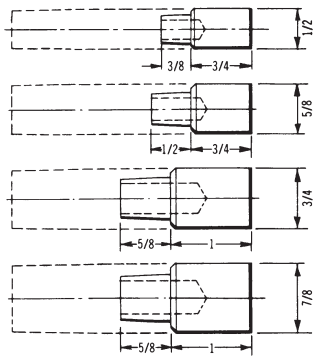

| Alloy Class | Taper of Adapter Shank | Description | Part No. |
|---|---|---|---|
| 1 | 4RW | TA-14 | 111-0014 |
| 2 | 4RW | TA-24 | 112-0024 |
| 3 | 4RW | TA-34 | 122-1034 |
| 1 | 5RW | TA-15 | 111-0015 |
| 1&2 | 5RW | TA-25Z | 126-0025 |
| 2 | 5RW | TA-25 | 112-0025 |
| 3 | 5RW | TA-35 | 122-1035 |
| 1 | 6RW | TA-16 | 111-0016 |
| 2 | 6RW | TA-26 | 112-0026 |
| 1 | 7RW | TA-17 | 111-0017 |
| 2 | 7RW | TA-27 | 112-0027 |

### DOME TIPS 'B'



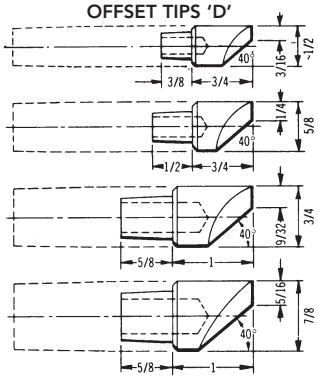

| | | | |
|---|---|---|---|
| 1 | 4RW | TB-14 | 113-0014 |
| 2 | 4RW | TB-24 | 114-0024 |
| 1 | 5RW | TB-15 | 113-0015 |
| 2 | 5RW | TB-25 | 114-0025 |
| 1 | 6RW | TB-16 | 113-0016 |
| 2 | 6RW | TB-26 | 114-0026 |
| 1 | 7RW | TB-17 | 113-0017 |
| 2 | 7RW | TB-27 | 114-0027 |

### FLAT TIPS 'C'




| | | | |
|---|---|---|---|
| 1 | 4RW | TC-14 | 115-0014 |
| 2 | 4RW | TC-24 | 116-0024 |
| 3 | 4RW | TC-34 | 122-3034 |
| 1 | 5RW | TC-15 | 115-0015 |
| 2 | 5RW | TC-25 | 116-0025 |
| 3 | 5RW | TC-35 | 122-3035 |
| 1 | 6RW | TC-16 | 115-0016 |
| 2 | 6RW | TC-26 | 116-0026 |
| 1 | 7RW | TC-17 | 115-0017 |
| 2 | 7RW | TC-27 | 116-0027 |

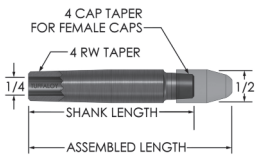
### OFFSET TIPS 'D'




| | | | |
|---|---|---|---|
| 1 | 4RW | TD-14 | 117-0014 |
| 2 | 4RW | TD-24 | 118-0024 |
| 3 | 4RW | TD-34 | 122-4034 |
| 1 | 5RW | TD-15 | 117-0015 |
| 2 | 5RW | TD-25 | 118-0025 |
| 3 | 5RW | TD-35 | 122-4035 |
| 1 | 6RW | TD-16 | 117-0016 |
| 2 | 6RW | TD-26 | 118-0026 |
| 1 | 7RW | TD-17 | 117-0017 |
| 2 | 7RW | TD-27 | 118-0027 |

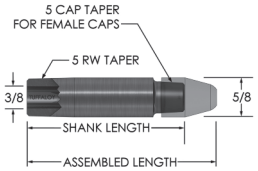
## STRAIGHT SHANKS FOR FEMALE CAPS (CLASS 2*)

### SHANKS 4 RW TAPER



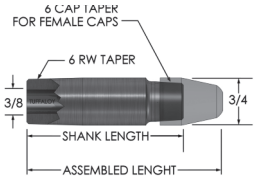

| Shank Length | Assembled Length | Description | Part No. |
|---|---|---|---|
| 1-1/2 | 2 | TP-2406 | 163-2406 |
| 1-3/4 | 2-1/4 | TP-2407 | 163-2407 |
| 2 | 2-1/2 | TP-2408 | 163-2408 |
| 2-1/4 | 2-3/4 | TP-2409 | 163-2409 |
| 2-1/2 | 3 | TP-2410 | 163-2410 |
| 2-3/4 | 3-1/4 | TP-2411 | 163-2411 |
| 3 | 3-1/2 | TP-2412 | 163-2412 |
| 3-1/4 | 3-3/4 | TP-2413 | 163-2413 |
| 3-1/2 | 4 | TP-2414 | 163-2414 |

### SHANKS 5 RW TAPER




| | | | |
|---|---|---|---|
| 1-1/2 | 2 | TP-2506 | 163-2506 |
| 1-3/4 | 2-1/4 | TP-2507 | 163-2507 |
| 2 | 2-1/2 | TP-2508 | 163-2508 |
| 2-1/4 | 2-3/4 | TP-2509 | 163-2509 |
| 2-1/2 | 3 | TP-2510 | 163-2510 |
| 2-3/4 | 3-1/4 | TP-2511 | 163-2511 |
| 3 | 3-1/2 | TP-2512 | 163-2512 |
| 3-1/4 | 3-3/4 | TP-2513 | 163-2513 |
| 3-1/2 | 4 | TP-2514 | 163-2514 |

### SHANKS 6 RW TAPER




| | | | |
|---|---|---|---|
| 1-1/2 | 2 | TP-2606 | 163-2606 |
| 2 | 2-1/2 | TP-2608 | 163-2608 |
| 2-1/2 | 3 | TP-2610 | 163-2610 |
| 3 | 3-1/2 | TP-2612 | 163-2612 |

**'E' NOSE 4 AND 5 CAP**



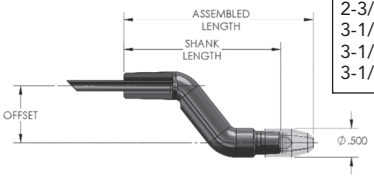
**'F' NOSE 4 AND 5 CAP**



For improved cooling, female shanks are drilled through (to put water in contact with cap). Shanks may be ordered with a blind water hole, upon request.

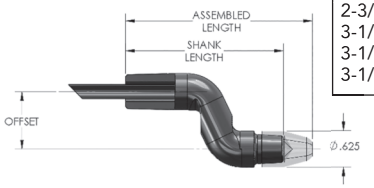
## BENT SHANKS FOR FEMALE CAPS (CLASS 2*)

### SHANKS 4 RW TAPER




| Shank Length | Offset | Length | Description | Item No. |
|---|---|---|---|---|
| 2-3/4 | 1/2 | 3-1/4 | TP-2411-08 | 164-2442 |
| 2-3/4 | 3/4 | 3-1/4 | TP-2411-12 | 164-2445 |
| 2-3/4 | 1 | 3-1/4 | TP-2411-16 | 164-2447 |
| 3-1/4 | 1/2 | 3-3/4 | TP-2413-08 | 164-2465 |
| 3-1/4 | 1-1/4 | 3-3/4 | TP-2413-20 | 164-2480 |
| 3-1/2 | 1 | 4 | TP-2414-16 | 164-2490 |

### SHANKS 5 RW TAPER

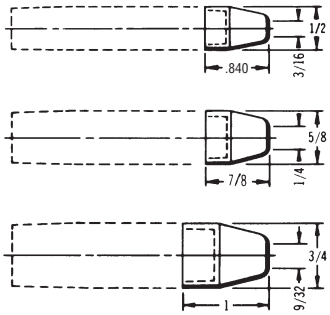



| | | | | |
|---|---|---|---|---|
| 2-3/4 | 1/2 | 3-1/4 | TP-2511-08 | 164-2542 |
| 2-3/4 | 3/4 | 3-1/4 | TP-2511-12 | 164-2545 |
| 2-3/4 | 1 | 3-1/4 | TP-2511-16 | 164-2547 |
| 3-1/4 | 1/2 | 3-3/4 | TP-2513-08 | 164-2565 |
| 3-1/4 | 1 | 3-3/4 | TP-2513-16 | 164-2570 |
| 3-1/4 | 1-1/4 | 3-3/4 | TP-2513-20 | 164-2580 |

* Class 3 Available

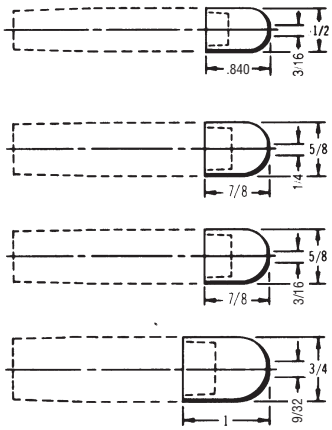
## FEMALE CAPS

### POINTED TIPS 'A'



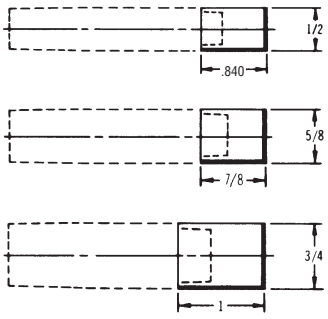

| Alloy Class | Taper of Adapter Shank | Description | Part No. |
|---|---|---|---|
| 2 | 4RW | TP-24A | 125-0241 |
| 2 (Cu Cr Zr) | 4RW | TP-24AZ | 126-0241 |
| 2 | 5RW | TP-25A | 125-0251 |
| 2 (Cu Cr Zr) | 5RW | TP-25AZ | 126-0251 |
| 2 | 6RW | TP-26A | 125-0261 |
| 2 (Cu Cr Zr) | 6RW | TP-26AZ | 126-0261 |

### DOME TIPS 'B'



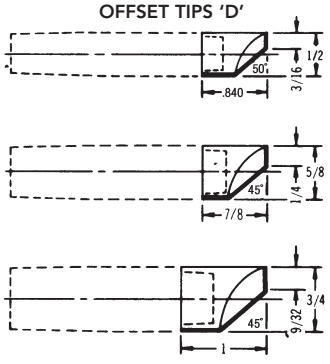

| | | | |
|---|---|---|---|
| 2 | 4RW | TP-24B | 125-0242 |
| 2 | 5RW | TP-25B | 125-0252 |
| 2 (Cu Cr Zr) | 5RW | TP-25BZ | 126-0252 |
| 2 | 5RW | TP-25B-.20 | 125-0252.20 |
| 2 (Cu Cr Zr) | 5RW | TP-25BZ-.20 | 126-0252.20 |
| 2 | 6RW | TP-26B | 125-0262 |
| 2 (Cu Cr Zr) | 6RW | TP-26BZ | 126-0262 |

### FLAT TIPS 'C'




| | | | |
|---|---|---|---|
| 2 | 4RW | TP-24C | 125-0243 |
| 2 | 5RW | TP-25C | 125-0253 |
| 2 (Cu Cr Zr) | 5RW | TP-25CZ | 126-0253 |
| 2 | 6RW | TP-26C | 125-0263 |

### OFFSET TIPS 'D'




| | | | |
|---|---|---|---|
| 2 | 4RW | TP-24D | 125-0244 |
| 2 | 5RW | TP-25D | 125-0254 |
| 2 (Cu Cr Zr) | 5RW | TP-25DZ | 126-0254 |
| 2 | 6RW | TP-26D | 125-0264 |

# DOUBLE-BEND, WITH STANDARD NOSE DESIGNS

These standard cold-formed tips are bent from straight tips (some after added machining) and have the same hardness and conductivity. They outlast, many times over, the old cast and forged tips of similar geometry, which are impossible to cool adequately.

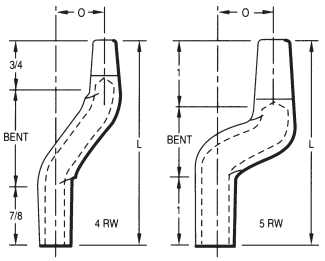
The table shows a wide range of tips generally available from stock. For sizes not shown, refer to the diagrams and description key at the bottom of the page, and order what you need. All measurements will be accurate. However, over-all length, in 1/8-in. multiples, will be held to within 1/16-in.

Tapers, water holes, and nose designs are the same as the standard straight tips in this catalog.
Water tubes can be furnished.

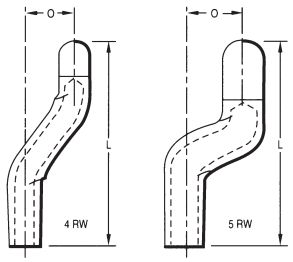
Standard nose designs other than those shown here may be furnished on short order. Follow the “Key to Description”, using a ‘B’ for Dome nose, ‘C’ for flat nose, ‘E’ for truncated cone, and ‘F’ for radius nose.

## DOUBLE-BENT, ADDITIONAL NOSE DESIGNS

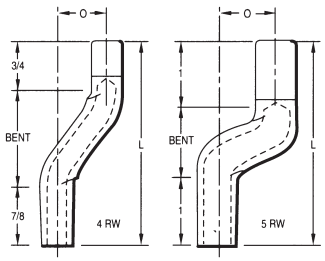
### ‘A’ POINTED NOSE



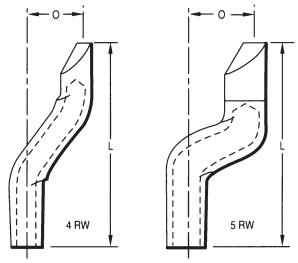

### ‘B’ DOME NOSE




### ‘C’ FLAT NOSE




### ‘D’ OFFSET NOSE




### KEY TO DESCRIPTION

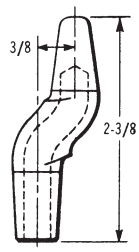
**FX-YZLD-O**

Example:
**FB-1438-16-T**

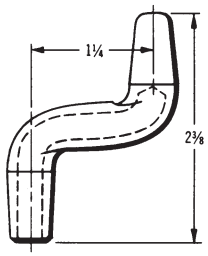
- **F** = Cold-Formed, Double-Bend Tips
- **X** = Nose Type
  - A
  - **B**
  - C
  - D
- **Y** = RWMA Alloy Class
  - **1** = Class 1
  - 2 = Class 2
- **Z** = RW Taper Number
  - **4** =4RW
  - 5 = 5RW
- **L** = Length in inches
  Refer to table for availability
- **D** = Additional Length in 16ths
- **O** = Offset in 16ths
  Refer to table for availability
- **T** = With water tubes

| | | | CLASS 1 | | | | CLASS 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | FA Pointed Nose | | FD Offset Nose | | FA Pointed Nose | | FD Offset Nose | |
| Taper No. | Length | Offset | Description | Item No. | Description | Item No. | Description | Item No. | Description | Item No. |
| 3 RW | 1-1/2 | 7/16 | | | | | FA-2317-8 | 167-0060 | | |
| 4 RW | 2-3/16 | 1 | | | | | | | FD-2423-16 | 167-2080 |
| | 2-1/4 | 1/2 | FA-1424-8 | 165-0100 | | | FA-2424-8 | 167-0100 | | |
| | 2-1/4 | 3/4 | | | | | FA-2424-12 | 167-0120 | | |
| | 2-3/8 | 3/8 | FA-1426-6 | 165-0160 | | | FA-2426-6 | 167-0160 | | |
| | 2-3/8 | 3/4 | | | | | FA-2426-12 | 167-0180 | | |
| | 2-3/8 | 1-1/4 | FA-1426-20 | 165-0200 | FD-1426-20 | 165-2200 | FA-2426-20 | 167-0200 | FD-2426-20 | 167-2200 |
| | 2-1/2 | 1/2 | | | | | FA-2428-8 | 167-0240 | | |
| | 2-1/2 | 1 | FA-1428-16 | 165-0280 | FD-1428-16 | 165-2280 | FA-2428-16 | 167-0280 | FD-2428-16 | 167-2280 |
| | 2-5/8 | 3/4 | FA-14210-12 | 165-0320 | | | FA-24210-12 | 167-0320 | FD-24210-12 | 167-2320 |
| | 2-3/4 | 1/2 | FA-14212-8 | 165-0360 | | | FA-24212-8 | 167-0360 | FD-24212-8 | 167-2360 |
| | 2-3/4 | 1 | | | | | FA-24212-16 | 167-0400 | | |
| | 2-3/4 | 1-1/4 | | | | | FA-24212-20 | 167-0420 | | |
| | 2-7/8 | 3/4 | | | | | FA-24214-12 | 167-0430 | | |
| | 2-7/8 | 1-1/4 | FA-14214-20 | 165-0460 | | | FA-24214-20 | 167-0460 | | |
| | 3 | 1 | FA-1430-16 | 165-0520 | | | FA-2430-16 | 167-0520 | | |
| | 3-3/8 | 1-1/4 | | | | | FA-2436-20 | 167-0580 | | |
| | 3-1/2 | 1 | | | | | FA-2438-16 | 167-0620 | | |
| 5 RW | 2-1/4 | 1/2 | | | | | | | FD-2524-8 | 167-3100 |
| | 2-1/4 | 1-1/4 | | | FD-1524-20 | 165-3140 | | | FD-2524-20 | 167-3140 |
| | 2-3/8 | 3/8 | FA-1526-6 | 165-1160 | | | FA-2526-6 | 167-1160 | FD-2526-6 | 167-3160 |
| | 2-3/8 | 3/4 | | | FD-1526-12 | 165-3180 | FA-2526-12 | 167-1180 | FD-2526-12 | 167-3180 |
| | 2-1/2 | 1/2 | FA-1528-8 | 165-1240 | | | FA-2528-8 | 167-1240 | | |
| | 2-1/2 | 1 | | | | | FA-2528-16 | 167-1280 | | |
| | 2-3/4 | 1/2 | FA-15212-8 | 165-1360 | FD-15212-8 | 165-3360 | FA-25212-8 | 167-1360 | FD-25212-8 | 167-3360 |
| | 2-3/4 | 3/4 | | | | | FA-25212-12 | 167-1380 | | |
| | 2-3/4 | 1 | FA-15212-16 | 165-1400 | FD-15212-16 | 165-3400 | FA-25212-16 | 167-1400 | FD-25212-16 | 167-3400 |
| | 2-7/8 | 1 | | | | | FA-25214-16 | 167-1440 | | |
| | 2-7/8 | 1-1/4 | FA-15214-20 | 165-1460 | | | FA-25214-20 | 167-1460 | | |
| | 3 | 1/2 | FA-1530-8 | 165-1480 | | | FA-2530-8 | 167-1480 | FD-2530-8 | 167-3480 |
| | 3 | 3/4 | | | | | FA-2530-12 | 167-1500 | | |
| | 3 | 1-3/4 | | | | | FA-2530-28 | 167-1540 | | |
| | 3 | 1 | | | | | | | FD-2530-16 | 167-3520 |
| | 3-1/4 | 1 | FA-1534-16 | 165-1560 | | | FA-2534-16 | 167-1560 | | |
| | 3-3/8 | 3/8 | | | FD-1536-6 | 165-3570 | | | | |
| | 3-3/8 | 1-1/4 | FA-1536-20 | 165-1580 | FD-1536-20 | 165-3580 | FA-2536-20 | 167-1580 | FD-2536-20 | 167-3580 |
| | 3-1/2 | 1/2 | FA-1538-8 | 165-1600 | | | FA-2538-8 | 167-1600 | | |
| | 3-1/2 | 1 | | | | | FA-2538-16 | 167-1620 | FD-2538-16 | 167-3620 |

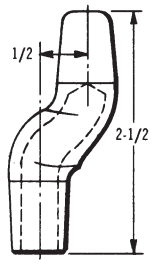
## 'A' POINTED NOSE



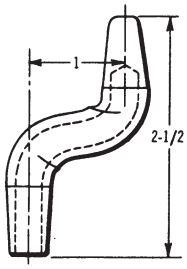

| | |
|---|---|
| FA-1426-6 | FA-2426-6 |
| FA-1526-6 | FA-2526-6 |



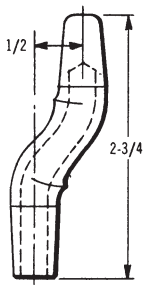

| | |
|---|---|
| FA-1426-20 | FA-2426-20 |



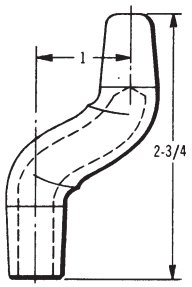

| | |
|---|---|
| | FA-2428-8 |
| FA-1528-8 | FA-2528-8 |



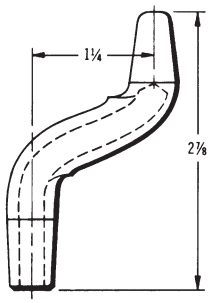

| | |
|---|---|
| FA-1428-16 | FA-2428-16 |
| | FA-2528-16 |



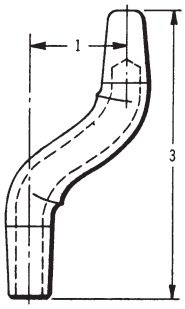

| | |
|---|---|
| FA-14212-8 | FA-24212-8 |
| FA-15212-8 | FA-25212-8 |



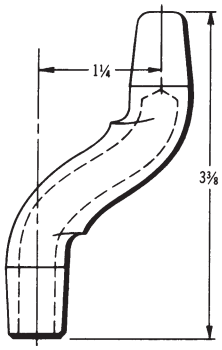

| | |
|---|---|
| | |
| FA-15212-16 | FA-25212-16 |



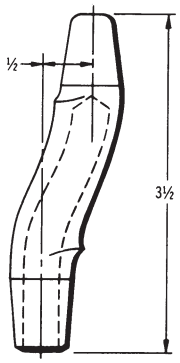

| | |
|---|---|
| FA-14214-20 | FA-24214-20 |
| FA-15214-20 | FA-25214-20 |




| | |
|---|---|
| FA-1430-16 | FA-2430-16 |

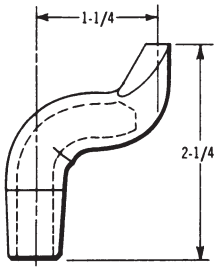



| | |
|---|---|
| | FA-2436-20 |
| FA-1536-20 | FA-2436-20 |

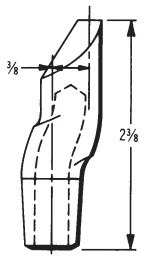



| | |
|---|---|
| | |
| FA-1538-8 | FA-2538-8 |

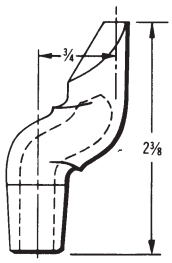
## 'D' OFFSET NOSE



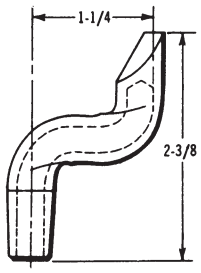

| | |
|---|---|
| | |
| FD-1524-20 | FD-2524-20 |



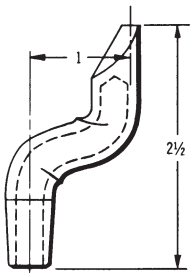

| | |
|---|---|
| | |
| | FD-2526-6 |



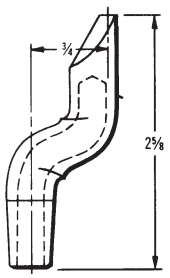

| | |
|---|---|
| | |
| FD-1526-12 | FD-2526-12 |



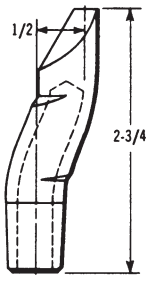

| | |
|---|---|
| FD-1426-20 | FD-2426-20 |



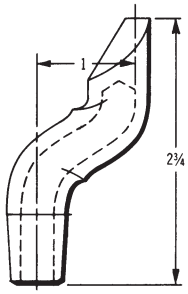

| | |
|---|---|
| FD-1428-16 | FD-2428-16 |



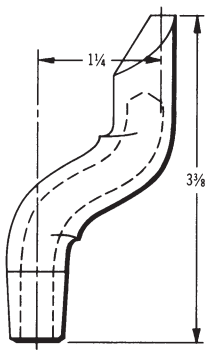

| | |
|---|---|
| | FD-24210-12 |
| | |



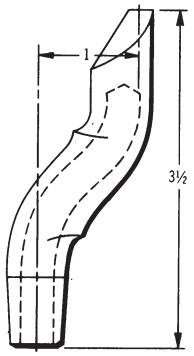

| | |
|---|---|
| | FD-24212-8 |
| FD-15212-8 | FD-25212-8 |




| | |
|---|---|
| | |
| FD-15212-16 | FD-25212-16 |




| | |
|---|---|
| | |
| FD-1536-20 | FD-2536-20 |

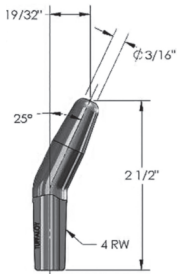



| | |
|---|---|
| | |
| | FD-2538-16 |

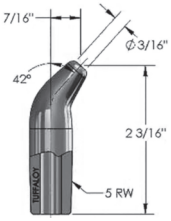
## SINGLE-BEND TIPS



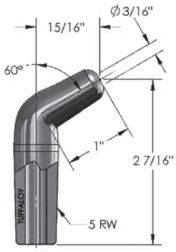

FP-2532-10
Part No.
167-5540



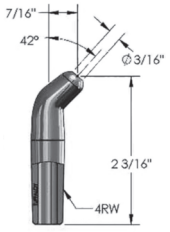

FP-2428-9.5
Part No.
167-4260



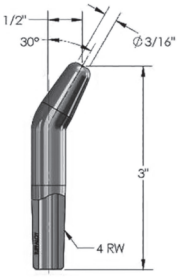

FP-2523-7
Part No.
167-5060



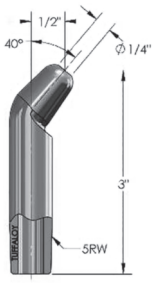

FP-2527-15
Part No.
167-5220




FP-2423-7
Part No.
167-5055

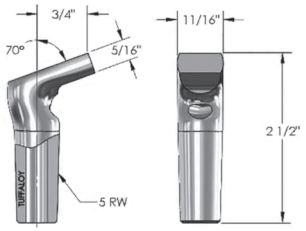



FP-2430-8
Part No.
167-5065

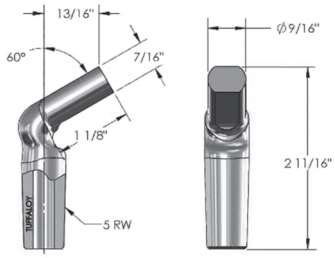



FP-2530-8
Part No.
167-5070

Cold-formed tips with a single bend have standard pointed-nose design. Other single-bend tips with flat noses (below) or other special designed noses and configurations are available on special order. These are of Class 2 alloy; Class I alloy can also be ordered.



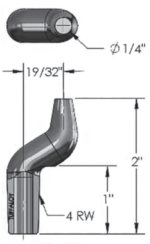

SE-4268
Part No. 170-4268



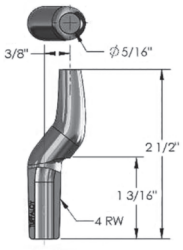

SE-4269
Part No. 170-4269

## MISCELLANEOUS TIPS

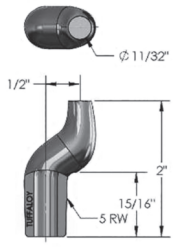
Double bend and flattened tips are made from bar stock. These are some of the standard designs available, but special designs can also be made. These are of Class 2 alloy; Class I alloy can also be ordered.



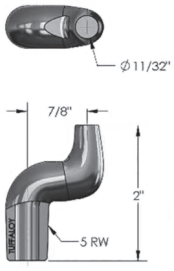

SE-4270
Part No. 170-4270



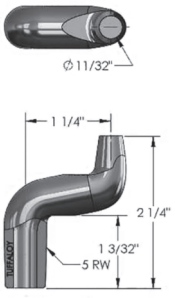

SE-4271
Part No. 170-4271



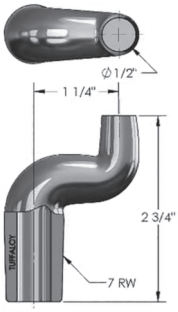

SE-4272
Part No. 170-4272



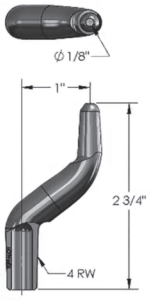

SE-4273
Part No. 170-4273



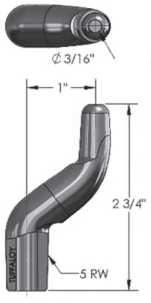

SE-4274
Part No. 170-4274




SE-4275
Part No. 170-4275

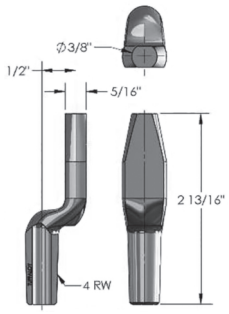



SE-4276-1
Part No. 170-4276-1

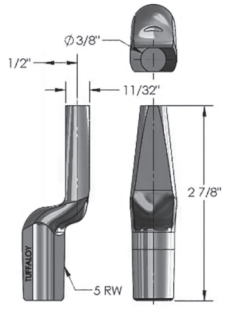



SE-4276
Part No. 170-4276

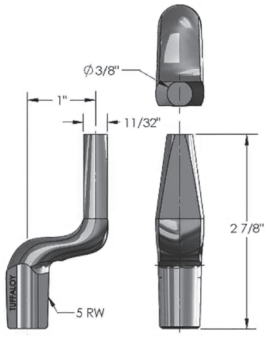
These standard bent tips are in addition to those shown on page 11.
They are of class 2 alloy; Other alloys can also be ordered.



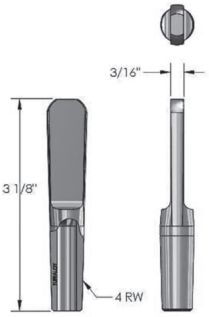

SE-4277
Part No. 170-4277



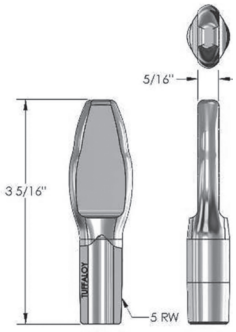

SE-4278
Part No. 170-4278



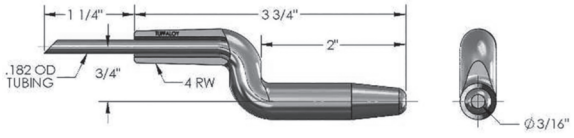

SE-4279
Part No. 170-4279



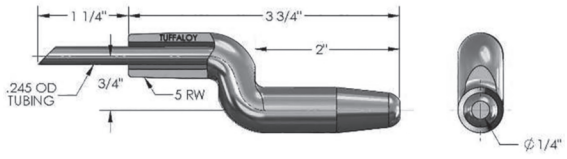

SE-4280
Part No. 170-4280



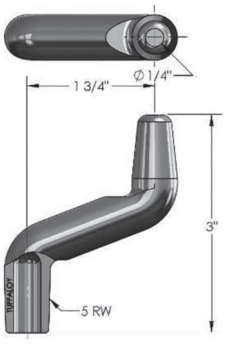

SE-4281
Part No. 170-4281



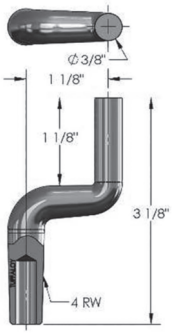

SE-4282
Part No. 170-4282



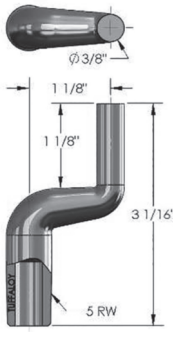

SE-4283
Part No. 170-4283



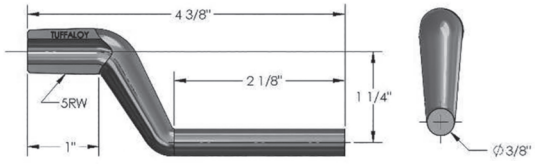

SE-4284 (short water hole)
Part No. 170-4284



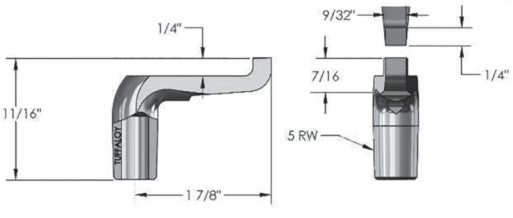

SE-4285
Part No. 170-4285



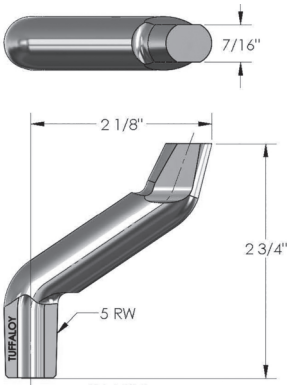

SE-4286
Part No. 170-4286



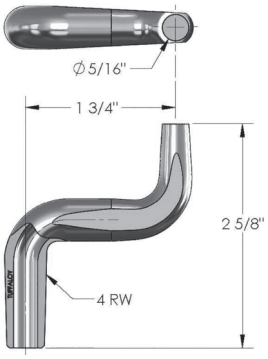

SE-4287
Part No. 170-4287



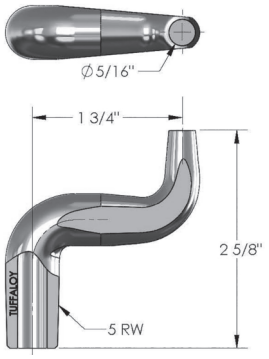

SE-4288
Part No. 170-4288



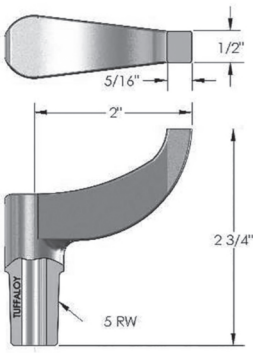

SE-4535
Part No. 186-0520



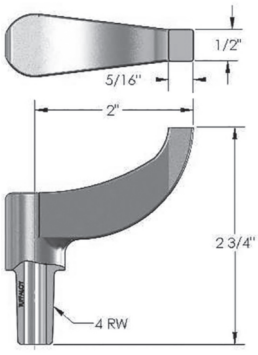

SE-4089-4
Part No. 170-4090




SE-4089-5
Part No. 170-4089



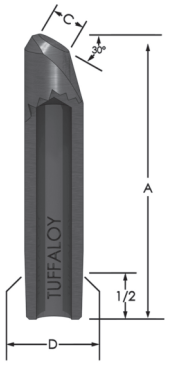

5RW: C-507-5
Part No. 186-0507




4RW: C-507-4
Part No. 186-0508

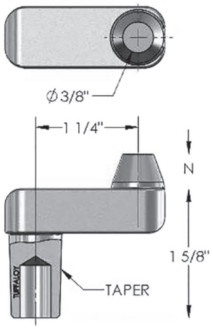
These straight tips have welding faces angled 30'.

| Alloy Class | Taper No. | Face 'C' | Length 'D' | Descrip-tion | Part No. |
|---|---|---|---|---|---|
| 2 | 4RW | 1/4 | 2 | H-2408-30 | 145-2408 |
| 2 | 4RW | 1/4 | 3 | H-2412-30 | 145-2412 |
| 2 | 4RW | 1/4 | 4 | H-2416-30 | 145-2416 |
| 2 | 5RW | 3/8 | 2 | H-2508-30 | 145-2508 |
| 2 | 5RW | 3/8 | 3 | H-2512-30 | 145-2512 |
| 2 | 5RW | 3/8 | 4 | H-2516-30 | 145-2516 |

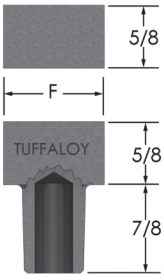



N-15 thru N-28

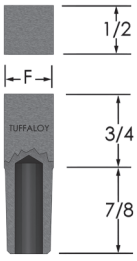
| Alloy Class | Taper No. | Length 'N' | Descrip-tion | Part No. |
|---|---|---|---|---|
| 2 | 4RW | 3/8 | N-15 | 186-0015 |
| 2 | 4RW | 3/4 | N-16 | 186-0016 |
| 2 | 5RW | 3/8 | N-27 | 186-0027 |
| 2 | 5RW | 3/4 | N-28 | 186-0028 |



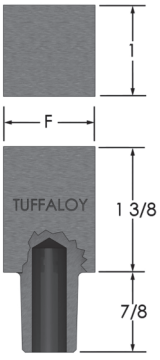

## BACK UP ELECTRODES



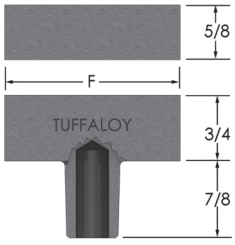

220




221 thru 224

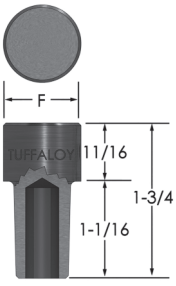



225

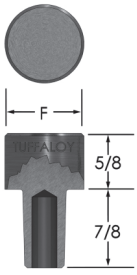



226 thru 229

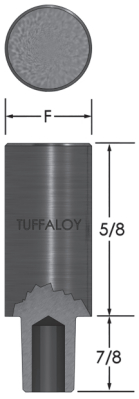
These tips are all machined from bar stock. Special designs can be made to order.




301 thru 304




305 thru 315




316

### RECTANGULAR FACE

| Alloy Class | Taper No. | Face 'F' | Descrip-tion | Part No. |
|---|---|---|---|---|
| 2 | 5RW | 1 | 220 | 186-0220 |
| 2 | 4RW | 1/2 | 221 | 186-0221 |
| 2 | 4RW | 1 | 223 | 186-0223 |
| 2 | 5RW | 1 | 224 | 186-0224 |
| 2 | 5RW | 1 | 225 | 186-0225 |
| 2 | 5RW | 2 | 226 | 186-0226 |
| 2 | 4RW | 2 | 227 | 186-0227 |
| 2 | 5RW | 1-1/2 | 228 | 186-0228 |
| 2 | 4RW | 1-1/2 | 229 | 186-0229 |

### ROUND FACE

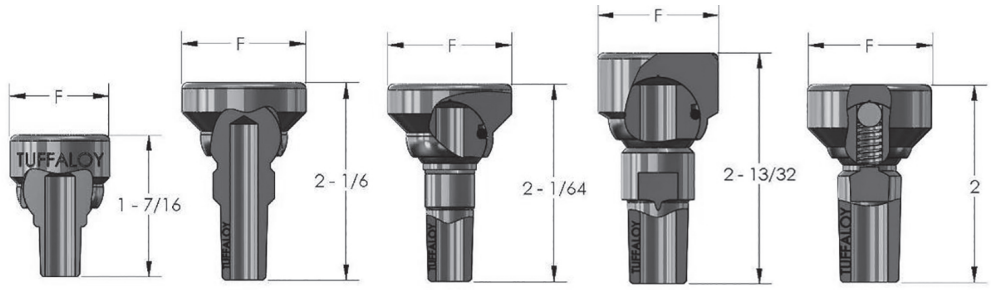
| Alloy Class | Taper No. | Face 'F' | Descrip-tion | Part No. |
|---|---|---|---|---|
| 2 | 4RW | 7/8 | 301 | 186-0301 |
| 1 | 4RW | 7/8 | 302 | 186-0302 |
| 2 | 5RW | 7/8 | 303 | 186-0303 |
| 1 | 5RW | 7/8 | 304 | 186-0304 |
| 2 | 4RW | 7/8 | 305 | 186-0305 |
| 1 | 4RW | 7/8 | 306 | 186-0306 |
| 2 | 5RW | 7/8 | 307 | 186-0307 |
| 1 | 5RW | 7/8 | 308 | 186-0308 |
| 2 | 4RW | 1 | 309 | 186-0309 |
| 1 | 4RW | 1 | 310 | 186-0310 |
| 2 | 5RW | 1 | 311* | 186-0311 |
| 1 | 5RW | 1 | 312 | 186-0312 |
| 2 | 5RW | 1-1/4 | 313* | 186-0313 |
| 2 | 5RW | 1-1/2 | 315 | 186-0315 |
| 2 | 5RW | 1 | 316* | 186-0316 |

*311, 313 and 316 available with Copper Tungsten face. See pg. 35

***Additional Back Up Electrodes with Copper Tungsten Facings – See Page 35***

Swivel tips have ball-jointed swivel heads to compensate for minor misalignment, and to eliminate marking of the work surface. They are all machined from Class 2 alloy bar stock. The S-and SS-Series tip water hole does not reach the head. In the OS and OSH models, the water does contact the head, and O-rings are used to seal it. In the SS Series a spring is used to keep pressure on head for better positioning. **Class 1 and class 3 heads are also available.**

**Note:** Standard swivel tilt is approximately 18', a 25' swivel is available on request. Add suffix "HS" to above part number.




S-Series* (Tuffcap Design) | S-Series | OS-Series | OSH-Series | SS-Series

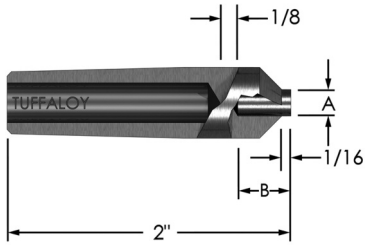
| Taper No. | Face Dia. 'F' | S-Series Descrip-tion | S-Series Part No. | OS-Series Descrip. tion | OS-Series Part No. | OSH-Series Descrip-tion | OSH-Series Part No. | SS-Series Descrip-tion | SS-Series Part No. |
|---|---|---|---|---|---|---|---|---|---|
| 5-CT* | 7/8<br>1<br>1-1/4 | S-248<br>S-249<br>S-250 | 182-0248<br>182-0249<br>182-0250 | | | | | | |
| 4RW | 7/8<br>1<br>1-1/4 | S-348<br>S-350<br>S-351 | 182-0348<br>182-0350<br>182-0351 | OS-348<br>OS-350<br>OS-351 | 182-1348<br>182-1350<br>182-1351 | | | | |
| 5RW | 7/8<br>1<br>1-1/4<br>1-1/2<br>2 | S-349<br>S-353<br>S-354 | 182-0349<br>182-0353<br>182-0354 | OS-349<br>OS-353<br>OS-354 | 182-1349<br>182-1353<br>182-1354 | OSH-353<br>OSH-354<br>OSH-356<br>OSH-358 | 182-2353<br>182-2354<br>182-2356<br>182-2358 | SS-353<br>SS-354 | 182-3353<br>182-3354 |
| 7RW | 2-1/2 | | | | | 3360 | 182-3360 | | |

**Will fit Tuffcap adapter shanks having No. 5 RW tapers, as shown on page 8.*

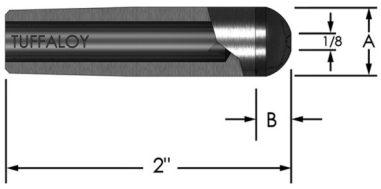
## TUFFALOY REFRACTORY METAL-FACED TIPS

| Nose Type | Taper No. | Facing Alloy Class | Dimensions A | Dimensions B | Descrip-tion | Part No. |
|---|---|---|---|---|---|---|
| Pointed | 4RW | 14 | 3/16 | 3/8 | A-2408-100M | 185-0120 |
| | 4RW | 13 | 3/16 | 3/8 | A-2408-100W | 185-0130 |
| | 5RW | 11 | 1/4 | 3/8 | A-2508-10W | 185-0150 |
| | 5RW | 14 | 1/4 | 3/8 | A-2508-100M | 185-0160 |
| | 5RW | 13 | 1/4 | 3/8 | A-2508-100W | 185-0170 |
| Dome | 4RW | 11 | 1/2 | 1/4 | B-2408-10W | 185-1110 |
| | 5RW | 11 | 5/8 | 1/4 | B-2508-10W | 185-1120 |
| | 5RW | 13 | 5/8 | 1/4 | B-2508-100W | 185-1170 |
| Flat | 4RW | 11 | 1/2 | 1/4 | C-2408-10W | 185-1210 |
| | 4RW | 14 | 1/2 | 1/4 | C-2408-100M | 185-1220 |
| | 4RW | 13 | 1/2 | 1/4 | C-2408-100W | 185-1230 |
| | 5RW | 11 | 5/8 | 1/4 | C-2508-10W | 185-1250 |
| | 5RW | 14 | 5/8 | 1/4 | C-2508-100M | 185-1260 |
| | 5RW | 13 | 5/8 | 1/4 | C-2508-100W | 185-1270 |

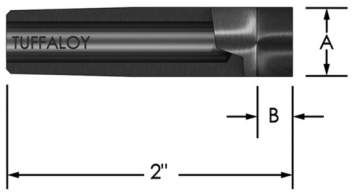
The **TUFFALOY** copper-tungsten, tungsten and molybdenum-faced tips listed here withstand greater heat and pressure, at the expense of some conductivity. Besides being used for spot welding high resistance base metals, they are useful in achieving "heat balance" when welding dissimilar metals. (The higher resistance electrode is used against the lower resistance, or thinner, member, to help contain the heat generated.) They have the same diameters and tapers as the standard straight tips in this catalog. Bodies are of Class 2 alloy. Lengths other than those shown can be ordered.



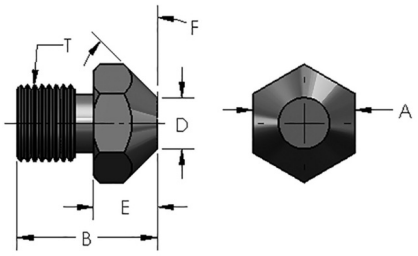

POINTED NOSE 'A'




DOME NOSE 'B'

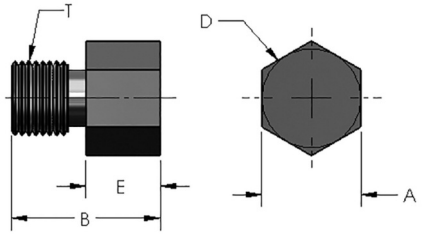



FLAT NOSE 'C'



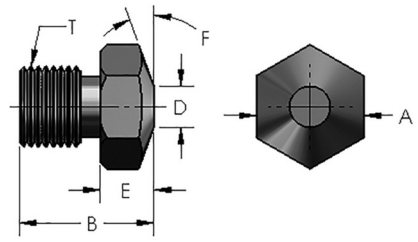

## "A" POINTED NOSE THREADED ELECTRODE

| RWMA Alloy Class No. | Part Number | Part Description | T Thread Size | A Hex Size (in) | B Overall Length | D Weld Face Diameter | E Hex Body Length (in) | F Angle |
|---|---|---|---|---|---|---|---|---|
| 2 (CuCr) | 188-2431-16-A | TH-2431-16-A | 3/8-16 | 1/2 | 11/16 | 1/4 | 5/16 | 45° |
| 2 (CuCrZr) | 188-2431-16-AZ | TH-2431-16-AZ | 3/8-16 | 1/2 | 11/16 | 1/4 | 5/16 | 45° |
| 2 (CuCrZr) | 188-2437-16-AZ | TH-2437-16-AZ | 3/8-16 | 1/2 | 3/4 | 1/4 | 3/8 | 45° |
| 2 (CuCrZr) | 188-2450-16-AZ | TH-2450-16-AZ | 3/8-16 | 1/2 | 7/8 | 1/4 | 1/2 | 45° |
| 3 | 188-3450-16-A | TH-3450-16-A | 3/8-16 | 1/2 | 7/8 | 1/4 | 1/2 | 45° |




## "C" FLAT NOSE THREADED ELECTRODE

| RWMA Alloy Class No. | Part Number | Part Description | T Thread Size | A Hex Size (in) | B Overall Length | D Weld Face Diameter | E Hex Body Length (in) |
|---|---|---|---|---|---|---|---|
| 3 | 188-3437-16-C | TH-3437-16-C | 3/8-16 | 1/2 | 3/4 | 1/2 | 3/8 |
| 2 (CuCr) | 188-2450-16-C | TH-2450-16-C | 3/8-16 | 1/2 | 7/8 | 1/2 | 1/2 |
| 3 | 188-3450-16-C | TH-3450-16-C | 3/8-16 | 1/2 | 7/8 | 1/2 | 1/2 |
| 2 (CuCr) | 187-5062-14 | 5062-14-C | 7/16-14 | 5/8 | 3/4 | 5/8 | 3/8 |
| 2 (CuCr) | 187-5062-16 | 5062-16-C | 3/8-16 | 5/8 | 3/4 | 5/8 | 3/8 |
| 2 (CuCr) | 187-5100-10 | 5100-10-C | 3/4-10 | 1 | 2 | 1 | 1-3/8 |
| 2 (CuCr) | 187-5125-10 | 5125-10-C | 3/4-10 | 1-1/4 | 2 | 1-1/4 | 1-3/8 |
| 2 (CuCr) | 187-5100-11 | 5100-11-C | 5/8-11 | 1 | 2 | 1 | 1-3/8 |
| 2 (CuCr) | 187-5100-18 | 5100-18-C | 5/8-18 | 1 | 2 | 1 | 1-3/8 |



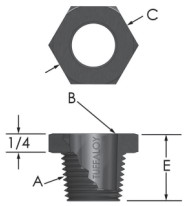

## "E" TRUNCATED NOSE THREADED ELECTRODE

| RWMA Alloy Class No. | Part Number | Part Description | T Thread Size | A Hex Size (in) | B Overall Length | D Weld Face Diameter | E Hex Body Length (in) | F Angle |
|---|---|---|---|---|---|---|---|---|
| 2 (CuCr) | 188-2425-16-E | TH-2425-16-E | 3/8-16 | 1/2 | 5/8 | 3/16 | 1/4 | 20° |
| 3 | 188-3425-16-E | TH-3425-16-E | 3/8-16 | 1/2 | 5/8 | 3/16 | 1/4 | 20° |
| 3 | 188-3437-16-E | TH-3437-16-E | 3/8-16 | 1/2 | 3/4 | 3/16 | 3/8 | 20° |
| 2 (CuCr) | 188-2450-16-E | TH-2450-16-E | 3/8-16 | 1/2 | 7/8 | 3/16 | 1/2 | 20° |
| 3 | 188-3450-16-E | TH-3450-16-E | 3/8-16 | 1/2 | 7/8 | 3/16 | 1/2 | 20° |
| 2 (CuCr) | 188-5062-14 | 5062-14-E | 7/16-14 | 5/8 | 3/4 | 1/4 | 3/8 | 45° |
| 2 (CuCr) | 188-5100-11 | 5100-11-E | 5/8-11 | 1 | 2 | 1/2 | 1-3/8 | 20° |
| 2 (CuCr) | 188-5100-18 | 5100-18-E | 5/8-18 | 1 | 2 | 1/2 | 1-3/8 | 20° |
| 2 (CuCr) | 188-5100-10 | 5100-10-E | 3/4-10 | 1 | 2 | 1/2 | 1-3/8 | 20° |
| 2 (CuCr) | 188-5125-10 | 5125-10-E | 3/4-10 | 1 | 2 | 1/2 | 1-3/8 | 20° |

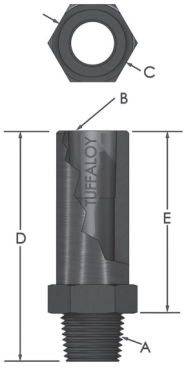
TUFFALOY threaded electrode adapters are used to provide longer electrode holder life, by providing a changable tip socket in holders having threaded openings. Class 2 alloy. Other alloys available.

| A Pipe Thread or Taper | B Taper Socket | C Body Size | D Body Length | E Over-All Length | Description | Part Number |
|---|---|---|---|---|---|---|
| 1/2-14 NPT | 4RW | 1" Hex | 1/4 | 7/8 | AD-124-.8 | 190-1408 |
| | | | 3/8 | 1 | AD-124-1.0 | 190-1410 |
| | | | 5/8 | 1-1/4 | AD-124-1.2 | 190-1412 |
| | | | 7/8 | 1-1/2 | AD-124-1.5 | 190-1415 |
| | | | 1-1/8 | 1-3/4 | AD-124-1.7 | 190-1417 |
| | | | 1-3/8 | 2 | AD-124-2.0 | 190-1420 |
| | | | 1-5/8 | 2-1/4 | AD-124-2.2* | |
| | | | 1-7/8 | 2-1/2 | AD-124-2.5 | 190-1425 |
| | | | 2-1/8 | 2-3/4 | AD-124-2.7* | |
| | | | 2-3/8 | 3 | AD-124-3.0 | 190-1430 |
| | | | 2-5/8 | 3-1/4 | AD-124-3.2* | |
| | | | 2-7/8 | 3-1/2 | AD-124-3.5 | 190-1435 |
| | | | 3-1/8 | 3-3/4 | AD-124-3.7* | |
| | | | 3-3/8 | 4 | AD-124-4.0 | 190-1440 |
| | | | 4-3/8 | 5 | AD-124-5.0* | |
| 1/2-14 NPT | 5RW | 1" Hex | 1/4 | 7/8 | AD-125-.8 | 190-1508 |
| | | | 3/8 | 1 | AD-125-1.0 | 190-1510 |
| | | | 5/8 | 1-1/4 | AD-125-1.2 | 190-1512 |
| | | | 7/8 | 1-1/2 | AD-125-1.5 | 190-1515 |
| | | | 1 | 1-5/8 | AD-125-1.6* | |
| | | | 1-1/8 | 1-3/4 | AD-125-1.7 | 190-1517 |
| | | | 1-3/8 | 2 | AD-125-2.0 | 190-1520 |
| | | | 1-5/8 | 2-1/4 | AD-125-2.2* | |
| | | | 1-7/8 | 2-1 /2 | AD-125-2.5 | 190-1525 |
| | | | 2-1/8 | 2-3/4 | AD-125-2.7* | |
| | | | 2-3/8 | 3 | AD-125-3.0 | 190-1530 |
| | | | 2-5/8 | 3-1/4 | AD-125-3.2* | |
| | | | 2-7/8 | 3-1/2 | AD-125-3.5 | 190-1535 |
| | | | 3-1/8 | 3-3/4 | AD-125-3.7* | |
| | | | 3-3/8 | 4 | AD-125-4.0 | 190-1540 |
| | | | 3-7/8 | 4-1/2 | AD-125-4.5* | |
| 5/8-14 NPT | 4RW | 1" Hex | 1/4 | 7/8 | AD-584-.8 | 190-2408 |
| | | | 3/8 | 1 | AD-584-1.0 | |
| | | | 7/8 | 1-1/2 | AD-584-1.5* | |
| | | | 1-3/8 | 2 | AD-584-2.0* | |
| 5/8-14 NPT | 5RW | 1" Hex | 1/4 | 7/8 | AD-585-.8 | 190-2508 |
| | | | 3/8 | 1 | AD-585-1.0* | 190-2510 |
| | | | 5/8 | 1-1/4 | AD-585-1.2 | 190-2512 |
| | | | 7/8 | 1-1/2 | AD-585-1.5 | 190-2515 |
| | | | 1-1/8 | 1-3/4 | AD-585-1.7 | 190-2517 |
| | | | 1-3/8 | 2 | AD-585-2.0* | |
| | | | 1-7/8 | 2-1/2 | AD-585-2.5* | |
| | | | 2-3/8 | 3 | AD-585-3.0* | |
| | | | 3-3/8 | 4 | AD-585-4.0* | |
| 3/4-14 NPT | 5RW | 1.25 Hex | 3/16 | 1-1/8 | AD-345-1.1* | |
| | | | 7/16 | 1-3/8 | AD-345-1.3* | |
| | | | 9/16 | 1-1/2 | AD-345-1.5 | 190-3515 |
| | | | 13/16 | 1-3/4 | AD-345-1.7 | 190-3517 |
| | | | 1-1/16 | 2 | AD-345-2.0 | 190-3520 |
| | | | 1-9/16 | 2-1/2 | AD-345-2.5 | 190-3525 |
| | | | 2-1/16 | 3 | AD-345-3.0 | 190-3530 |
| | | | 2-9/16 | 3-1/2 | AD-345-3.5 | 190-3535 |
| | | | 3-1/16 | 4 | AD-345-4.0 | 190-3540 |
| | | | 4-1/16 | 5 | AD-345-5.0 | 190-3550 |
| 3/4-14 NPT | 6RW | 1.25 Hex | 5/16 | 1-1/4 | AD-346-1.2* | |
| | | | 7/16 | 1-3/8 | AD-346-1.3 | 190-3613 |
| | | | 9/16 | 1-1/2 | AD-346-1.5 | 190-3615 |
| | | | 1-1/16 | 2 | AD-346-2.0 | 190-3620 |
| | | | 1-9/16 | 2-1/2 | AD-346-2.5 | 190-3625 |
| | | | 1-13/16 | 2-3/4 | AD-346-2.7* | |
| | | | 2-1/16 | 3 | AD-346-3.0 | 190-3630 |
| | | | 2-9/16 | 3-1/2 | AD-346-3.5 | 190-3635 |
| | | | 3-1/16 | 4 | AD-346-4.0 | 190-3640 |
| | | | 3-9/16 | 4-1/2 | AD-346-4.5 | 190-3645 |
| | | | 4-1/16 | 5 | AD-346-5.0 | 190-3650 |
| 3/4-14 NPT | 7RW | 1.25 Hex | 9/16 | 1-1/2 | AD-347-1.5 | 190-3715 |
| | | | 1-1/16 | 2 | AD-347-2.0 | 190-3720 |
| | | | 1-9/16 | 2-1/2 | AD-347-2.5 | 190-3725 |
| | | | 2-1/16 | 3 | AD-347-3.0 | 190-3730 |
| | | | 2-9/16 | 3-1/2 | AD-347-3.5 | 190-3735 |
| | | | 3-1/16 | 4 | AD-347-4.0 | 190-3740 |
| | | | 3-9/16 | 4-1/2 | AD-347-4.5 | 190-3745 |
| | | | 4-1/16 | 5 | AD-347-5.0 | 190-3750 |
| 4RW | 5RW | 1" Hex | 1 | 2 | AD-45-2 | 190-4520 |
| | | | 2 | 3 | AD-45-3 | 190-4530 |
| | | | 3 | 4 | AD-45-4 | 190-4540 |
| 5RW | 4RW | 7/8 Hex | 1/4 | 1-1/8 | AD-54-1 | 190-5410 |
| | | | 1 | 2 | AD-54-2 | 190-5420 |
| | | | 1-1/2 | 2-1/2 | AD-54-2.5* | |
| | | | 2 | 3 | AD-54-3 | 190-5430 |
| | | | 3 | 4 | AD-54-4 | 190-5440 |
| 5RW | 5RW | 7/8 Hex | 1 | 2 | AD-55-2 | 190-5520 |
| | | | 1-1/2 | 2-1/2 | AD-55-2.5 | 190-5525 |
| | | | 2 | 3 | AD-55-3* | |
| | | | 3 | 4 | AD-55-4 | 190-5540 |
| | | | 4 | 5 | AD-55-5 | 190-5550 |
| 5RW | 6RW | 1" Hex | 1-1/8 | 2 | AD-56-2 | 190-5620 |
| 6RW | 4RW | 1" Hex | 1/4 | 1-1/4 | AD-64-1 | 190-6410 |
| 6RW | 5RW | 1" Hex | 1/4 | 1-1/4 | AD-65-1 | 190-6510 |
| 7RW | 4RW | 1" Hex | 1/4 | 1-1/2 | AD-74-1 | 190-7410 |
| 7RW | 5RW | 1" Hex | 1/4 | 1 | AD-75-1 | 190-7510 |
| | | | 3/4 | 2 | AD-75-2 | 190-7520 |
| | | | 2-1/4 | 3-1/2 | AD-75-3.5* | |
| | | | 2-3/4 | 4 | AD-75-4* | |

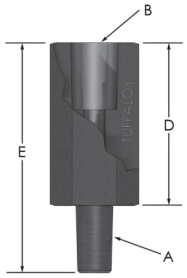
**Not commonly stocked - other adapters available upon request*



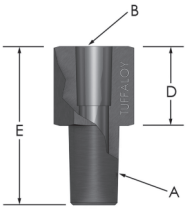

AD-124-.8, AD-125-.8, AD-584-.8, AD-585-.8,



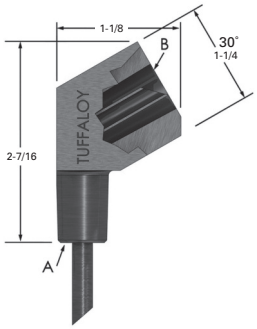

AD-124-1.0, AD-124-4.0, AD-125-1.0, AD-125-4.0, AD-345-1.0, AD-347-4.0,



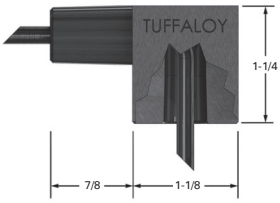

AD-45-2, AD-45-4,




AD-54-1, AD-75-2,



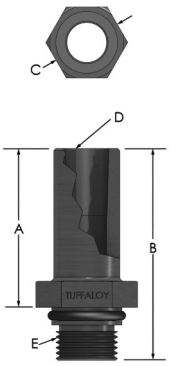

AD-55-30, for 5 RW Tip, Part No. 190-9553




AD-55-90, for 5 RW Tip, Part No. 190-9559

AD-54-90, for 4 RW Tip, Part No. 190-9549

## STRAIGHT THREADED ADAPTERS FOR MULTI-SPOT BARREL AND CLAMP




| | A | B | Description | Part No. |
|---|---|---|---|---|
| 1.25 Hex | D = 4 RW TAPER - E = 7/8-14 NF | | | |
| | 3/8 | 1-1/8 | AD-134-1.1 | 190-3211 |
| | 1/2 | 1-1/4 | AD-134-1.2 | 190-3212 |
| | 5/8 | 1-3/8 | AD-134-1.3 | 190-3213 |
| | 3/4 | 1-1/2 | AD-134-1.5 | 190-3215 |
| | 1 | 1-3/4 | AD-134-1.7 | 190-3217 |
| | 1-1/4 | 2 | AD-134-2.0 | 190-3220 |
| | 1-1/2 | 2-1/4 | AD-134-2.2 | 190-3222 |
| | 1-3/4 | 2-1/2 | AD-134-2.5 | 190-3225 |
| | 2-1/4 | 3 | AD-134-3.0 | 190-3230 |
| | 2-3/4 | 3-1/2 | AD-134-3.5 | 190-3250 |
| 1.25 Hex | D = 5 RW TAPER - E = 7/8-14 NF | | | |
| | 3/8 | 1-1/8 | AD-135-1.1 | 190-3311 |
| | 1 /2 | 1-1/4 | AD-135-1.2 | 190-3312 |
| | 5/8 | 1-3/8 | AD-135-1.3 | 190-3313 |
| | 3/4 | 1-1/2 | AD-135-1.5 | 190-3315 |
| | 1 | 1-3/4 | AD-135-1.7 | 190-3317 |
| | 1-1/4 | 2 | AD-135-2.0 | 190-3320 |
| | 1-1/2 | 2-1/4 | AD-135-2.2 | 190-3322 |
| | 1-3/4 | 2-1/2 | AD-135-2.5 | 190-3325 |
| | 2-1/4 | 3 | AD-135-3.0 | 190-3330 |
| | 2-3/4 | 3-1/2 | AD-135-3.5 | 190-3335 |
| 1.25 Hex | D = 5 RW TAPER - E = 1-12 NF | | | |
| | 3/8 | 1-1/8 | AD-105-1.1 | 190-4311 |
| | 1/2 | 1-1/4 | AD-105-1.2 | 190-4312 |
| | 5/8 | 1-3/8 | AD-105-1.3 | 190-4313 |
| | 3/4 | 1-1/2 | AD-105-1.5 | 190-4315 |
| | 1 | 1-3/4 | AD-105-1.7 | 190-4317 |
| | 1-1/4 | 2 | AD-105-2.0 | 190-4320 |
| 1.25 Hex | D = 5 RW TAPER - E = 1-12 NF | | | |
| | 1-1/2 | 2-1/4 | AD-105-2.2 | 190-4322 |
| | 1-3/4 | 2-1/2 | AD-105-2.5 | 190-4325 |
| | 2 | 2-3/4 | AD-105-2.7 | 190-4327 |
| | 2-1/4 | 3 | AD-105-3.0 | 190-4330 |
| | 2-3/4 | 3-1/2 | AD-105-3.5 | 190-4335 |

**194-2085 1-3/8 D. Barrel Required for 1-12 NF Adapter**

These standard-tip holders are mounted directly to air or hydraulic cylinder pistons. They are ideal for assembling special multi-head resistance welding equipment. Current and coolant water are brought to each of the holders separately.

Electrode adapters for the tip diameter being used and in lengths to suit your set-up are ordered separately: see page 17. Water tubes, for carrying water into the tip, should also be ordered separately.

TUFFALOY offers both straight and offset holders for cylinder mounting. Clamps, hose connections, water tubes and adaptors are not included. Order separately.



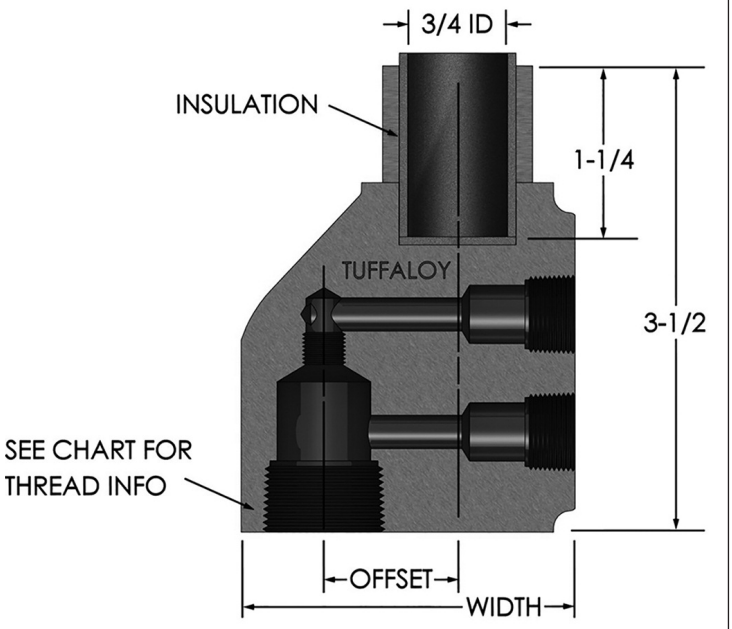
## OFFSET HOLDERS

Offset holders are offered in eight offset sizes, from 1/8 to 1 inch. The standard models have a 1/2-NPT adapter socket, to hold adapters for 4 & 5RW tips. Ordering a 3/4-NPT socket will permit adapters for 6 & 7RW tips to be used.

**OFFSET HOLDERS**

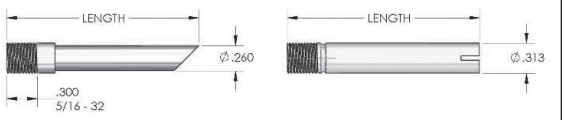
| Offset (inches) | Width (inches) | 4 & 5 RW Part No. 7/8-14 Threads | 4 & 5 RW Part No. 1/2" Pipe | 6 & 7 RW Part No. 3/4" Pipe |
|---|---|---|---|---|
| 1.0 | 2.5 | 194-1578 | 194-1588 | 194-1598 |
| 0.88 | 2.5 | 194-1577 | 194-1587 | |
| 0.75 | 2.31 | 194-1576 | 194-1586 | 194-1596 |
| 0.62 | 2.18 | 194-1575 | 194-1585 | |
| 0.50 | 2.06 | 194-1574 | 194-1584 | 194-1594 |
| 0.38 | 1.94 | 194-1573 | 194-1583 | |
| 0.25 | 1.81 | 194-1572 | 194-1582 | |
| 0.12 | 1.68 | 194-1571 | 194-1581 | |

**ORDER CLAMP SEPARATELY**




*To determine distance adapter sticks out from holder, deduct 1/2-in from length of adapter selected. Water tubes 1/2-in. longer than adapter will install approximately flush with adapter face.*

**STATIONARY WATER TUBES**




FOR 4 RW TIPS FOR 5, 6 OR 7 RW TIPS

**STATIONARY WATER TUBES**

| Length | FOR 4RW USE Description | FOR 4RW USE Part No. | FOR 5RW, 6RW OR 7RW USE Description | FOR 5RW, 6RW OR 7RW USE Part No. |
|---|---|---|---|---|
| 3/4 | 301-.7 | 194-3107 | 312-.7 | 194-3207 |
| 1 | 301-1.0 | 194-3110 | 312-1.0 | 194-3210 |
| 1-1/4 | 301-1.2 | 194-3112 | 312-1.2 | 194-3212 |
| 1-1/2 | 301-1.5 | 194-3115 | 312-1.5 | 194-3215 |
| 1-3/4 | 301-1.7 | 194-3117 | 312-1.7 | 194-3217 |
| 2 | 301-2.0 | 194-3120 | 312.2.0 | 194-3220 |
| 2-1/2 | 301-2.5 | 194-3125 | 312-2.5 | 194-3225 |
| 3 | 301-3.0 | 194-3130 | 312-3.0 | 194-3230 |
| 3-1/2 | 301-3.5 | 194-3135 | 312-3.5 | 194-3235 |
| 4 | 301-4.0 | 194-3140 | 312-4.0 | 194-3240 |
| 4-1/2 | 301-4.5 | 194-3145 | 312-4.5 | 194-3245 |

## STRAIGHT HOLDERS

Straight holders for multi-spot welding are available in two sizes, to carry tips having four different diameters. Series 101 holders are for 4 & 5RW tips, and Series 102 holders are for 6 & 7RW tips. They may be ordered with one or two sets of coolant ports.

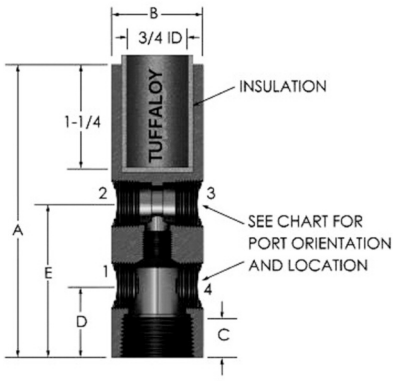
Mating electrical contact surfaces of both the barrels and the clamp are silver plated. Item Numbers for replacement barrels and clamp parts are called out on the drawings.




## ADAPTERS FOR MULTI-SPOT BARREL AND CLAMP

TUFFALOY threaded electrode adapters are used to provide longer electrode holder life, by providing a changeable electrode socket in holders having threaded openings. Standard electrode adapters are made of class 2 alloy. Other alloys available.

## STRAIGHT HOLDERS





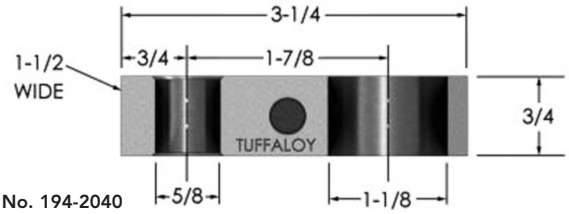


IN LINE PORTS OFFSET 20° PORTS

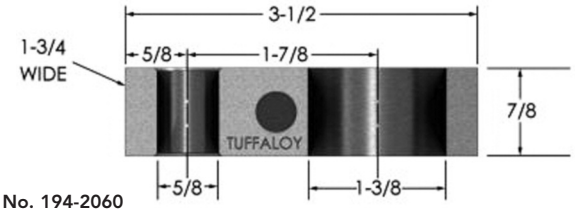
### CYLINDER MOUNTED STRAIGHT BARREL HOLDERS

| Part Number | Description | Overall Length "A" (inches) | Clamping Diameter "B" (inches) | Thread Type | Water In "E" | Water Out "D" | Water Fitting Thread | Water Port Orientation |
|---|---|---|---|---|---|---|---|---|
| 194-2020 | 101-A | 3.58 | 1-1/8 | 1/2-14 NPT | 1-7/8 | 7/8 | 1/4-18 NPT | In Line 1 & 2 |
| 194-2025 | 101-B | 3.58 | 1-1/8 | 1/2-14 NPT | 1-7/8 | 7/8 | 1/4-18 NPT | In Line 1, 2, 3 & 4 |
| 194-2026 | SH-101-1 | 3.25 | 1-1/8 | 1/2-14 NPT | 1-5/8 | 7/8 | 1/8-27 NPT | In Line 1, 2, 3 & 4 |
| 194-2070 | 102-A | 3.93 | 1-3/8 | 3/4-14 NPT | 2-3/16 | 1-3/16 | 1/4-18 NPT | In Line 1 & 2 |
| 194-2075 | 102-B | 3.93 | 1-3/8 | 3/4-14 NPT | 2-3/16 | 1-3/16 | 1/4-18 NPT | In Line 1, 2, 3 & 4 |
| 194-2080 | 103-A | 3.58 | 1-1/8 | 7/8-14 | 1-7/8 | 1-1/16 | 1/4-18 NPT | In Line 1 & 2 |
| 194-2081 | SH-101-876 | 3.58 | 1-1/8 | 7/8-14 | 1-7/8 | 1-1/16 | 1/4-18 NPT | In Line 1, 2, 3 & 4 Offset 20° |
| 194-2082 | 653-1036 | 3.58 | 1-1/8 | 7/8-14 | 1-7/8 | 1-1/16 | 1/4-18 NPT | In Line 1 & 2 Offset 20° |
| 194-2085 | SH-102-B | 3.93 | 1-3/8 | 1-12 | 2-3/16 | 1-3/16 | 1/4-18 NPT | In Line 1, 2, 3 & 4 |

## CLAMPS FOR CYLINDER MOUNTED HOLDERS




Part No. 194-2040




Part No. 194-2060

### CLAMPS FOR CYLINDER MOUNTED HOLDERS

| Part Number | Description | Length (inches) | Width (inches) | Height (inches) | Diameter of Holder Socket (inches) | Diameter of Welding Cable Socket (inches) | Location of Welding Cable Socket (inches) | Location of Holder Stocket (inches) |
|---|---|---|---|---|---|---|---|---|
| 194-2040 | 101-2 | 3-1/4 | 1-1/2 | 3/4 | 1-1/8 | 5/8 | 3/4 | 2-5/8 |
| 194-2060 | 102-2 | 3-1/2 | 1-3/4 | 7/8 | 1-3/8 | 5/8 | 5/8 | 2-1/2 |

# GOLDCROWN® AND STANDARD EJECTOR HOLDERS

## with self-adjusting water tubes

TUFFALOY straight tip-ejecting holders deliver dependable, first class performance. They are designed with maximum simplicity to require minimum maintenance.
All TUFFALOY straight holders now feature exclusive spring-loaded self-adjusting water tubes to ensure the proper flow of coolant through resistance welding electrodes.
The larger ejector holders incorporate bigger fittings for higher coolant flow rates.

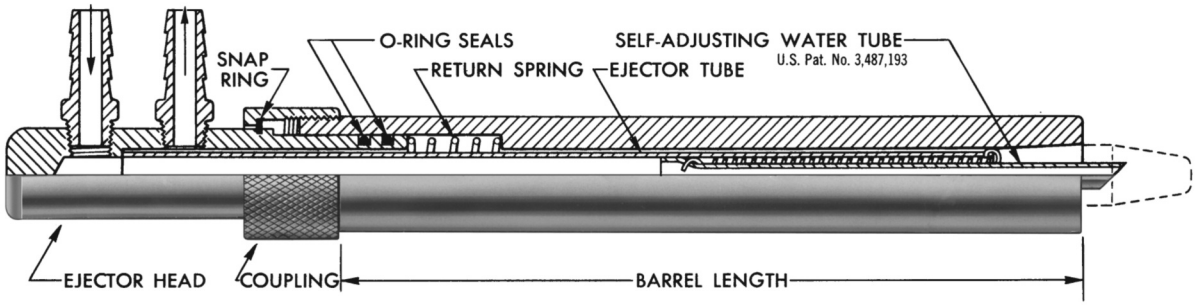
**Goldcrown** premium holders are made of extra-strength Class 2 alloy and are ground and polished to yield greatest conductivity.

| ADAPTER FOR THREADED BARRELS | | | |
|---|---|---|---|
| Part No. | Description | Taper | THD |
| 195-8550 | 8550 | 4RW | 5/8-14 NPT |
| 195-8551 | 8551 | 5RW | 5/8-14 NPT |
| 190-3615 | AD-346-1.5 | 6RW | 3/4-14 NPT |

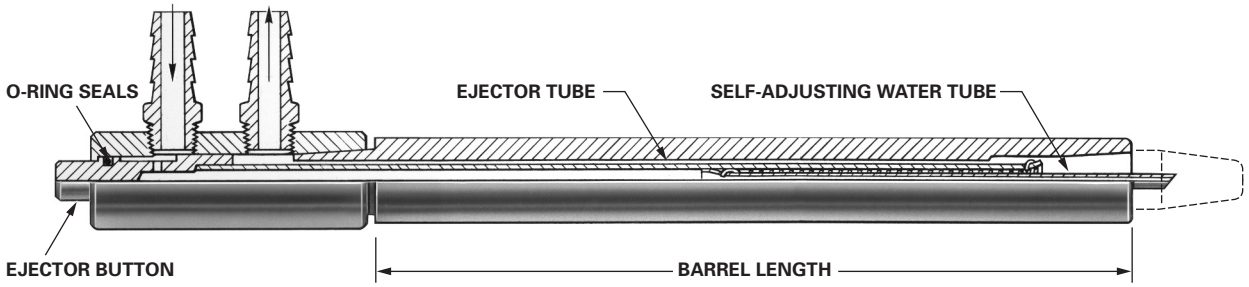
***THESE ADAPTERS ARE SUPPLIED***
*with the holder*

| | | | GOLDCROWN | | STANDARD | |
|---|---|---|---|---|---|---|
| Barrel Dia. | Tip Socket RW | Barrel Length | Description | Part No. | Description | Part No. |
| 5/8 | 4 | 8 | E-05084 | 320-0100 | | |
| 5/8 | 4 | 12 | E-05124 | 320-0120 | | |
| 3/4 | 4 | 8 | E-06084 | 320-0140 | | |
| 3/4 | 5 | 8 | E-06085 | 320-0150 | | |
| 3/4 | 4 | 12 | E-06124 | 320-0160 | | |
| 3/4 | 5 | 12 | E-06125 | 320-0170* | | |
| 7/8 | 4 | 8 | E-07084 | 320-0180 | | |
| 7/8 | 5 | 8 | E-07085 | 320-0190 | | |
| 7/8 | 4 | 12 | E-07124 | 320-0200 | | |
| 7/8 | 5 | 12 | E-07125 | 320-0210 | | |
| 1 | 4 | 8 | E-08084 | 320-0220 | SHE-08084 | 321-0220 |
| 1 | 5 | 8 | E-08085 | 320-0230 | SHE-08085 | 321-0230 |
| 1 | 6 | 8 | E-08086 | 320-0240* | SHE-08086 | 321-0240* |
| 1 | 4 | 12 | E-08124 | 320-0250 | SHE-08124 | 321-0250 |
| 1 | 5 | 12 | E-08125 | 320-0260 | SHE-08125 | 321-0260 |
| 1 | 6 | 12 | E-08126 | 320-0270* | SHE-08126 | 321-0270* |
| 1-1/4 | 4 | 8 | E-10084 | 320-0280 | SHE-10084 | 321-0280 |
| 1-1/4 | 5 | 8 | E-10085 | 320-0290 | SHE-10085 | 321-0290 |
| 1-1/4 | 6 | 8 | E-10086 | 320-0300* | SHE-10086 | 321-0300* |
| 1-1/4 | 7 | 8 | E-10087 | 320-0310 | SHE-10087 | 321-0310 |
| 1-1/4 | 4 | 12 | E-10124 | 320-0320 | SHE-10124 | 321-0320 |
| 1-1/4 | 5 | 12 | E-10125 | 320-0330 | SHE-10125 | 321-0330 |
| 1-1/4 | 6 | 12 | E-10126 | 320-0340* | SHE-10126 | 321-0340* |
| 1-1/4 | 7 | 12 | E-10127 | 320-0350 | SHE-10127 | 321-0350 |
| 1-1/2 | 4 | 8 | E-12084 | 320-0360* | SHE-12084 | 321-0360 |
| 1-1/2 | 5 | 8 | E-12085 | 320-0370 | SHE-12085 | 321-0370 |
| 1-1/2 | 5 | 8 | E-12085-A | 320-0375* | SHE-12085-A | 321-0375* |
| 1-1/2 | 6 | 8 | E-12086 | 320-0380 | SHE-12086 | 321-0380 |
| 1-1/2 | 6 | 8 | E-12086-A | 320-0385 | SHE-12086-A | 321-0385 |
| 1-1/2 | 7 | 8 | E-12087 | 320-0390 | SHE-12087 | 321-0390 |
| 1-1/2 | 4 | 12 | E-12124 | 320-0410 | SHE-12124 | 321-0410 |
| 1-1/2 | 4 | 12 | E-12124-A | 320-0415* | SHE-12124-A | 321-0415* |
| 1-1/2 | 5 | 12 | E-12125 | 320-0420 | SHE-12125 | 321-0420 |
| 1-1/2 | 5 | 12 | E-12125-A | 320-0425* | SHE-12125-A | 321-0425* |
| 1-1/2 | 6 | 12 | E-12126 | 320-0440* | SHE-12126 | 321-0440* |
| 1-1/2 | 7 | 12 | E-12127 | 320-0450 | SHE-12127 | 321-0450 |

*Suffix 'A' in holder description denotes a threaded tip adapter is supplied*
**Item not normally stocked*




*Cross-section of holders with barrels 1 inch or more in diameter.*




*Cross-section of holders with barrels 7/8 inch or less in diameter.*

# GOLDSPOT® AND STANDARD NON-EJECTOR HOLDERS

## with self-adjusting water tubes

TUFFALOY straight non-ejector holders are now equipped with the same springloaded self-adjusting water tubes as the Goldcrown ejector unit, so electrode cooling is facilitated and improved. They are low in initial cost and inexpensive to maintain. Simple design and few parts contribute to low maintenance cost and excellent performance. Holders are heavy-duty and built to withstand very high welding rates.

**Goldspot** premium holders have barrels of Class 2 alloy, ground and polished for best conductivity.



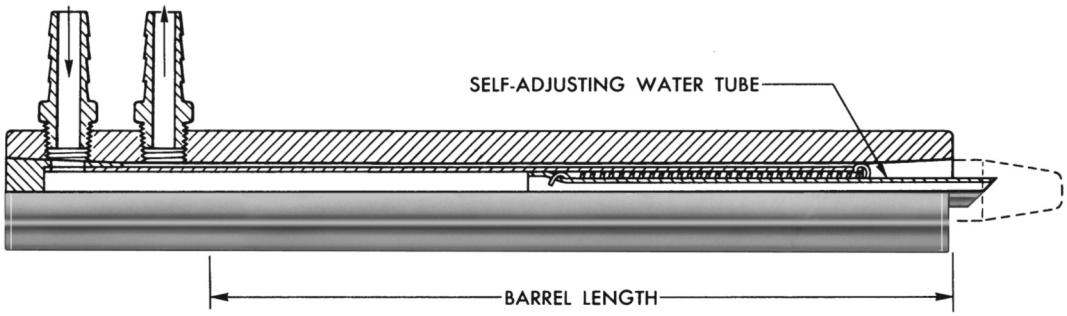

*Cross-section view of holders with barrels less than 1 inch diameter.*

| ADAPTER FOR THREADED BARRELS | | | |
|---|---|---|---|
| Part No. | Descrip-tion | Taper | THD |
| 195-8550 | 8550 | 4RW | 5/8-14 NPT |
| 195-8551 | 8551 | 5RW | 5/8-14 NPT |
| 190-3615 | AD-346-1.5 | 6RW | 3/4-14 NPT |
| 190-3715 | AD-347-1.5 | 7RW | 3/4-14 NPT |

***THESE ADAPTERS ARE SUPPLIED*** *with the holder*

| | | | GOLDSPOT | | STANDARD | |
|---|---|---|---|---|---|---|
| Barrel Dia. | Tip Socket RW | Barrel Length | Descrip-tion | Part No. | Descrip-tion | Part No. |
| 5/8 | 4 | 8 | N-05084 | 325-0100 | | |
| 5/8 | 4 | 12 | N-05124 | 325-0120* | | |
| 3/4 | 4 | 8 | N-06084 | 325-0140 | | |
| 3/4 | 5 | 8 | N-06085 | 325-0150* | | |
| 3/4 | 4 | 12 | N-06124 | 325-0160* | | |
| 3/4 | 5 | 12 | N-06125 | 325-0170* | | |
| 7/8 | 4 | 8 | N-07084 | 325-0180 | | |
| 7/8 | 5 | 8 | N-07085 | 325-0190* | | |
| 7/8 | 4 | 12 | N-07124 | 325-0200 | | |
| 7/8 | 5 | 12 | N-07125 | 325-0210* | | |
| 1 | 4 | 8 | N-08084 | 325-0220 | SHN-08084 | 326-0220 |
| 1 | 4 | 8 | N-08084-A | 325-0225 | SHN-08084-A | 326-0225 |
| 1 | 5 | 8 | N-08085 | 325-0230 | SHN-08085 | 326-0230 |
| 1 | 5 | 8 | N-08085-A | 325-0235* | SHN-08085-A | 326-0235* |
| 1 | 6 | 8 | N-08086 | 325-0240* | SHN-08086 | 326-0240* |
| 1 | 4 | 12 | N-08124 | 325-0250 | SHN-08124 | 326-0250 |
| 1 | 4 | 12 | N-08124-A | 325-0255 | SHN-08124-A | 326-0255 |
| 1 | 5 | 12 | N-08125 | 325-0260 | SHN-08125 | 326-0260 |
| 1 | 5 | 12 | N-08125-A | 325-0265 | SHN-08125-A | 326-0265 |
| 1 | 6 | 12 | N-08126 | 325-0270* | SHN-08126 | 326-0270* |
| 1-1/4 | 4 | 8 | N-10084 | 325-0280* | SHN-10084 | 326-0280* |
| 1-1/4 | 4 | 8 | N-10084-A | 325-0285 | SHN-10084-A | 326-0285 |
| 1-1/4 | 5 | 8 | N-10085 | 325-0290 | SHN-10085 | 326-0290 |
| 1-1/4 | 5 | 8 | N-10085-A | 325-0295 | SHN-10085-A | 326-0295 |
| 1-1/4 | 6 | 8 | N-10086 | 325-0300* | SHN-10086 | 326-0300* |
| 1-1/4 | 7 | 8 | N-10087 | 325-0310* | SHN-10087 | 326-0310* |
| 1-1/4 | 4 | 12 | N-10124 | 325-0320 | SHN-10124 | 326-0320 |
| 1-1/4 | 4 | 12 | N-10124-A | 325-0325* | SHN-10124-A | 326-0325* |
| 1-1/4 | 5 | 12 | N-10125 | 325-0330 | SHN-10125 | 326-0330 |
| 1-1/4 | 5 | 12 | N-10125-A | 325-0335 | SHN-10125-A | 326-0335 |
| 1-1/4 | 6 | 12 | N-10126 | 325-0340* | SHN-10126 | 326-0340* |
| 1-1/4 | 7 | 12 | N-10127 | 325-0350* | SHN-10127 | 326-0350* |
| 1-1/2 | 4 | 8 | N-12084 | 325-0360* | SHN-12084 | 326-0360* |
| 1-1/2 | 4 | 8 | N-12084-A | 325-0365* | SHN-12084-A | 326-0365* |
| 1-1/2 | 5 | 8 | N-12085 | 325-0370 | SHN-12085 | 326-0370 |
| 1-1/2 | 5 | 8 | N-12085-A | 325-0375 | SHN-12085-A | 326-0375 |
| 1-1/2 | 6 | 8 | N-12086 | 325-0380* | SHN-12086 | 326-0380* |
| 1-1/2 | 7 | 8 | N-12087 | 325-0390 | SHN-12087 | 326-0390 |
| 1-1/2 | 4 | 12 | N-12124 | 325-0410* | SHN-12124 | 326-0410* |
| 1-1/2 | 5 | 12 | N-12125 | 325-0420 | SHN-12125 | 326-0420 |
| 1-1/2 | 5 | 12 | N-12125-A | 325-0425* | SHN-12125-A | 326-0425* |
| 1-1/2 | 6 | 12 | N-12126 | 325-0440* | SHN-12126 | 326-0440* |
| 1-1/2 | 7 | 12 | N-12127 | 325-0450* | SHN-12127 | 326-0450* |

*Suffix "A" in holder description denotes a threaded tip adapter is supplied*
**Item not normally stocked*



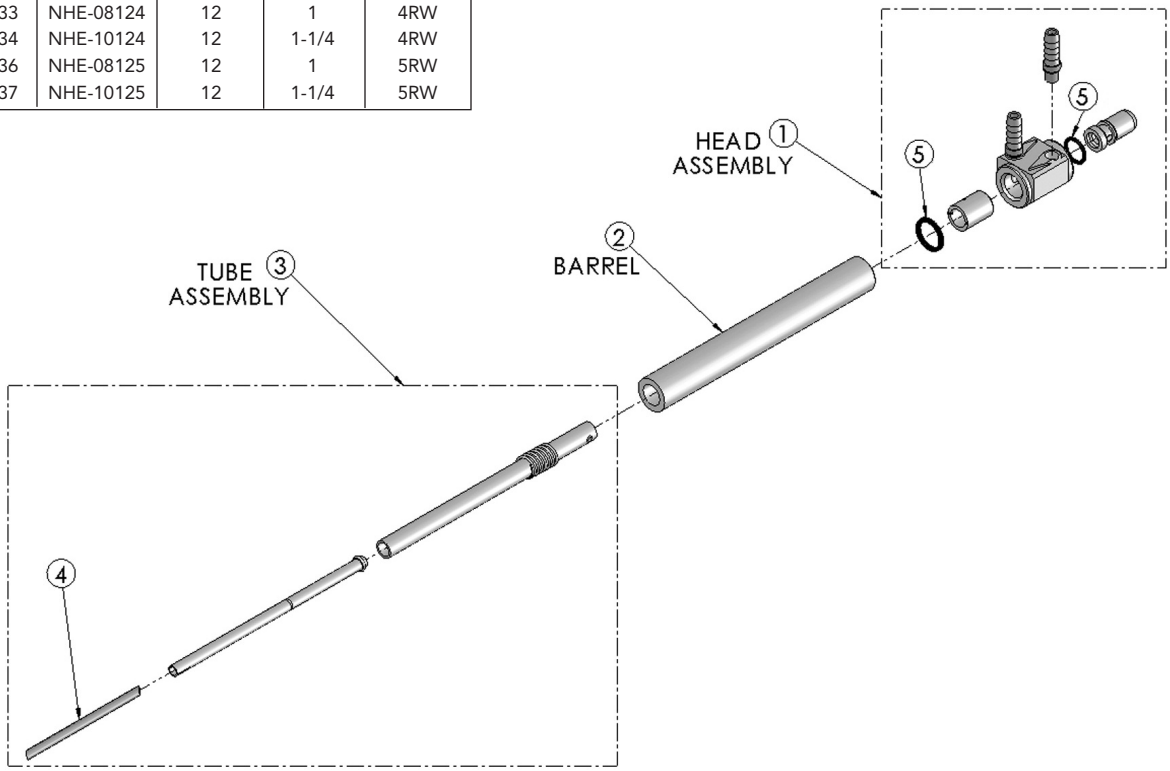

*Cross-section view of holders with barrels 1 inch or more in diameter.*



| Part Number | Descrip-tion | Barrel Length (in) | Barrel Dia. (in) | Tip Socket Taper |
|---|---|---|---|---|
| 319-0206 | NHE-08035 | 3 | 1 | 5RW |
| 319-0207 | NHE-10035 | 3 | 1-1/4 | 5RW |
| 319-2011 | NHE-06084 | 8 | 3/4 | 4RW |
| 319-0212 | NHE-07084 | 8 | 7/8 | 4RW |
| 319-0213 | NHE-08084 | 8 | 1 | 4RW |
| 319-0214 | NHE-10084 | 8 | 1-1/4 | 4RW |
| 319-0216 | NHE-08085 | 8 | 1 | 5RW |
| 319-0217 | NHE-10085 | 8 | 1-1/4 | 5RW |
| 319-0231 | NHE-06124 | 12 | 3/4 | 4RW |
| 319-0232 | NHE-07124 | 12 | 7/8 | 4RW |
| 319-0233 | NHE-08124 | 12 | 1 | 4RW |
| 319-0234 | NHE-10124 | 12 | 1-1/4 | 4RW |
| 319-0236 | NHE-08125 | 12 | 1 | 5RW |
| 319-0237 | NHE-10125 | 12 | 1-1/4 | 5RW |

## TUFFALOY NICKEL PLATED EJECTOR HOLDERS

TUFFALOY nickel plated ejector holders feature high conductivity copper with nickel plated surfaces for corrosion resistance and super conductivity. These holders also feature adjustable water tubes to insure proper water flow for all electrodes.



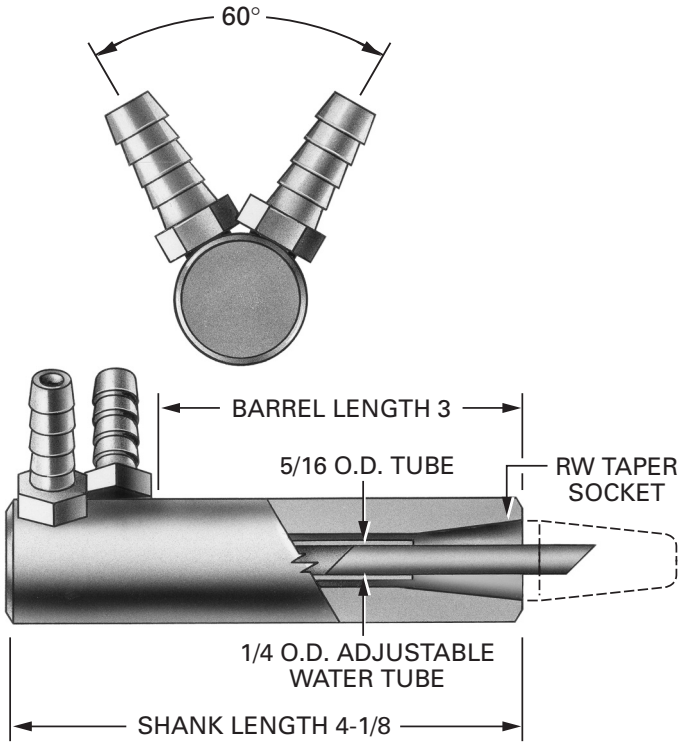

| Descrip-tion | Holder Assy. | 1 Head Assy. | 2 Barrel | 3 Tube Assy. | 4 Water Tube | 5 Hose O-Ring Kit |
|---|---|---|---|---|---|---|
| NHE-08084 | 319-0213 | 195-0101 | 001-213B | 195-0210 | 195-0017 | 037-0105 |
| NHE-10084 | 319-0214 | 195-0101 | 001-214B | 195-0210 | 195-0017 | 037-0105 |
| NHE-08085 | 319-0216 | 195-0100 | 001-216B | 195-0208 | 195-0015 | 037-0106 |
| NHE-10085 | 319-0217 | 195-0100 | 001-217B | 195-0208 | 195-0015 | 037-0106 |
| NHE-08124 | 319-0233 | 195-0101 | 001-233B | 195-0211 | 195-0017 | 037-0105 |
| NHE-10124 | 319-0234 | 195-0101 | 001-234B | 195-0211 | 195-0017 | 037-0105 |
| NHE-08125 | 319-0236 | 195-0100 | 001-236B | 195-0212 | 195-0015 | 037-0106 |
| NHE-10125 | 319-0237 | 195-0100 | 001-237B | 195-0212 | 195-0015 | 037-0106 |

## CLOSED-COUPLED HOLDERS

For use where welding space is limited. Standard body length is 3 inches. Other lengths are made on request; minimum length 2 inches.

| Body Dia. | Tip Socket | Description | Part No. |
|---|---|---|---|
| 3/4 | 4RW | N-06034 | 330-0140 |
| 7/8 | 4RW | N-07034 | 330-0180 |
| 7/8 | 5RW | N-07035 | 330-0190 |
| 1 | 4RW | N-08034 | 330-0220 |
| 1 | 5RW | N-08035 | 330-0230 |
| 1-1/4 | 4RW | N-10034 | 330-0280 |
| 1-1/4 | 5RW | N-10035 | 330-0290 |
| 1-1/2 | 4RW | N-12034 | 330-0360* |
| 1-1/2 | 5RW | N-12035 | 330-0370* |

**Item not normally stocked*

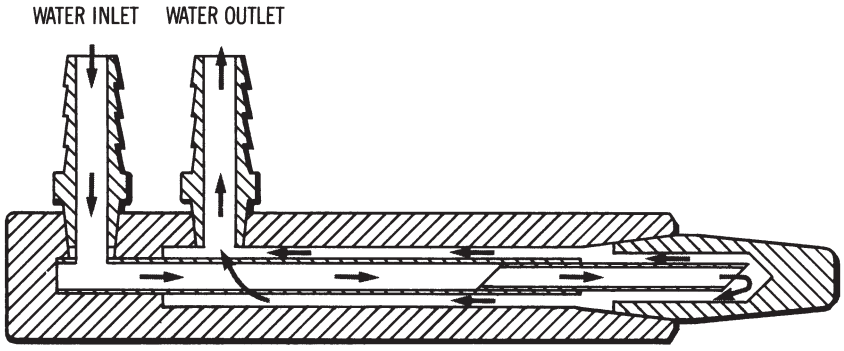



## ADJUSTABLE WATER TUBE USE

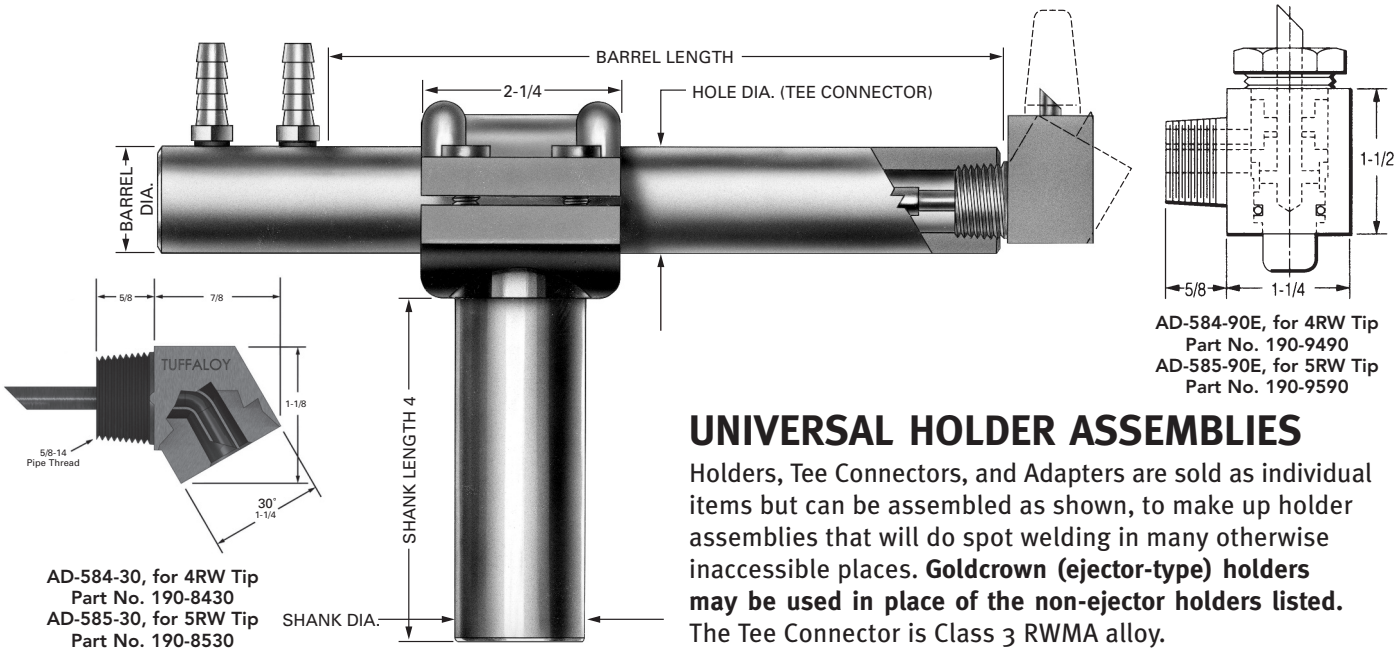
It is very important that resistance welding electrodes be kept as cool as possible; excessive heat softens them, allowing the nose to mushroom and weld quality to drop.

Adjustable water tubes are used to deflect incoming coolant water to the full extent of the water hole in the electrode. Before installing a tip, check that there is an adjustable water tube in place and that it is pulled out far enough so that it will contact the end of the water hole in the tip.

The drawing shows a typical straight holder, but the principle is the same for all types of holders.




*Adjustable water tube correctly positioned in tip. Cold water will strike the hottest part of the tip first.*

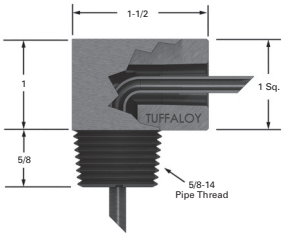



AD-584-30, for 4RW Tip
Part No. 190-8430
AD-585-30, for 5RW Tip
Part No. 190-8530

AD-584-90E, for 4RW Tip
Part No. 190-9490
AD-585-90E, for 5RW Tip
Part No. 190-9590

## UNIVERSAL HOLDER ASSEMBLIES

Holders, Tee Connectors, and Adapters are sold as individual items but can be assembled as shown, to make up holder assemblies that will do spot welding in many otherwise inaccessible places. **Goldcrown (ejector-type) holders may be used in place of the non-ejector holders listed.** The Tee Connector is Class 3 RWMA alloy.




AD-584-90, for 4RW Tip
Part No. 190-8490
AD-585-90, for 5RW Tip
Part No. 190-8590

| HOLDERS | | | | TEE CONNECTORS | | | |
|---|---|---|---|---|---|---|---|
| Barrel Dia. | Barrel Length | Descrip-tion. | Part No. | Hole Dia. | Shank Dia. | Descrip-tion | Part No. |
| 1 | 8 | N-08085-A | 325-0235 | 1 | 1 | T-1-1 | 192-1100 |
| 1-1/4 | 8 | N-10085-A | 325-0295 | 1-1/4 | 1 | T-1 | 192-1000 |
| 1-1/4 | 8 | N-10085-A | 325-0295 | 1-1/4 | 1 | T-1 | 192-1000 |
| 1-1/4 | 8 | N-10085-A | 325-0295 | 1-1/4 | 1-1/4 | T-125 | 192-1250 |
| 1-1/4 | 8 | N-10085-A | 325-0295 | 1-1/4 | 1-1/4 | T-125 | 192-1250 |
| 1-1/4 | 8 | N-10085-A | 325-0295 | 1-1/4 | 1-1/4 | T-125 | 192-1250 |
| 1-1/2 | 8 | N-12085-A | 325-0375 | 1-1/2 | 1-1/2 | T-15 | 192-1500 |
| 1-1/2 | 8 | N-12085-A | 325-0375 | 1-1/2 | 1-1/2 | T-15 | 192-1500 |
| 1-1/2 | 8 | N-12085-A | 325-0375 | 1-1/2 | 1-1/2 | T-15 | 192-1500 |

| ADAPTERS TO CHOOSE FROM | | | |
|---|---|---|---|
| Tip Socket | Angle Degrees | Descrip-tion | Part No. |
| 4RW | 90 | AD-584-90 | 190-8490 |
| 4RW | 30 | AD-584-30 | 190-8430 |
| 5RW | 90 | AD-585-90 | 190-8590 |
| 5RW | 30 | AD-585-30 | 190-8530 |
| 6RW | 90 | AD-586-90 | 190-8690 |

## WELDER ARMS TUFFALOY

Class 2 spot welding machine arms made by Tuffaloy reduce set up time and give longer life.

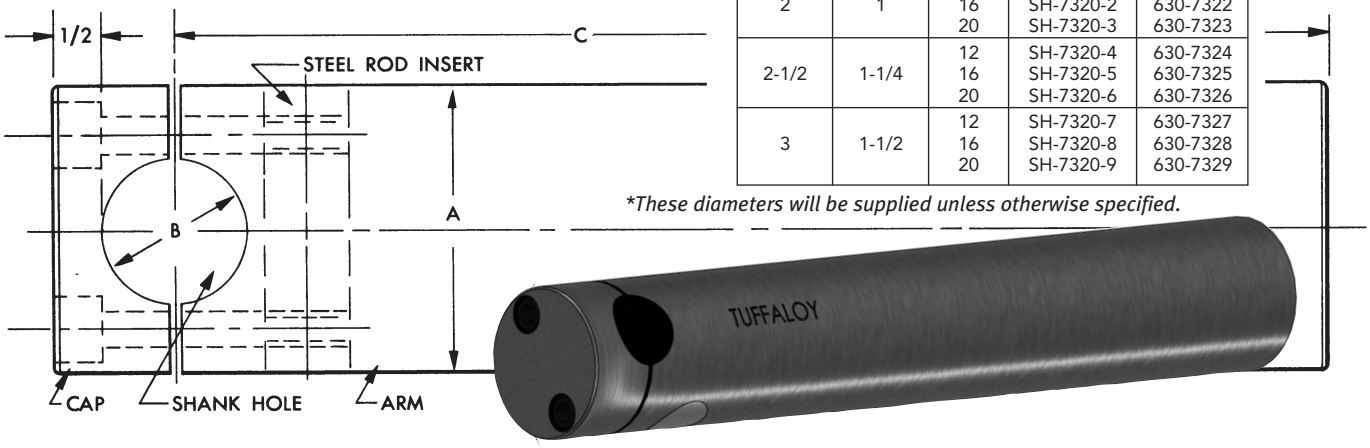
Electrode holder shanks can be attached to these arms from the front, by bolting the cap over them. This means no extra clearance is required between the arms to allow running a shank up (or down) into a hole in the arm. It makes the insertion of Tuffaloy multiple-welding holders much easier.

One of the most common failures of welder arms is the destruction of the bolt hole threads, due to the relatively soft copper involved. Tuffaloy arms have a transverse steel bar insert in which the bolt hole threads are cut. This provides greatly increased thread life.

Standard arm configurations are shown in the table. Special arms are also available.

| A Arm Diameter | B Hole Diameter* | C Arm Length | Descrip-tion | Part No. |
|---|---|---|---|---|
| 2 | 1 | 12 | SH-7320-1 | 630-7321 |
| | | 16 | SH-7320-2 | 630-7322 |
| | | 20 | SH-7320-3 | 630-7323 |
| 2-1/2 | 1-1/4 | 12 | SH-7320-4 | 630-7324 |
| | | 16 | SH-7320-5 | 630-7325 |
| | | 20 | SH-7320-6 | 630-7326 |
| 3 | 1-1/2 | 12 | SH-7320-7 | 630-7327 |
| | | 16 | SH-7320-8 | 630-7328 |
| | | 20 | SH-7320-9 | 630-7329 |

**These diameters will be supplied unless otherwise specified.*

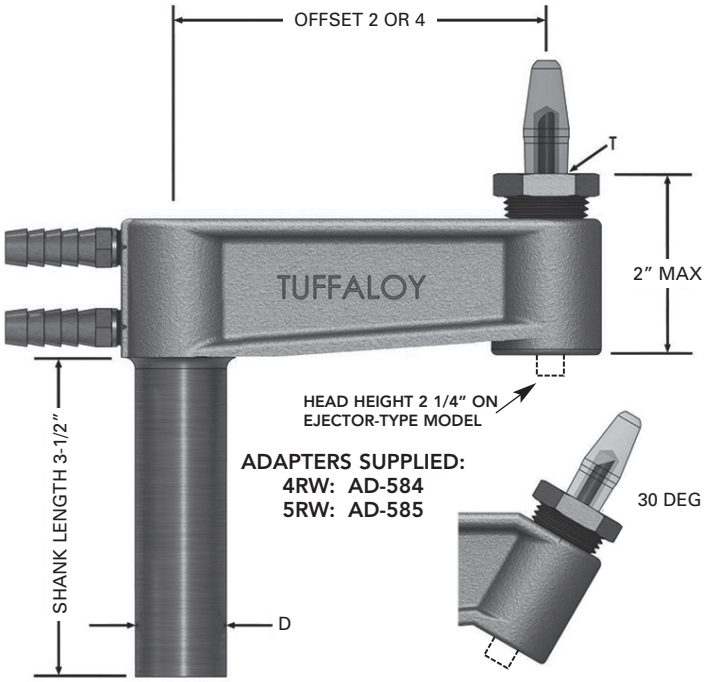


# STANDARD OFFSET HOLDERS

TUFFALOY Cast Class 2 Alloy offset holders combine long life with good conductivity. Threaded tip adapters are easily replaced when tip socket is worn beyond use, or when you wish to change to a different taper size.

TUFFALOY offset holders are made in 2- and 4-inch offsets, and in four shank sizes, with 90° and 30° heads. They are supplied with adapters for No. 4 or No. 5 RW taper tips.

Tip Ejector mechanisms are available on all 90° head holders and the 30° head 4-in. offset holders. **When ordering this feature change order number prefix from 'ON' to 'OE'. Example: OE-874-290.**




## TWO-INCH OFFSET HOLDERS

| Adapter Tip Socket | Socket Angle | 3/4″ SHANK DIA. | | 7/8″ SHANK DIA. | | 1″ SHANK DIA. | | 1-1/4″ SHANK DIA. | | 1-1/2″ SHANK DIA. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Description | Part No. | Description | Part No. | Description | Part No. | Description | Part No. | Description | Part No. |
| 4RW | 30° | ON-754-230 | 335-1300 | ON-874-230 | 335-1400* | ON-14-230 | 335-1000 | ON-1254-230 | 335-1100 | ON-154-230 | 335-1200* |
| 4RW | 90° | ON-754-290 | 335-1310* | ON-874-290 | 335-1410* | ON-14-290 | 335-1010 | ON-1254-290 | 335-1110 | ON-154-290 | 335-1210* |
| 5RW | 30° | ON-755-230 | 335-1350* | ON-875-230 | 335-1450* | ON-15-230 | 335-1050 | ON-1255-230 | 335-1150 | ON-155-230 | 335-1250* |
| 5RW | 90° | ON-755-290 | 335-1360* | ON-875-290 | 335-1460* | ON-15-290 | 335-1060 | ON-1255-290 | 335-1160 | ON-155-290 | 335-1260 |

## FOUR-INCH OFFSET HOLDERS

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4RW | 30° | ON-754-430 | 335-1320* | ON-874-430 | 335-1420* | ON-14-430 | 335-1020 | ON-1254-430 | 335-1120 | ON-154-430 | 335-1220* |
| 4RW | 90° | ON-754-490 | 335-1330* | ON-874-490 | 335-1430* | ON-14-490 | 335-1030 | ON-1254-490 | 335-1130 | ON-154-490 | 335-1230* |
| 5RW | 30° | ON-755-430 | 335-1370* | ON-875-430 | 335-1470* | ON-15-430 | 335-1070 | ON-1255-430 | 335-1170 | ON-155-430 | 335-1270 |
| 5RW | 90° | ON-755-490 | 335-1380* | ON-875-490 | 335-1480* | ON-15-490 | 335-1080 | ON-1255-490 | 335-1180 | ON-155-490 | 335-1280 |

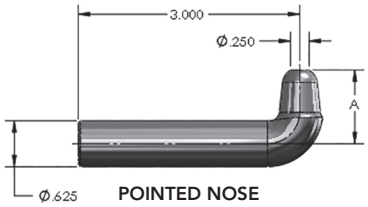
## TWO-INCH EJECTOR STYLE OFFSET HOLDERS

| Adapter Tip Socket | Socket Angle | 3/4″ SHANK DIA. | | 7/8″ SHANK DIA. | | 1″ SHANK DIA. | | 1-1/4″ SHANK DIA. | | 1-1/2″ SHANK DIA. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Description | Part No. | Description | Part No. | Description | Part No. | Description | Part No. | Description | Part No. |
| 4RW | 90° | OE-754-290 | 335-0310* | OE-874-290 | 335-0410* | OE-14-290 | 335-0010 | OE-1254-290 | 335-0110 | OE-154-290 | 335-0210 |
| 5RW | 90° | OE-755-290 | 335-0360* | OE-875-290 | 335-0460* | OE-15-290 | 335-0060 | OE-1255-290 | 335-0160 | OE-155-290 | 335-0260 |

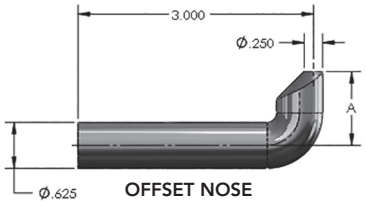
## FOUR-INCH EJECTOR STYLE OFFSET HOLDERS

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4RW | 30° | OE-754-430 | 335-0320* | OE-874-430 | 335-0420* | OE-14-430 | 335-0020 | OE-1254-430 | 335-0120 | OE-154-430 | 335-0220 |
| 4RW | 90° | OE-754-490 | 335-0330* | OE-874-490 | 335-0430* | OE-14-490 | 335-0030 | OE-1254-490 | 335-0130 | OE-154-490 | 335-0230 |
| 5RW | 30° | OE-755-430 | 335-0370* | OE-875-430 | 335-0470* | OE-15-430 | 335-0070 | OE-1255-430 | 335-0170 | OE-155-430 | 335-0270 |
| 5RW | 90° | OE-755-490 | 335-0380* | OE-875-490 | 335-0480* | OE-15-490 | 335-0080 | OE-1255-490 | 335-0180 | OE-155-490 | 335-0280 |

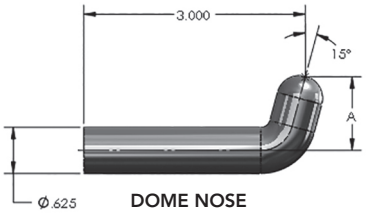
**May not be in stock*



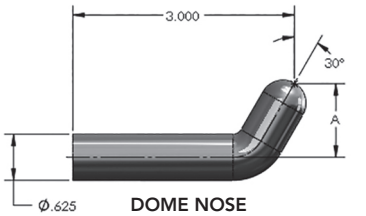
POINTED NOSE



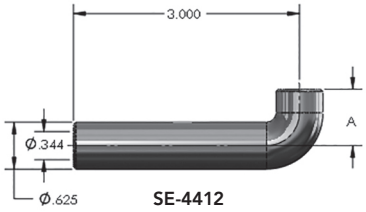
OFFSET NOSE



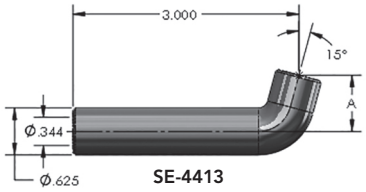
DOME NOSE



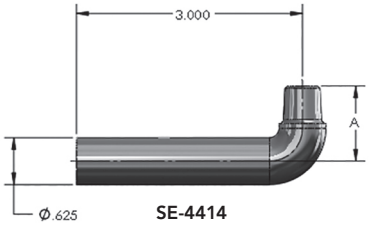
DOME NOSE



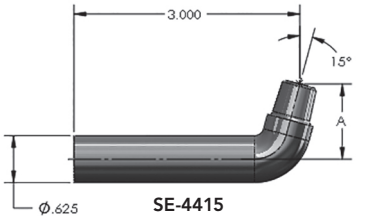
SE-4412



SE-4413



SE-4414



SE-4415

| VARIABLE-OFFSET HOLDERS | | |
|---|---|---|
| Shank Dia. | Descrip-tion | Part No. |
| 1 | SH-7223 | 345-7223 |
| 1-1/4 | SH-7224 | 345-7224 |
| 1-1/2 | SH-7225 | 345-7225 |






## VARIABLE OFFSET HOLDER AND STRAIGHT SHANK TIPS

These offset holders provide a range of offset dimensions rather than one fixed amount, as with other one-piece offset holders. The top has a long shank and can be moved in or out to vary the offset anywhere between four and five inches.

The holders, all of Class 3 alloy, are made in three barrel diameters: 1, 1-1/4, and 1-1/2 inches.

The tips are positional because they have no taper: they have straight shanks, and are held in any selected position by a locking-wedge device in the holder.

Tips are made in one and two-piece designs. The one-piece tips are offered with the nose designs shown. The two-piece tips are made up by combining the shanks shown here with Tuffcap caps (normally used with No. 5 RW size Tuffcap shanks). Either male or female tips can be used, with any #5 nose design offered on pages 6 & 7. All integral tips and shanks shown here are of Class 2 alloy.

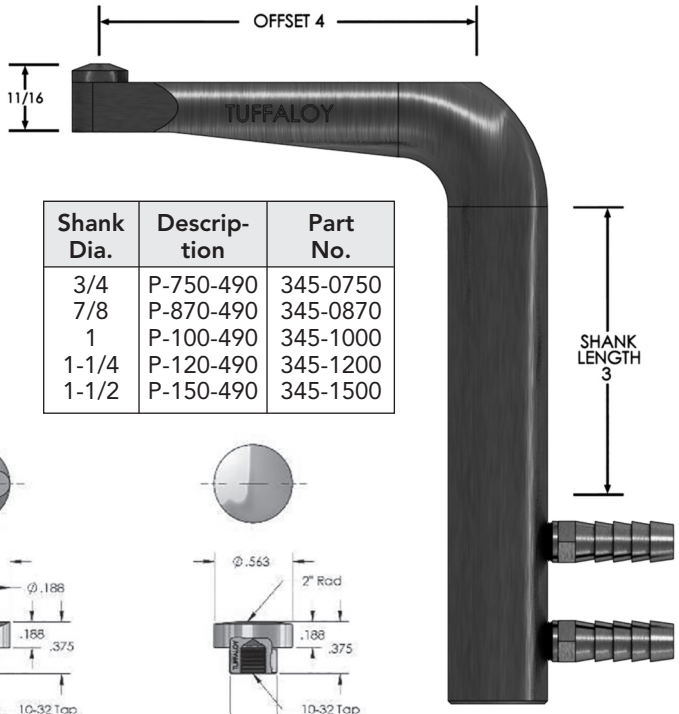
| STRAIGHT-SHANK TIPS | | | |
|---|---|---|---|
| Type of Tip | Nose Length 'A' | Descrip-tion | Part No. |
| Pointed | 1" | SE-4408-1 | 170-4408 |
| Offset | 1" | SE-4409-1 | 170-4409 |
| 15° Dome | 1" | SE-4410-1 | 170-4410 |
| 30° Dome | 1" | SE-4411-1 | 170-4411 |
| Pointed | 2" | SE-4408-2 | 170-4418 |
| Offset | 2" | SE-4409-2 | 170-4419 |
| 15° Dome | 2" | SE-4410-2 | 170-4420 |
| 30° Dome | 2" | SE-4411-2 | 170-4421 |

| STRAIGHT-SHANK TUFFCAP SHANKS | | | | |
|---|---|---|---|---|
| Tuffcap Cap Type | Nose Length 'A' | Angle | Descrip-tion | Part No. |
| Male | 3/4" | 90° | SE-4412 | 170-4422 |
| Male | 3/4" | 15° | SE-4413 | 170-4423 |
| Female | 1" | 90° | SE-4414 | 170-4424 |
| Female | 1" | 15° | SE-4415 | 170-4425 |

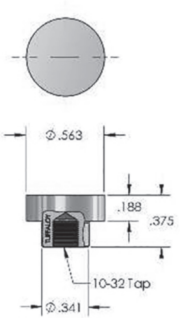
# TUFFALOY PADDLE-TYPE HOLDERS AND SOCKET-TYPE TIPS

This holder is for welding in very restricted areas. It provides a very low head height and a four-inch offset. It is made in shank diameters of 3/4, 7/8, 1, and 1-1/4 inches. An adapter bushing is used to add a 1-1/2-in. dia. model to the line. Each holder comes complete with a socket-type tip (SE-3101) and holding screw. The tip may be inserted in either side of the paddle. Holders are of Class 2 alloy. Tips are available in Class 1, Class 2, Class 3 alloy, or Z alloy.

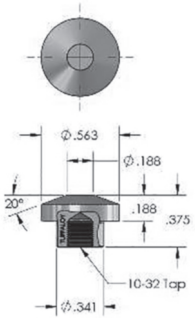
The four socket-type tips shown here can be used in special welding fixtures and dies as well as in the paddle-type holders.



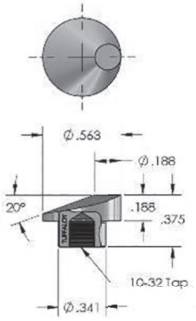

| Shank Dia. | Descrip-tion | Part No. |
|---|---|---|
| 3/4 | P-750-490 | 345-0750 |
| 7/8 | P-870-490 | 345-0870 |
| 1 | P-100-490 | 345-1000 |
| 1-1/4 | P-120-490 | 345-1200 |
| 1-1/2 | P-150-490 | 345-1500 |



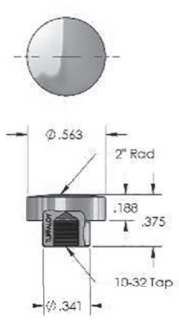

FLAT FACED
Class 1 SE-3099-1
Part No. 170-3099-1
Class 2 SE-3099
Part No. 170-3099
Class 3 SE-3111
Part No. 170-3111
ZIRC SE-3099-Z
Part No. 170-3099-Z



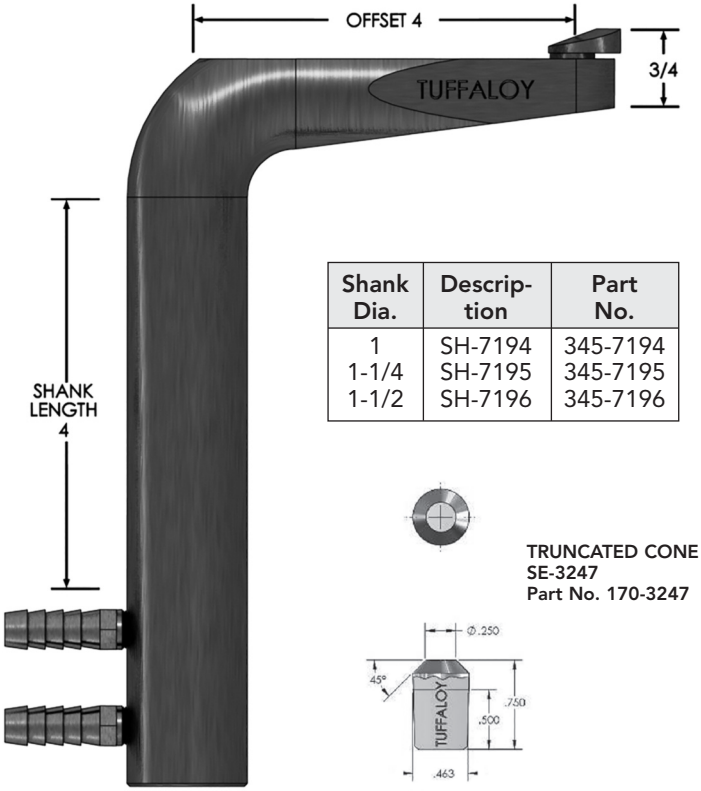

TRUNCATED CONE
Class 1 SE-3101-1
Part No. 170-3101-1
Class 2 SE-3101
Part No. 170-3101
Class 3 SE-3113
Part No. 170-3113
ZIRC SE-3101-Z
Part No. 170-3101-Z




OFFSET
Class 1 SE-3102-1
Part No. 170-3102-1
Class 2 SE-3102
Part No. 170-3102
Class 3 SE-3123
Part No. 170-3123
ZIRC SE-3102-Z
Part No. 170-3102-Z




RADIUS FACED
Class 1 SE-3110-1
Part No. 170-3110-1
Class 2 SE-3110
Part No. 170-3110
Class 3 SE-3133
Part No. 170-3133
ZIRC SE-3110-Z
Part No. 170-3110-Z




| Shank Dia. | Descrip-tion | Part No. |
|---|---|---|
| 1 | SH-7194 | 345-7194 |
| 1-1/4 | SH-7195 | 345-7195 |
| 1-1/2 | SH-7196 | 345-7196 |

# TUFFALOY HEAVY-DUTY PADDLE-TYPE HOLDERS AND TIPS

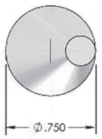
TUFFALOY heavy-duty paddle-type holders are made of the stronger Class 3 alloy, for greater rigidity and minimum deflection, even under loads of 1000 pounds and more. Class 3 alloy provides 154% more tensile strength. Head height is a low 3/4-in. and the shank length is a usable 4 inches.

Three low-profile electrodes of Class 2 alloy are offered for use in this heavy-duty holder. If applications permit greater head height, any standard No. 4 RW tip may be used.

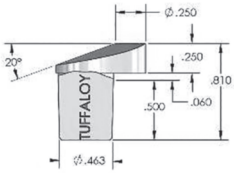


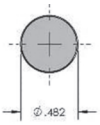
TRUNCATED CONE
SE-3247
Part No. 170-3247



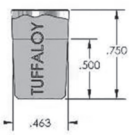




OFFSET
SE-3248
Part No. 170-3248




FLAT FACED
SE-3249
Part No. 170-3249

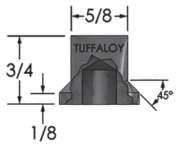


# HIGH PRESSURE TIPS

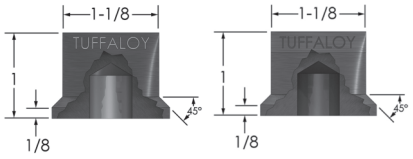
Spot and projection welding operations may utilize pressures over 2000 lbs. TUFFALOY high-pressure tips have flat bottoms which eliminates tip jamming in tapered holders. Assembled tip and holder heights are always the same, as contrasted to tapered tips which can be forced into the sockets varying distances.

TUFFALOY high pressure tips can be used in the two holder styles shown: PM holders for mounting on the platens of press-type welders, and straight holders for spot welder arm mounting. The tips are held to the holders by a threaded coupling. Copper tungsten faced tips are available for high pressure wear and projection welding.

## FLAT FACED

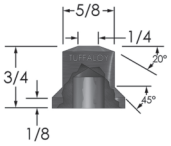



Size 1 PMC-2503
Part No. 180-2203
Part No. 180-2203-10W

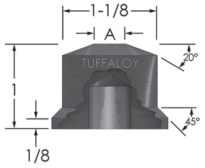



Size 2 PMC-2104
Part No. 180-1040
Part No. 180-2104-10W

## TRUNCATED CONE



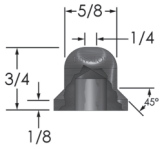

Size 1 PME-2503
Part No. 180-2303




Size 2

| 'A' | Description | Part No. |
|---|---|---|
| 1/4 | PME-21041 | 180-1041 |
| 5/16 | PME-21042 | 180-1042 |
| 3/8 | PME-21043 | 180-1043 |
| 7/16 | PME-21044 | 180-1044 |
| 1/2 | PME-21045 | 180-1045 |

## DOME NOSED

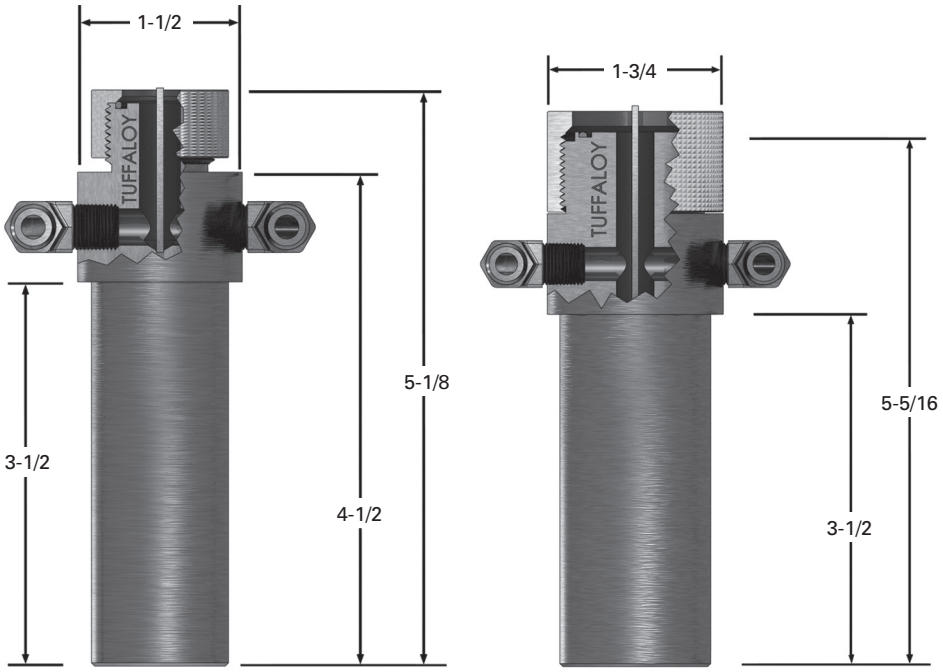



Size 1 PMB-2503
Part No. 180-2103

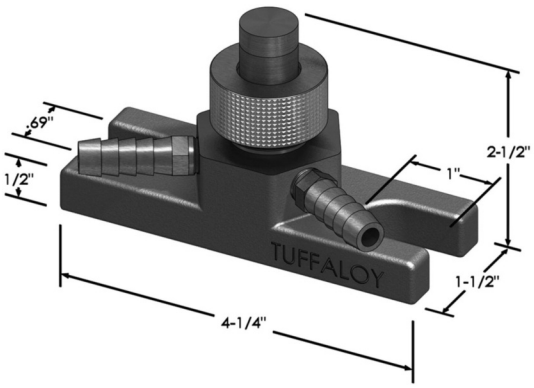
# STRAIGHT HOLDERS CLASS 2 ALLOY

Straight holders are made for carrying TUFFALOY high pressure tips in rocker arm welders or press-type welder horn extensions. They are made in two basic sizes, to accommodate the Size 1 and 2 tips. They are of Class 2 alloy and hold the tips in the same manner as do the PM holders.

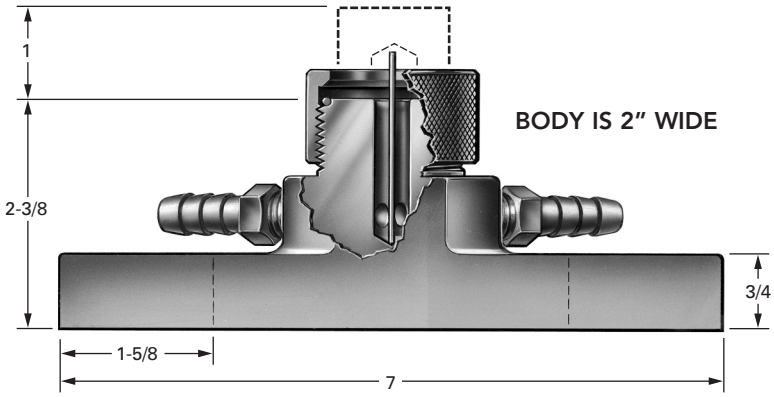


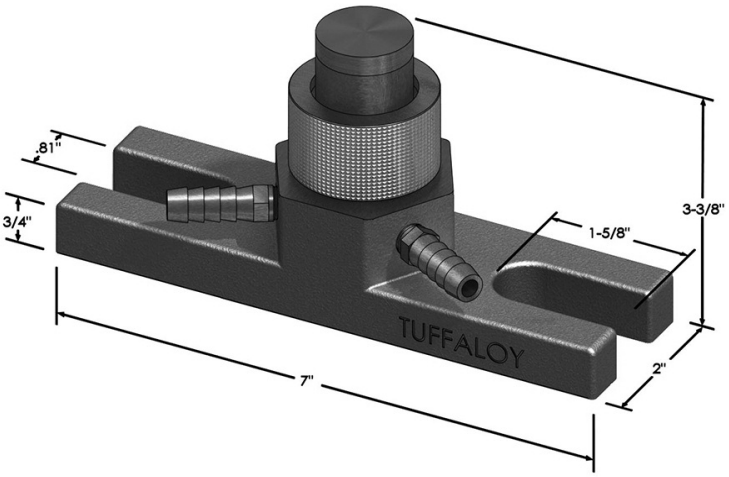

| Size | Barrel Dia. | Description | Part No. |
|---|---|---|---|
| 1 | 1 | 4511 | 350-4511 |
| 1 | 1-1/4 | 4512 | 350-4512 |
| 1 | 1-1/2 | 4513 | 350-4513 |
| 2 | 1-1/4 | 4521 | 350-4521 |
| 2 | 1-1/2 | 4522 | 350-4522 |




Size 1 PM holder (9/16-in. mounting bolts)
4510 holder, Part No. 350-4510




Size 2 PM holder (3/4-in. mounting bolts)
4520 holder, Part No. 350-4520



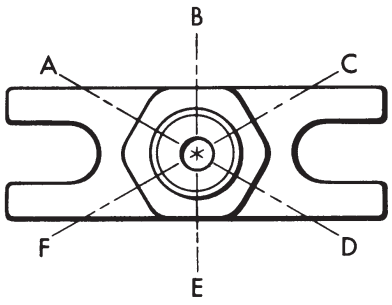

## PM HOLDERS

TUFFALOY PM holders are mounted directly to press-type welder platens, or are used as components of special weld fixturing.

Platen Mounting: PM holders bolt easily to the platen T-slots at any desired location, in a minimum of time (no intermediary device is required). Big half-inch mounting bolts may be used to assure good conductivity. They are the first such standard, stocked holders to be made available. They come in two sizes, to match standard T-slot spacing, and to hold the 2 sizes of tips shown. The small size 1 PM holder is for use on RWMA Size 1 press-type welders (3-1/2 in. spacing) and the large size, 2 PM holder is for Size 2 and 3 welders (5- and 6-in. spacing). The electrodes used do not require any particular radial positioning to obtain proper coolant flow. These are compact holders that may be used one-to-one or in multiples in close proximity to one another.

Fixture Building: PM holders make special fixture building easy too. They can be bolted to a fixture or backup base as easily as to a platen. They are compact and have self-contained coolant systems that eliminate making a coolant manifold out of the fixture.

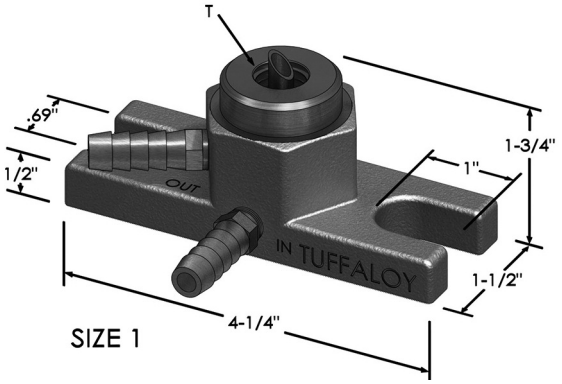
Hose Connections: You may specify where you want the hose connectors in the hexagonal base. Select any two of the six possible locations and specify by using the symbols shown on the diagram (connector locations: A-B, or A-D, etc.). Position A-C is standard. (A-F and C-D are not possible.)

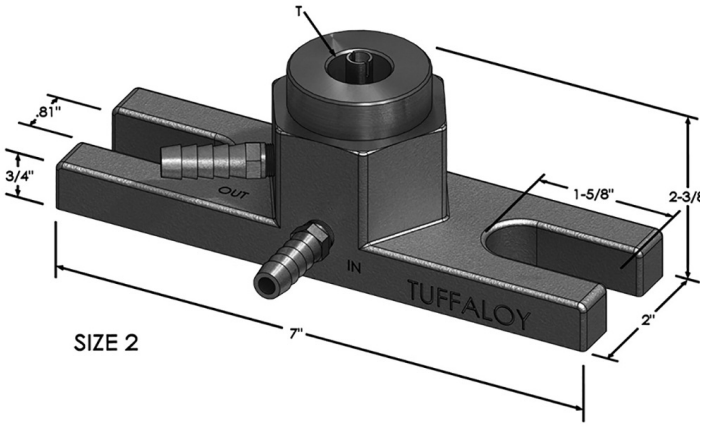


## PM HOLDERS

TUFFALOY PM holders may be mounted directly to press-type welder platens, or they can be used as components of special weld fixturing. They come in two sizes, which match standard T-slot spacings (either of which can be furnished to hold any of the four standard tips: 4, 5, 6 or 7 RW). The smaller holder is for use on RWMA Size 1 welders, which have the 3-1/2" spacing. The larger one is for the Size 2 and 3 welders, which have the 5- and 6-inch spacing.

Big, half-inch mounting bolts may be used to assure good conductivity. The holders may be used one-to-one or in multiples closely bunched. PM holders make special fixture building easy. They can be bolted to a fixture or back-up base as easily as to a platen. They are compact and have self-contained coolant systems.




Size 2 PM Holder (3/4-in. mounting bolts)

### STANDARD TIP PM HOLDERS

| RW Tip Socket | Size 1 (Small) | | Size 2 (Large) | |
|---|---|---|---|---|
| | Description | Part No. | Description | Part No. |
| 4 | 4560 | 350-4560 | 4570 | 350-4570 |
| 5 | 4561 | 350-4561 | 4571 | 350-4571 |
| 6 | 4562 | 350-4562 | 4572 | 350-4572* |
| 7 | 4563 | 350-4563 | 4573 | 350-4573 |

**Item not normally stocked*

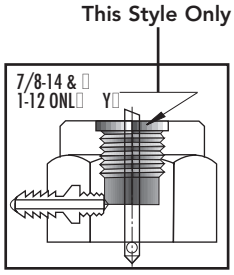
### FOR THREADED ELECTRODES

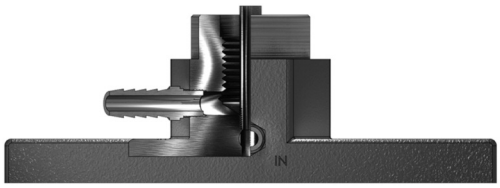
| Thread Size | Size 1 | Size 2 |
|---|---|---|
| 5/8-11 | 350-4580 | 350-4590 |
| 3/4-10 | 350-4581 | 350-4591 |

### FOR THREADED ADAPTERS

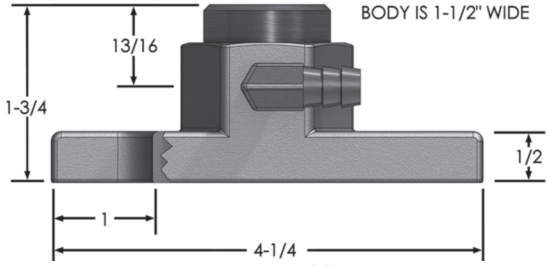
| Thread Size | Size 1 | Size 2 |
|---|---|---|
| 7/8-14 | 350-4582 | 350-4592 |
| 1-12 | 350-4583 | 350-4593 |

*See adapters page 16*

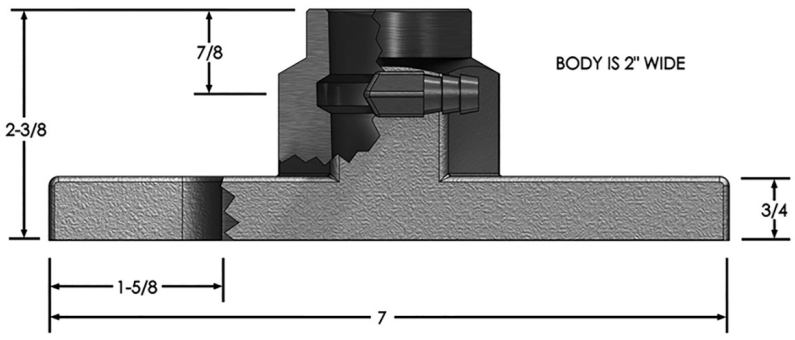


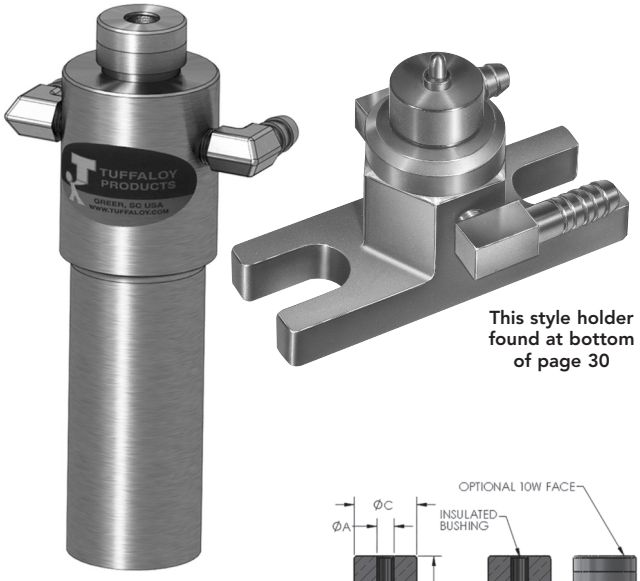

| PM Holders T-Slot Spacing | Holder Size | For 1" Dia. Electrodes | | For 1-1/2" Dia. Electrodes | |
|---|---|---|---|---|---|
| | | Description | Part No. | Description | Part No. |
| 3-1/2 | 1PM | 4515 | 350-4515 | | |
| 5 & 6 | 2PM | 4525 | 350-4525 | 4526 | 350-4526 |




Size 1 PM Holder

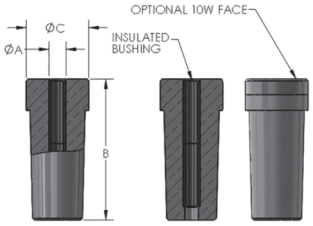



Size 2 PM Holder




This style holder found at bottom of page 30

This style holder found at top of page 32



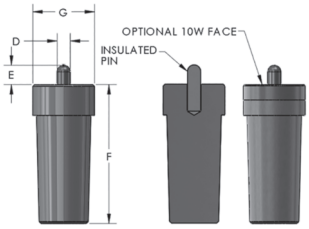

# ELECTRODES

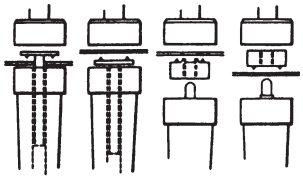
**Stud Electrodes**

Tuffaloy stud electrode tips are for projection-welding screws, bolts or pins, whether they pass through the sheet or are to be attached directly to its face.

**Nut Electrodes**

Tuffaloy projection weld nut electrodes are designed for either self-piloted or non-piloted nuts. The pilots of the non-piloted-nut electrodes are spring-loaded so they can't interfere with the contacting of nut and sheet under welding pressure.



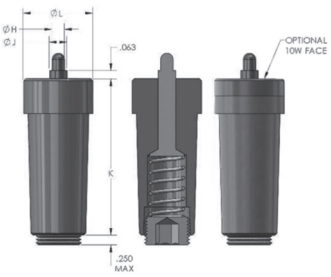



*Welding a stud through a hole in sheet metal.*

*Welding a stud directly to face of sheet metal.*

*Self-piloted nut aligns itself with the hole in sheet.*

*Non-piloted-nut is guided by specially designed electrode.*




The various types and sizes of TUFFALOY stud-and-nut welding electrodes and holders are described below. For excessive wear applications any of these electrodes may be ordered with refractory metal facings, such as TUFFALOY 10W.

## STUD ELECTRODES

| A | B | C | Description | Part No. | With 10W Face Refractory - Item Number |
|---|---|---|---|---|---|
| .150 | 2-1/4 | 1 | 400 | 175-4001 | 175-4001-10W |
| .164 | | | 401 | 175-4011 | 175-4011-10W |
| .190 | | | 402 | 175-4021 | 175-4021-10W |
| .216 | | | 403 | 175-4031 | 175-4031-10W |
| 1/4 | | | 404 | 175-4041 | 175-4041-10W |
| 5/16 & 8mm | | | 405 | 175-4051 | 175-4051-10W |
| 3/8 | | | 406 | 175-4061 | 175-4061-10W |
| 6mm | | | 506 | 175-5061 | 175-5061-10W |
| 7mm | | | 507 | 175-5071 | 175-5071-10W |
| 9mm | | | 509 | 175-5091 | 175-5091-10W |
| 10mm | | | 510 | 175-5101 | 175-5101-10W |
| 3/8 | 2-3/4 | 1-1/2 | 436 | 175-4361 | 175-4361-10W |
| 7/16 | | | 437 | 175-4371 | 175-4371-10W |
| 1/2 | | | 438 | 175-4381 | 175-4381-10W |
| 9/16 | | | 439 | 175-4391 | 175-4391-10W |
| 5/8 | | | 440 | 175-4401 | 175-4401-10W |
| 11/16 | | | 441 | 175-4411 | 175-4411-10W |
| 3/4 | | | 442 | 175-4421 | 175-4421-10W |
| 10mm | | | 510-2 | 175-5102 | 175-5102-10W |
| 12mm | | | 512-2 | 175-5122 | 175-5122-10W |

## SELF-PILOTED-NUT ELECTRODES

| D For Nut Size | E Pin Length | F Electrode Length | G Electrode Diameter | Description | Part No. | With 10W Face Refractory - Item Number |
|---|---|---|---|---|---|---|
| .164 | 3/16 | 2-1/4 | 1 | 411 | 175-4111 | 175-4111-10W |
| .190 | 3/16 | | | 412 | 175-4121 | 175-4121-10W |
| .216 | 1/4 | | | 413 | 175-4131 | 175-4131-10W |
| 1/4 | 5/16 | | | 414 | 175-4141 | 175-4141-10W |
| 5/16 & 8mm | 5/16 | | | 415 | 175-4151 | 175-4151-10W |
| 3/8 | 3/8 | | | 416 | 175-4161 | 175-4161-10W |
| 6mm | 1/4 | | | 606 | 175-6061 | 175-6061-10W |
| 7mm | 5/16 | | | 607 | 175-6071 | 175-6071-10W |
| 9mm | 3/8 | | | 609 | 175-6091 | 175-6091-10W |
| 10mm | 3/8 | | | 610 | 175-6101 | 175-6101-10W |
| 3/8 | 3/8 | 2-3/4 | 1-1/2 | 456 | 175-4561 | 175-4561-10W |
| 7/16 | 3/8 | | | 457 | 175-4571 | 175-4571-10W |
| 1/2 | 7/16 | | | 458 | 175-4581 | 175-4581-10W |
| 9/16 | 7/16 | | | 459 | 175-4591 | 175-4591-10W |
| 5/8 | 1/2 | | | 460 | 175-4601 | 175-4601-10W |
| 11/16 | 1/2 | | | 461 | 175-4611 | 175-4611-10W |
| 3/4 | 5/8 | | | 462 | 175-4621 | 175-4621-10W |
| 10mm | 3/8 | | | 610-2 | 175-6102 | 175-6102-10W |
| 12mm | 7/16 | | | 612-2 | 175-6122 | 175-6122-10W |

## NON-PILOTED-NUT ELECTRODES

| H For Nut Size | J Pin Diameter | K Electrode Length | L Electrode Diameter | Description | Part No. | With 10W Face Refractory - Item Number |
|---|---|---|---|---|---|---|
| .164 | 0.18 | 2-1/4 | 1 | 421 | 175-4211 | 175-4211-10W |
| .190 | 0.215 | | | 422 | 175-4221 | 175-4221-10W |
| .216 | 0.24 | | | 423 | 175-4231 | 175-4231-10W |
| 1/4 | 0.275 | | | 424 | 175-4241 | 175-4241-10W |
| 5/16 & 8mm | 0.345 | | | 425 | 175-4251 | 175-4251-10W |
| 3/8 | 0.405 | | | 426 | 175-4261 | 175-4261-10W |
| 6mm | 0.261 | | | 706 | 175-7061 | 175-7061-10W |
| 7mm | 0.3 | | | 707 | 175-7071 | 175-7071-10W |
| 9mm | 0.385 | | | 709 | 175-7091 | 175-7091-10W |
| 10mm | 0.425 | | | 710 | 175-7101 | 175-7101-l0W |
| 3/8 | 0.437 | 2-3/4 | 1-1/2 | 476 | 175-4761 | 175-4761-10W |
| 7/16 | 0.562 | | | 477 | 175-4771 | 175-4771-10W |
| 1/2 | 0.625 | | | 478 | 175-4781 | 175-4781-10W |
| 9/16 | 0.687 | | | 479 | 175-4791 | 175-4791-l0W |
| 5/8 | 0.75 | | | 480 | 175-4801 | 175-4801-10W |
| 10mm | 0.453 | | | 710-2 | 175-7102 | 175-7102-10W |
| 12mm | 0.595 | | | 712-2 | 175-7122 | 175-7122-10W |

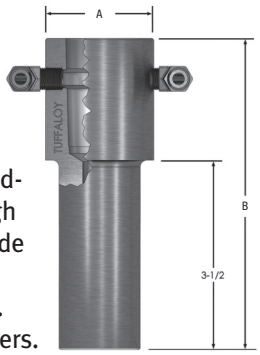
# ELECTRODE HOLDERS

*U.S. Pat. No. 3,504,159 Canada Pat. No. 858,060*

Several standard electrode holders are manufactured by Tuffaloy to accommodate all the Tuffaloy stud-and nut electrode tips.

| Straight Holders Barrel Diameter | A Dia. | B Length | For 1" Dia. Electrodes | | For 1-1/2" Dia. Electrodes | |
|---|---|---|---|---|---|---|
| | | | Description | Part No. | Description | Part No. |
| 1 | 1-3/4 | 5-5/8 | 4530 | 350-4530 | | |
| 1-1/4 | 1-3/4 | 5-5/8 | 4531 | 350-4531 | | |
| 1-1/2 | 1-3/4 | 5-5/8 | 4532 | 350-4532 | | |
| 1 | 2 | 5-3/4 | | | 4535 | 350-4535 |
| 1-1/4 | 2 | 5-3/4 | | | 4536 | 350-4536 |
| 1-1/2 | 2 | 5-3/4 | | | 4537 | 350-4537 |

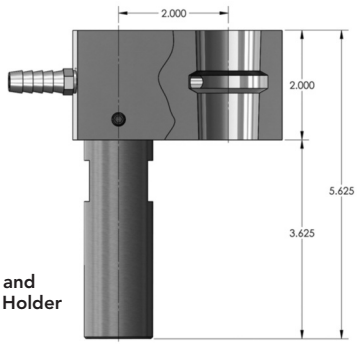
**Straight Holders -** Tuffaloy straight nut-and-stud-electrode holders are of the same high quality as the standard straight holders made for spot welder arm mounting. Coolant is brought to the tip and circulated around it. Holders are available in three barrel diameters.



Straight Holder

## OFFSET NUT AND STUD WELDING HOLDERS

| Shank OD | For 1" Dia. Electrodes | | For 1.5" Dia. Electrodes | |
|---|---|---|---|---|
| | Description | Part No. | Description | Part No. |
| 1.00 | 4540 | 350-4540 | | |
| 1.25 | 4541 | 350-4541 | 4546 | 350-4546 |
| 1.50 | 4542 | 350-4542 | 4547 | 350-4547 |



Offset Nut and Stud Welding Holder

# ARCTIC HOLDERS

## ARCTIC STUD ELECTRODES

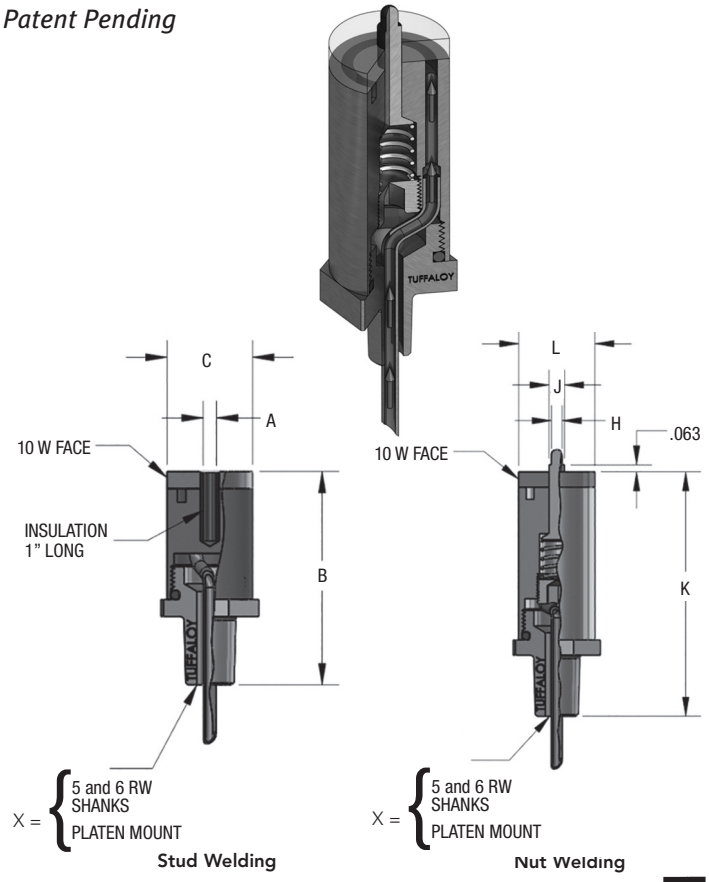
| A For Stud Diameter | B Electrode Length | C Electrode Diameter | Description | Part Number Shank Size |
|---|---|---|---|---|
| 0.150 | 3 | 1-1/4 | 115 | 175-1151-X |
| 0.164 | | | 116 | 175-1161-X |
| 0.190 | | | 119 | 175-1191-X |
| 0.216 | | | 122 | 175-1221-X |
| 1/4 | | | 125 | 175-1252-X |
| 5/16 & 8mm | | | 131 | 175-1312-X |
| 3/8 | | | 138 | 175-1382-X |
| 7/16 | | | 144 | 175-1442-X |
| 6mm | | | 106 | 175-1061-X |
| 7mm | | | 107 | 175-1072-X |
| 9mm | | | 109 | 175-1092-X |
| 10mm | | | 110 | 175-1102-X |
| 1/2 | 3 | 1-1/2 | 150 | 175-1503-X |
| 9/16 | | | 156 | 175-1563-X |
| 5/8 | | | 163 | 175-1633-X |
| 11/16 | | | 169 | 175-1693-X |
| 12mm | | | 112 | 175-1123-X |

## ARCTIC NON-PILOTED-NUT ELECTRODES

| H For Nut Diameter | J Pilot Diameter | K Electrode Length | L Electrode Diameter | Description | Part Number Shank Size |
|---|---|---|---|---|---|
| 0.164 | 0.180 | 4 | 1-1/4 | 216 | 175-2162-X |
| 0.190 | 0.215 | | | 219 | 175-2192-X |
| 0.216 | 0.240 | | | 222 | 175-2222-X |
| 1/4 | 0.275 | | | 225 | 175-2252-X |
| 5/16 & 8mm | 0.345 | | | 231 | 175-2312-X |
| 3/8 | 0.405 | | | 238 | 175-2382-X |
| 6mm | 0.261 | | | 206 | 175-2062-X |
| 7mm | 0.300 | | | 207 | 175-2072-X |
| 9mm | 0.385 | | | 209 | 175-2092-X |
| 10mm | 0.425 | | | 210 | 175-2102-X |
| 7/16 | 0.562 | 4 | 1-1/2 | 244 | 175-2443-X |
| 1/2 | 0.625 | | | 250 | 175-2503-X |
| 9/16 | 0.687 | | | 256 | 175-2563-X |
| 12mm | 0.595 | | | 212 | 175-2123-X |

**Arctic Electrodes -** The Arctic system is a compact stud-and-nut electrode with internal water cooling. Also available with optional air expulsion and platen mounts.

*Patent Pending*



# METRIC NUT ELECTRODES

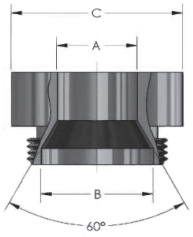
TUFFALOY now stocks the head/pin style welding system components that adds to your selection for stud and nut welding needs. From our standard style to our Arctic, that produces higher quality welds and longer life, you can select the product that best meets your needs.

**Heads** are made from RWMA class 2 material that are an optimal cost consumable. Class 3 and 10W are available for longer life. With a concave seat the pin locates in the center of assembly when air is applied to the system. This gives you a repeatable location for automated nut feeders to introduce the nut to the environment.

**Pins** have a nonconductive surface on a steel matrix that gives longer life in a repetitive motion environment. With the threaded head securing the pin in place it makes it easy to replace the pin to meet your requirements. TUFFALOY can design pins for special applications.

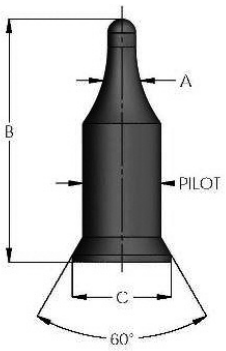
**HEADS**

| Part Number | Hole Dia. | A Pin Size | B Thread | C Dia. | Copper-Tungsten Faced Heads |
|---|---|---|---|---|---|
| 175-8004 | .197 | 4mm | M18 | 1.0 | 175-8004-10W |
| 175-8005 | .236 | 5mm | | | 175-8005-10W |
| 175-8006 | .276 | 6mm | | | 175-8006-10W |
| 175-8007 | .315 | 7mm | | | 175-8007-10W |
| 175-8008 | .354 | 8mm | | | 175-8008-10W |
| 175-8009 | .394 | 9mm | | | 175-8009-10W |
| 175-8010 | .432 | 10mm | M22 | 1.125″ | 175-8010-10W |
| 175-8011 | .472 | 11mm | | | 175-8011-10W |
| 175-8012 | .512 | 12mm | | | 175-8012-10W |
| 175-8013 | .551 | 13mm | | | 175-8013-10W |
| 175-8014 | .588 | 14mm | M26 | 1.250″ | 175-8014-10W |



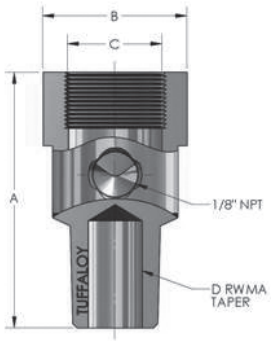

**PINS**

| Part Number | A Nut | B OAL | C Base | Pilot Dia. |
|---|---|---|---|---|
| 195-3004 | 4mm | 1.12″ | 12mm | .185 |
| 195-3005 | 5mm | 1.17″ | | .224 |
| 195-3006 | 6mm | 1.23″ | | .264 |
| 195-3007 | 7mm | 1.24″ | | .303 |
| 195-3008 | 8mm | 1.25″ | | .340 |
| 195-3009 | 9mm | 1.19″ | | .380 |
| 195-3010 | 10mm | 1.37″ | 16mm | .422 |
| 195-3011 | 11mm | 1.38″ | | .458 |
| 195-3012 | 12mm | 1.40″ | | .500 |
| 195-3013 | 13mm | 1.37″ | | .539 |
| 195-3014 | 14mm | 1.50″ | .815 | .580 |
| 195-3015 | 15mm | 1.52″ | .815 | .620 |



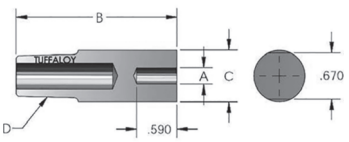

**BODIES**

| Description | Part Number | A OAL | B Dia. | C Thread | D Taper/Thread |
|---|---|---|---|---|---|
| TDH-25A | 301-0004 | 1.77″ | 1″ | 18mm | #4 |
| TDH-25C | 301-0005 | 1.97″ | 1″ | 18mm | #5 |
| TDH-25C-THD | 301-0006 | 2.13″ | 1″ | 18mm | 5/8-11 |
| TDH-30A | 301-0015 | 1.97″ | 1.125″ | 22mm | #5 |
| TDH-35A | 301-0020 | 1.97″ | 1.125″ | 26mm | #5 |

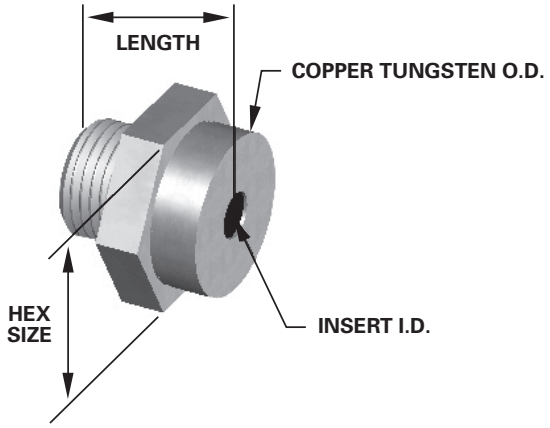



**UPPER ELECTRODE**

| Description | Part Number | A ID | B OAL | C Dia. | D Taper | 10W |
|---|---|---|---|---|---|---|
| TNFD 16-M5-16-3 | 186-0101 | 5mm | 2.36″ | .625″ | 5RW | 186-0101-10W |
| TNFD 20-M6-16-3 | 186-0102 | 6mm | | .75″ | | 186-0102-10W |
| TNFD 20-M8-16-3 | 186-0103 | 7.5mm | | .75″ | | 186-0103-10W |
| TNFD 20-M10-16-3 | 186-0104 | 10mm | | .75″ | | 186-0104-10W |
| TNFD 20-M12-16-3 | 186-0105 | 12mm | | .75″ | | 186-0105-10W |



# GH SERIES NUT WELDING HEADS

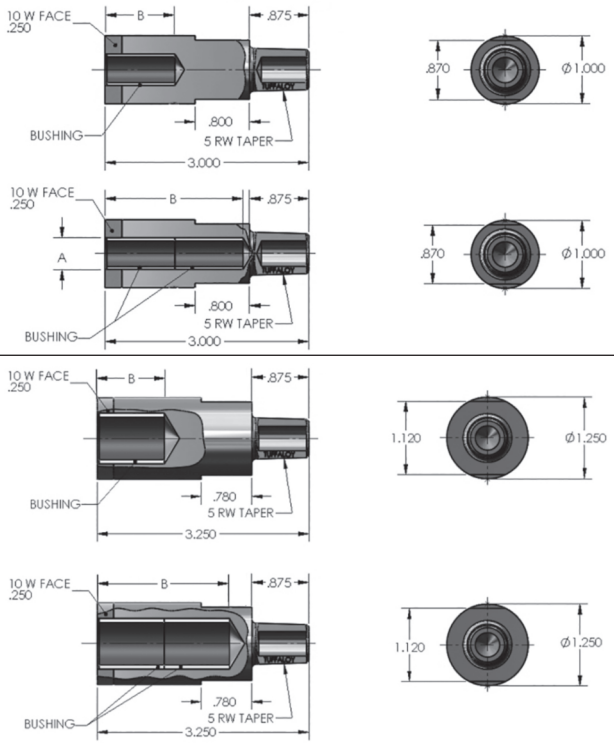



| | 175-GH-2 Series | 175-GH-3 Series | 175-GH-4 Series | Insert I.D. |
|---|---|---|---|---|
| Length | 0.875 | 1.000 | 1.125 | |
| Tungsten OD | 0.875 | 1.250 | 1.500 | |
| Hex Size | 1.000 | 1.375 | 1.500 | |
| Thread Size | 5/8-18 | 7/8-14 | 1 1/8-12 | |
| | 175-GH-2-188 | 175-GH-3-188 | | 0.188 |
| | 175-GH-2-193 | 175-GH-3-193 | | 0.193 |
| | 175-GH-2-197 | | | 0.197 |
| | | 175-GH-3-200 | | 0.200 |
| | 175-GH-2-212 | | | 0.212 |
| | 175-GH-2-218 | | | 0.218 |
| | 175-GH-2-239 | | | 0.239 |
| | 175-GH-2-240 | | | 0.240 |
| | 175-GH-2-242 | 175-GH-3-242 | | (6mm) 0.242 |
| | 175-GH-2-245 | 175-GH-3-245 | | 0.245 |
| | | 175-GH-3-247 | | 0.247 |
| | 175-GH-2-250 | | | 0.250 |
| | | 175-GH-3-251 | | 0.251 |
| | 175-GH-2-252 | | | 0.252 |
| | | 175-GH-3-254 | | 0.254 |
| | 175-GH-2-258 | | | 0.258 |
| | | 175-GH-3-262 | | 0.262 |
| | 175-GH-2-263 | | | 0.263 |
| | | 175-GH-3-264 | | 0.264 |
| | 175-GH-2-272 | 175-GH-3-272 | | 0.272 |
| | 175-GH-2-273 | 175-GH-3-273 | | 0.273 |
| | 175-GH-2-275 | | | 0.275 |
| | 175-GH-2-277 | | | 0.277 |
| | 175-GH-2-280 | | | 0.280 |
| | 175-GH-2-282 | | | 0.282 |
| | 175-GH-2-287 | | | 0.287 |
| | 175-GH-2-312 | 175-GH-3-312 | | 0.312 |
| | | 175-GH-3-317 | | (8mm) 0.317 |
| | 175-GH-2-322 | 175-GH-3-322 | | 0.322 |
| | 175-GH-2-325 | | 175-GH-4-325 | 0.325 |
| | | 175-GH-3-326 | | 0.326 |
| | 175-GH-2-332 | 175-GH-3-332 | | 0.332 |
| | | 175-GH-3-337 | | 0.337 |
| | 175-GH-2-342 | | | 0.342 |
| | 175-GH-2-347 | 175-GH-3-347 | | 0.347 |
| | | 175-GH-3-351 | 175-GH-4-351 | 0.351 |
| | 175-GH-2-352 | 175-GH-3-352 | | 0.352 |
| | 175-GH-2-354 | | | 0.354 |
| | 175-GH-2-357 | 175-GH-3-357 | | 0.357 |
| | 175-GH-2-359 | | | 0.359 |

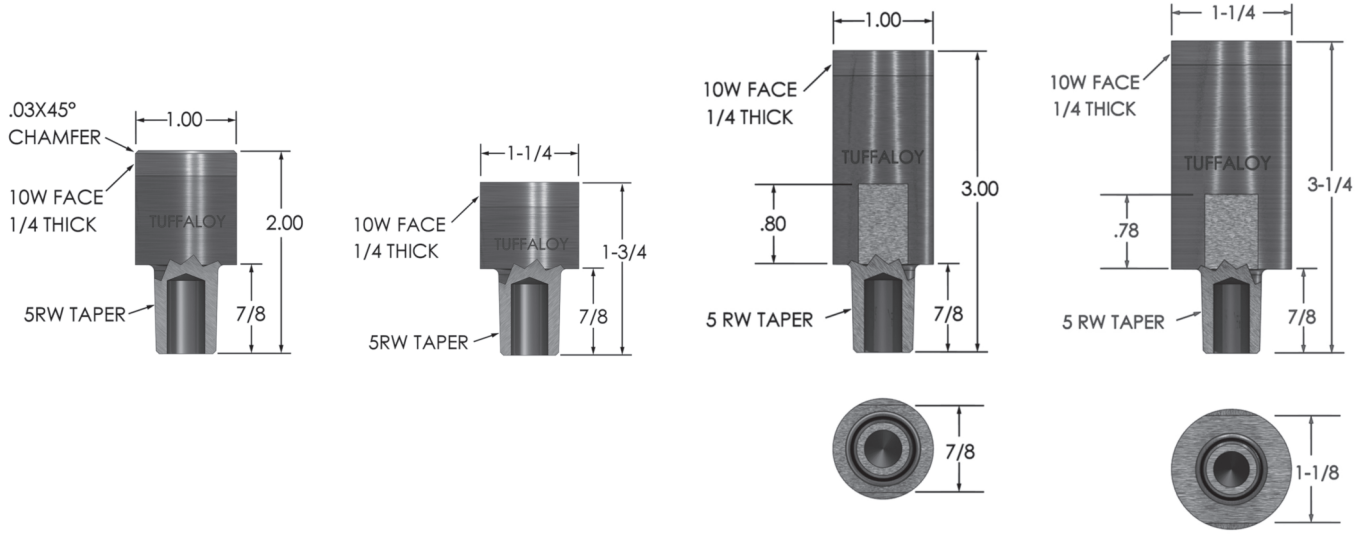
| 175-GH-2 Series | 175-GH-3 Series | 175-GH-4 Series | Insert I.D. |
|---|---|---|---|
| 0.875 | 1.000 | 1.125 | |
| 0.875 | 1.250 | 1.500 | |
| 1.000 | 1.375 | 1.500 | |
| 5/8-18 | 7/8-14 | 1 1/8-12 | |
| 175-GH-2-368 | | | 0.368 |
| 175-GH-2-372 | 175-GH-3-372 | | 0.372 |
| | 175-GH-3-392 | | 0.392 |
| | 175-GH-3-397 | | (10mm) 0.397 |
| | 175-GH-3-412 | | 0.412 |
| | 175-GH-3-417 | | 0.417 |
| | 175-GH-3-423 | | 0.423 |
| | 175-GH-3-425 | | 0.425 |
| | 175-GH-3-427 | | 0.427 |
| | 175-GH-3-430 | | 0.430 |
| | 175-GH-3-432 | | 0.432 |
| | 175-GH-3-437 | | 0.437 |
| | 175-GH-3-445 | | 0.445 |
| | 175-GH-3-447 | | 0.447 |
| | 175-GH-3-452 | | 0.452 |
| | 175-GH-3-465 | | 0.465 |
| | 175-GH-3-467 | | 0.467 |
| | 175-GH-3-470 | | 0.470 |
| | 175-GH-3-472 | | 0.472 |
| | 175-GH-3-480 | | (12mm) 0.480 |
| | 175-GH-3-504 | | 0.504 |
| | 175-GH-3-507 | | 0.507 |
| | 175-GH-3-508 | | 0.508 |
| | | 175-GH-4-509 | 0.509 |
| | 175-GH-3-512 | | 0.512 |
| | 175-GH-3-517 | | 0.517 |
| | 175-GH-3-522 | | 0.522 |
| | | 175-GH-4-532 | 0.532 |
| | 175-GH-3-538 | | 0.538 |
| | 175-GH-3-542 | | 0.542 |
| | 175-GH-3-547 | | 0.547 |
| | 175-GH-3-548 | | 0.548 |
| | 175-GH-3-552 | | 0.552 |
| | 175-GH-3-557 | | 0.557 |
| | 175-GH-3-587 | | 0.587 |
| | 175-GH-3-592 | | 0.592 |
| | 175-GH-3-632 | | 0.632 |
| | 175-GH-3-656 | | 0.656 |
| | | 175-GH-4-667 | 0.667 |
| | | 175-GH-4-677 | 0.677 |

These series of Stud electrodes are made from RWMA Class 2 material with TUFFALOYS' 10W (copper tungsten) on the weld face and wrench flats for easy removal from holders. The Insulator is made to withstand the constant friction that is applied as the stud is inserted and removed.

| Screw Thread Size | INSULATOR ID. A | INSULATOR Length B | Part Number |
|---|---|---|---|
| | .218 | | 175-0316-4032-10W |
| 6mm | .243 | | 175-0316-40062-10W |
| 0.250 | .256 | | 175-0316-4042-10W |
| 0.312, 8mm | .319 | 1" | 175-0316-4052-10W |
| 0.375 | .381 | | 175-0316-4062-10W |
| 10mm | .400 | | 175-0316-40102-10W |
| | .218 | | 175-0316-4031-10W |
| 6mm | .243 | | 175-0316-4006-10W |
| 0.250 | .256 | | 175-0316-4041-10W |
| 0.312, 8mm | .319 | 2" | 175-0316-4051-10W |
| 0.375 | .381 | | 175-0316-4061-10W |
| 10mm | .400 | | 175-0316-4010-10W |
| 0.437 | .444 | | 175-1313-4372-10W |
| 12mm | .479 | | 175-1313-40122-10W |
| 0.500 | .506 | | 175-1313-4382-10W |
| | .569 | 1" | 175-1313-4392-10W |
| 0.625 | .652 | | 175-1313-4402-10W |
| | .694 | | 175-1313-4412-10W |
| | .777 | | 175-1313-4422-10W |
| 0.437 | .444 | | 175-1313-4371-10W |
| 12mm | .479 | | 175-1313-4012-10W |
| 0.500 | .506 | | 175-1313-4381-10W |
| | .569 | 2" | 175-1313-4391-10W |
| 0.625 | .652 | | 175-1313-4401-10W |
| | .694 | | 175-1313-4411-10W |
| | .777 | | 175-1313-4421-10W |




## BACKUP ELECTRODES FOR UPPERS




186-0311-10W

186-0313-10W

186-0316-10W

186-1313-10W

# QUICKEST WAY TO CUT WELDING COSTS

Increased productivity without capital investment or increased labor costs just has to spell PROFIT. Hundreds of resistance welding users are profiting from the TUFFALOY methods of multiple welding, to produce almost any assembly requiring closely spaced welds.

The key is to **"think multiple!"** Whenever the welding machine goes through a cycle, have it do more than one weld at a time. It's easy and practical with one of the TUFFALOY multiple welding devices: The Teeter-Tip dual tip adapter, the Equatip dual tip holder, the Equa-Press dual tip holder, or the Tri-Spacer.

They're ready to go to work, cutting costs and increasing production efficiency for you.

Study the multiple welding holders and adapters in this section. Learn their capabilities, **"think multiple,"** and you'll probably see many ways in which TUFFALOY multiple welding can improve your operation. Remember that TUFFALOY is prepared to provide any special fixturing you need. Show our engineers what you require, and they'll design a set-up to do it.

## TEETER-TIP DUAL TIP ADAPTERS

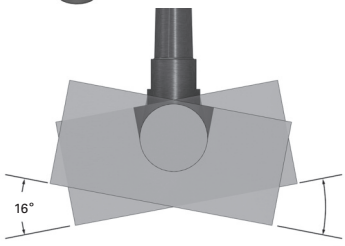
*U.S. Pat. 3,356,821*

You can spot or projection weld in half the time by doubling the number of welds per machine stroke. Use Teeter-Tip dual tip adapters, which come with water-coolant fittings to beat high heat build-up. These, adapters transmit total pressures of 1000 lbs., and deliver equal current and pressure to each tip. They compensate for normal electrode wear, imperfect tip dressing, and work variations up to .060".

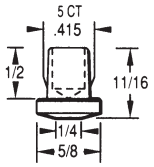



**LIGHT-DUTY** adapters have no. 4 or 5 RW shanks, tip spacing to 4 inches, tip sockets for 1/2" or 5/8" diameter male Tuffcap caps, or 4 RW tips (5/8" cap sockets are standard).

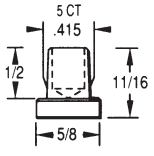
**HEAVY-DUTY** adapters have shanks from 5 to 7 RW size, tip spacing to 6 inches, tip sockets for 1/2" or 5/8" diameter male Tuffcap caps, or 4 or 5 RW tips (4 RW sockets are standard). These adapters have a deeper, stronger body.




Two low-height 5/8" dia. cap-type tips are shown below. They are recommended for use in these adapters. Other standard caps, both 5/8" & 1/2" dia., are tabled on the next page. You must specify the size tip sockets you want, or the standard socket will be supplied.



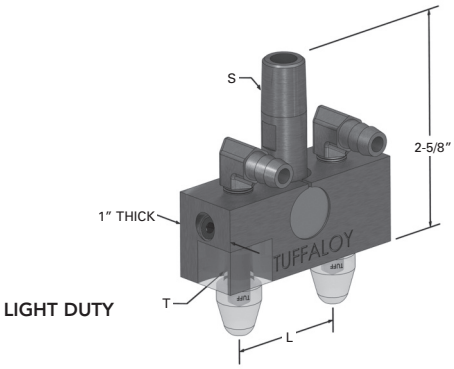

TRUNCATED CONE SE-6332
(Part No. 186-0522)



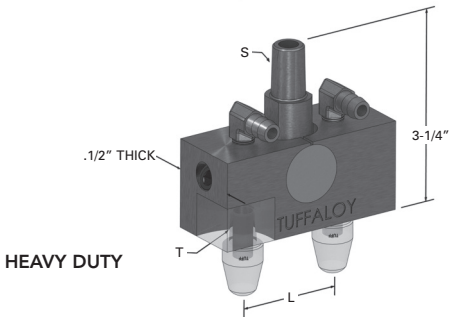

FLAT FACED SE-6296
(Part No. 186-0523)

| Style | S Shank Taper | Description* | L Tip Spacing Range (inches) | T Socket Taper |
|---|---|---|---|---|
| LIGHT Duty | 4RW | TT-1408 | 1-1/4 to 2 | 4RW 4CT 5CT |
| | 4RW | TT-1416 | 2 to 4 | 4RW 4CT 5CT |
| | 5RW | TT-1508 | 1-1/2 to 2 | 4RW 4CT 5CT |
| | 5RW | TT-1516 | 2 to 4 | 4RW 4CT 5CT |
| HEAVY Duty | 5RW | TT-15516 | 2 to 4 | 4RW 5RW 4CT 5CT |
| | 5RW | TT-15524 | 4 to 6 | 4RW 5RW 4CT 5CT |
| | 6RW | TT-15616 | 2 to 4 | 4RW 5RW 4CT 5CT |
| | 6RW | TT-15624 | 4 to 6 | 4RW 5RW 4CT 5CT |
| | 7RW | TT-15716 | 2 to 4 | 4RW 5RW 4CT 5CT |
| | 7RW | TT-15724 | 4 to 6 | 4RW 5RW 4CT 5CT |

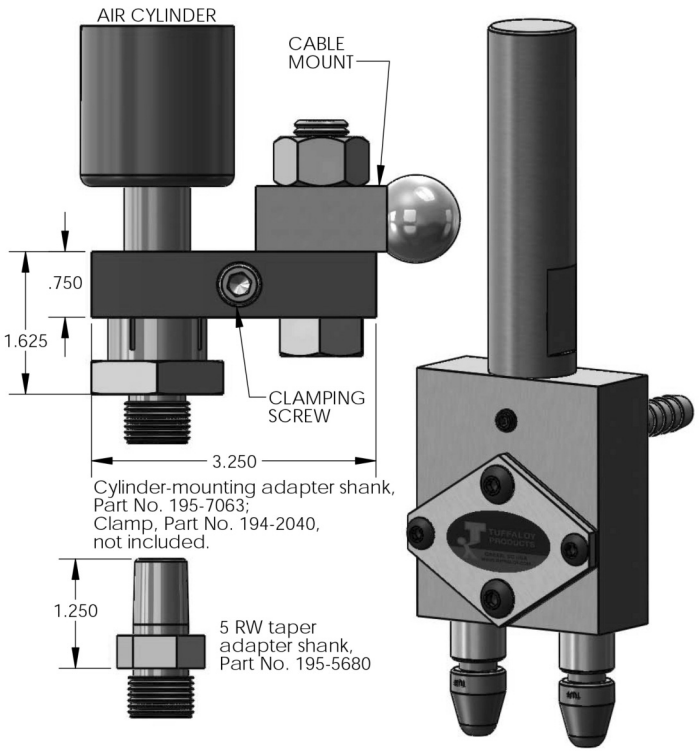
**When ordering, also state exact tip spacing and tip socket size, Example: TT - 1508 - 1-1/2 - 5CT. (5CT means 5/8" diameter cap, 4CT means 1/2" diameter cap.)*




LIGHT DUTY




HEAVY DUTY




# EQUATIP DUAL TIP HOLDERS

*U.S. Pat. No. 3,558,847*

The Equatip dual tip holder is a smaller version of the Equa-Press holder (on next page). It is more compact, and is more economical for those applications where it will work equally well. An even smaller device, the Equatip adapter (not water-cooled) is shown in box below.

Using the Equatip holder, both tips contact the work squarely, because tip axes remain parallel to direction of force (unlike the Teeter-Tip adapters). An internal roller equalizes current and pressure between the two electrodes, and will compensate for work height variations up to 1/16".

The holders are ordered with either 1" or 1-1/2" spacing between barrels, and with tip sockets to accept either male Tuffcap caps (5/8" dia.) or straight No. 4 RW electrodes. (Bent tips are not recommended.) The distance between welds can be varied by rotating offset-nose tips in the barrels.

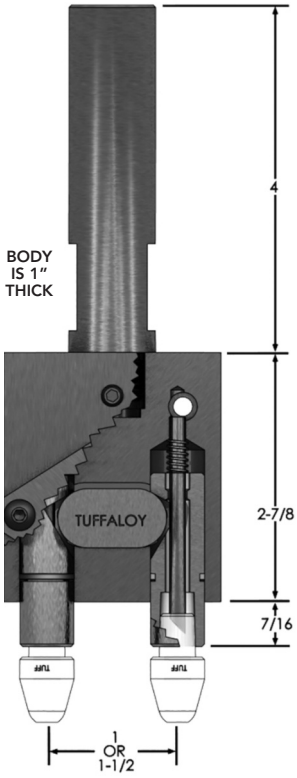
Equatip holders can be supplied with straight shanks for arm mounting, a tapered adapter shank for holder mounting, or a cylinder adapter shank to be clamped to a cylinder rod.

Equatip holders can be used with forces up to 1000 lbs.

**EQUATIP HOLDERS**

| Tip Spacing & Mounting Style | For 5/8" Dia. Tuffcap Caps: Description | For 5/8" Dia. Tuffcap Caps: Part No. | For No. 4 RW Tips: Description | For No. 4 RW Tips: Part No. |
|---|---|---|---|---|
| **ONE-INCH SPACING:** | | | | |
| 1-in. shank | 4050 | 350-4050 | 4055 | 350-4055 |
| 1-1/4-in. shank | 4051 | 350-4051 | 4056 | 350-4056 |
| 1-1/2-in. shank | 4052 | 350-4052 | 4057 | 350-4057 |
| 5RW adapter | 4053 | 350-4053 | 4058 | 350-4058 |
| Cylinder adapter* | 4054 | 350-4054 | 4059 | 350-4059 |
| **1-1/2-INCH SPACING:** | | | | |
| 1-in. shank | 4150 | 350-4150 | 4155 | 350-4155 |
| 1-1/4-in. shank | 4151 | 350-4151 | 4156 | 350-4156 |
| 1-1/2-in. shank | 4152 | 350-4152 | 4157 | 350-4157 |
| 5RW adapter | 4153 | 350-4153 | 4158 | 350-4158 |
| Cylinder adapter* | 4154 | 350-4154 | 4159 | 350-4159 |

**Without clamp*




**5/8" DIA. TUFFCAP CAPS (5 CT)**

| Nose Style | Alloy Class | Description | Part No. |
|---|---|---|---|
| Pointed | 1 | TA-15 | 111-0015 |
| | 2 | TA-25 | 112-0025 |
| Dome | 1 | TB-15 | 113-0015 |
| | 2 | TB-25 | 114-0025 |
| Flat | 1 | TC-15 | 115-0015 |
| | 2 | TC-25 | 116-0025 |
| Offset | 1 | TD-15 | 117-0015 |
| | 2 | TD-25 | 118-0025 |

*Those caps are fully dimensioned on page 8.*

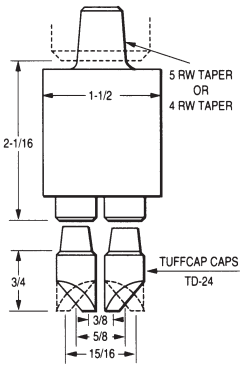
## For light-duty welding EQUATIP ADAPTER

The Equatip dual tip adapter works like the Equatip holder, but it is not water-cooled and is meant for less demanding jobs. It costs less, and is a little smaller, barrels being 5/8" apart. Its straight tips are TUFFCAP caps, 1/2" in diameter.

**1/2" DIA. TUFFCAP CAPS (4 CT)**

| Nose Style | Alloy Class | Description | Part No. |
|---|---|---|---|
| Pointed | 1 | TA-14 | 111-0014 |
| | 2 | TA-24 | 112-0024 |
| Dome | 1 | TB-14 | 113-0014 |
| | 2 | TB-24 | 114-0024 |
| Flat | 1 | TC-14 | 115-0014 |
| | 2 | TC-24 | 116-0024 |
| Offset | 1 | TD-14 | 117-0014 |
| | 2 | TD-24 | 118-0024 |

*Those caps are fully dimensioned on page 8.*

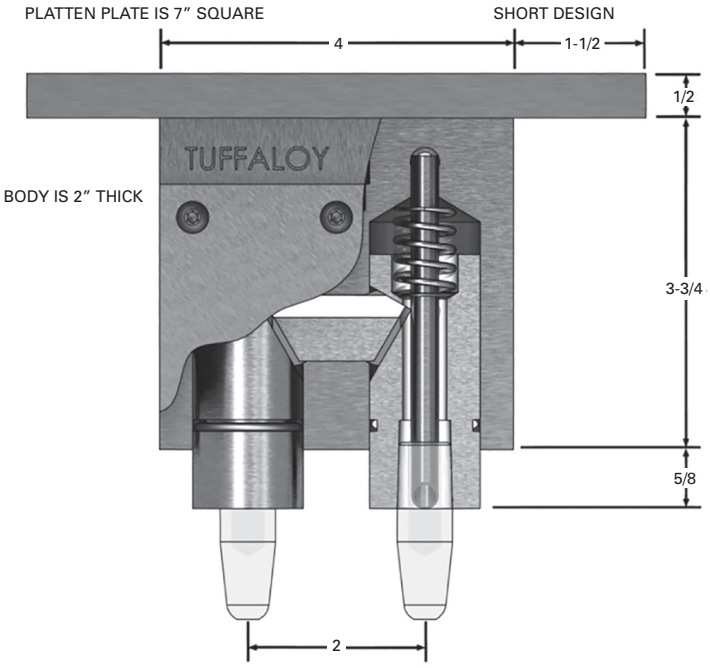


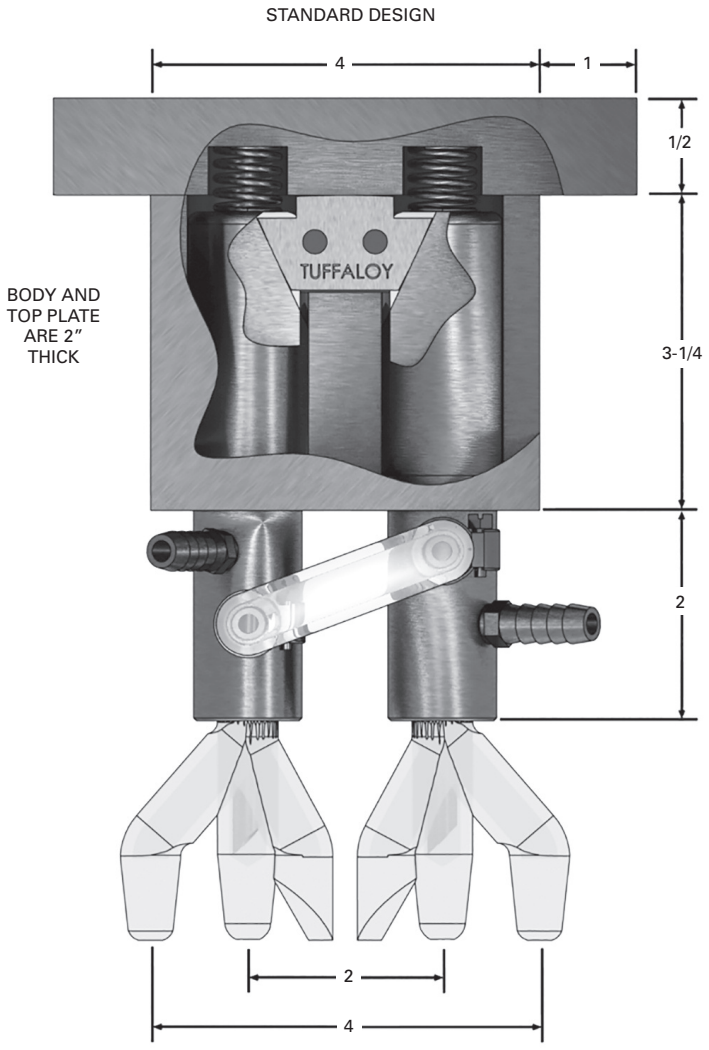

**4045, Part No. 350-4045-5RW**
**4046, Part No. 350-4046-4RW**



# EQUA-PRESS™ DUAL TIP HOLDERS

*U.S. Pat. No. 2,979,599*
*Canada Pat. 637470*




The Equa-Press Holder makes two identical welds at once. When it contacts the workpiece, the forging pressure is automatically equalized between the two electrodes, regardless of variations in work thickness, or electrode wear (up to 3/16"). The two tip-holding barrels are sliding pistons, whose movements are controlled by a mechanical equalizing slide in the housing (see cutaway drawings). The spring's only function is to return the barrels to a fully extended position when there is no work contact. Maximum conductivity is maintained through sturdy copper alloy working parts. Spacing can vary up to 4 inches, using TUFFALOY bent offset tips in Equa-Press holders having the standard barrel spacing of two inches (shown).

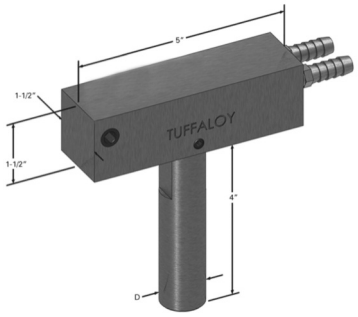
Barrel spacing up to six inches is available as semi-standard (see price list). These are drilled to order from stock components. To order you must give the barrel spacing desired, along with the Item number (from table).

Equa-Press Holders are made in two mounting styles: platen models to mount directly to the platen on press-type welding machines, and shank models for rocker arm machines. All are available in two designs: the standard and the short (close-coupled) type. The short design is internally flood-cooled and takes up less space in the welder.

Equa-Press holders can be used with forces up to 1500 lbs.

| Mounting Style | Standard Design | | Short Design | |
|---|---|---|---|---|
| | Descrip-tion | Part No. | Descrip-tion | Part No. |
| 1-in. shank | 4010 | 350-4010 | 4015 | 350-4015 |
| 1-1/4-in. shank | 4011 | 350-4011 | 4016 | 350-4016 |
| 1-1/2-in. shank | 4012 | 350-4012 | 4017 | 350-4017 |
| Platen | 4013 | 350-4013 | 4018 | 350-4018 |

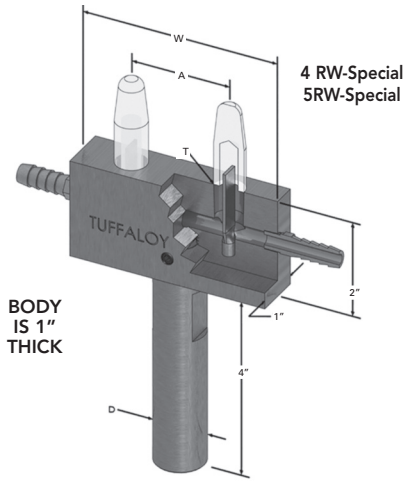
*Note: For best results, position the holder so that a line drawn through the electrode centers is at, or nearly at, right angles to the direction of the welder arms. Otherwise, the magnetic field between the arms can cause an excess of current to flow through the inboard electrode.*




| LOWER ELECTRODES | | |
|---|---|---|
| D Shank Diameter | Description | Part No. |
| 1 | 4020 | 350-4020 |
| 1-1/4 | 4021 | 350-4021 |
| 1-1/2 | 4022 | 350-4022 |

## LOWER HOLDERS AND ELECTRODES FOR USE WITH EQUA-PRESS HOLDER

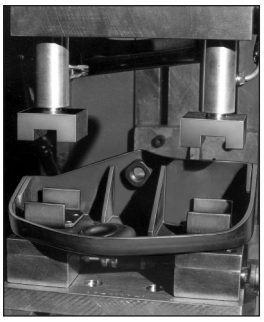
A lower, fixed, dual tip holder is offered for use with Equa-Press Holders. Like the Equa-Press, it has a standard two-inch tip spacing and helps make two welds at once, precisely alike. The standard trans-verse bar electrode shown is used when work geometry doesn't require tips on the lower side. They are water-cooled.



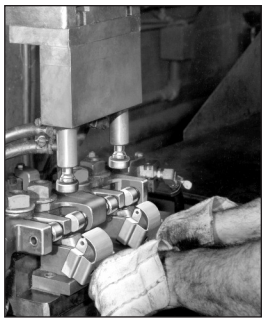

| STANDARD LOWER HOLDER - 2" SPACING 5 RW | | |
|---|---|---|
| D | Lower Holder | |
| Shank Diameter | Description | Part No. |
| 1 | 4030 | 350-4030 |
| 1-1/4 | 4031 | 350-4031 |
| 1-1/2 | 4032 | 350-4032 |

| SPECIAL LOWER ELECTRODES | | | |
|---|---|---|---|
| W Style | D Shank Diameter (inches) | Description* | A Tip Spacing Range (inches) |
| 4" Body | 1 | 4030 | 1-1/4 to 2-7/8 |
| | 1-1/4 | 4031 | 1-1/4 to 2-7/8 |
| | 1-1/2 | 4032 | 1-1/4 to 2-7/8 |
| 8" Body | 1 | 8030 | 3 to 6 |
| | 1-1/4 | 8031 | 3 to 6 |
| | 1-1/2 | 8032 | 3 to 6 |

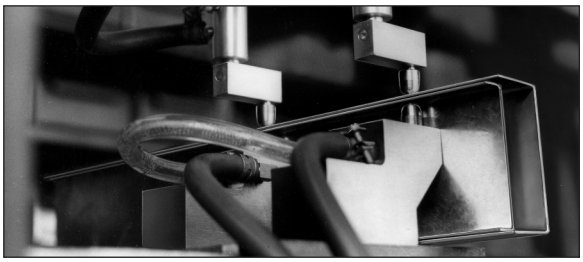
**When ordering specify center distance and either 4RW or 5RW sockets*



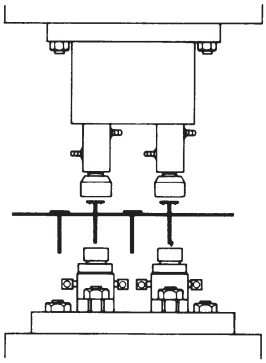
*A Case History: Projection welding brackets to automotive frame assemblies is twice as fast with an Equa-Press dual tip holder. Lower welding fixture acts as an inspection device, so warped parts are discovered before welding. Inspection time and scrap loss are both reduced.*



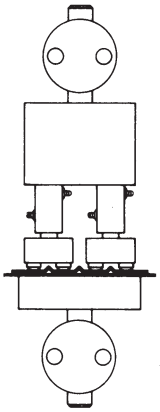
*A Case History: Joining a piece of metal to itself is always tough. This job was done with an Equa-Press holder - two at a time. Lower clamp faces, carrying current, contact parts near the weld areas to avoid current bypassing weld projections. Two standard swivel tips make four welds, two per part.*



*A Case History: Dual spot welding of panelled wall sections reduced welding costs enough to justify buying welding machine to do the job in-plant. Equa-Press holder with 5-inch spacing, and special (but simple) tooling to provide two offset tip adapters and matching holders were used. Electrodes are standard TUFFCAP caps.*



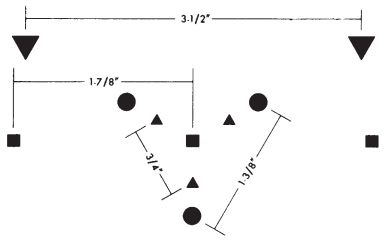
*In this drawing, two studs are projection welded in each welder stroke, using an Equa-Press dual holder over a pair of studwelding electrodes held in PM-style holders.*



*Here, four spot welds are made simultaneously on a corrugated part. An Equa-Press dual holder is used to hold two Teeter-Tip dual tip adapters.*

| TRISPACER HOLDER | | |
|---|---|---|
| Mounting Style | Description | Part No. |
| 1-in. shank | 4040 | 350-4040 |
| 1-1/4-in. shank | 4041 | 350-4041 |
| 1-1/2-in. shank | 4042 | 350-4042 |
| Platen | 4043 | 350-4043 |






**SYMBOLS**

- Maximum Triangle Size
- Straight-Tip Triangle Size
- Minimum Triangle Size
- Maximum Straight-Line Spacing

*Diagram indicates the wide range of weld patterns which can be made with the Trispacer by using straight, standard bent or special bent tips.*

## TRISPACER™ TRIPLE TIP HOLDER

*U.S. Pat. No. 3,558,848*

The Trispacer tip holder will make three spot welds at one time, automatically splitting the current and the pressure equally between the three tips. In doing so, it compensates for variations in work thicknesses and electrode wear-up to 3/16-in.

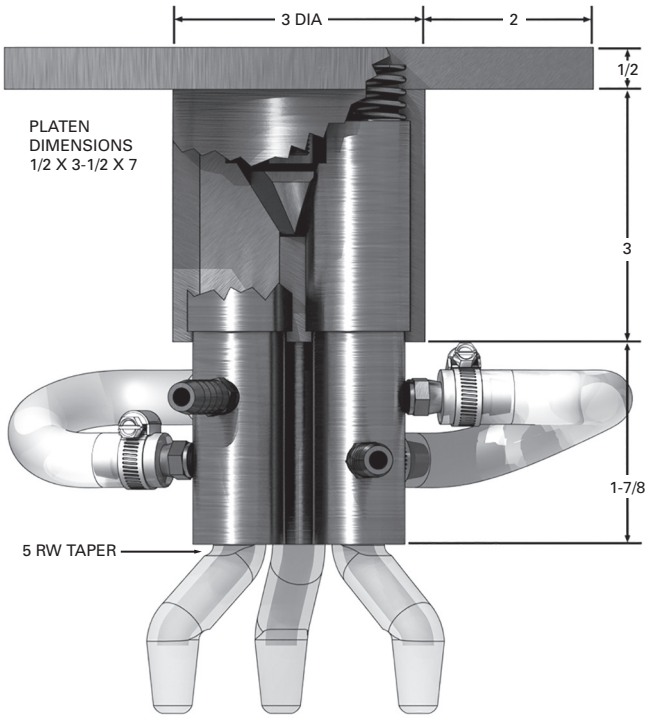
The three tip-holder barrels (#5 RW) are equidistant from one another, all falling on a 1-5/8-in. diameter circle (in the standard model shown). Using straight tips the weld pattern would form an equilateral triangle. However, the weld pattern can be widely varied by using standard or special bent tips. In fact, the three welds can be made in a straight line.

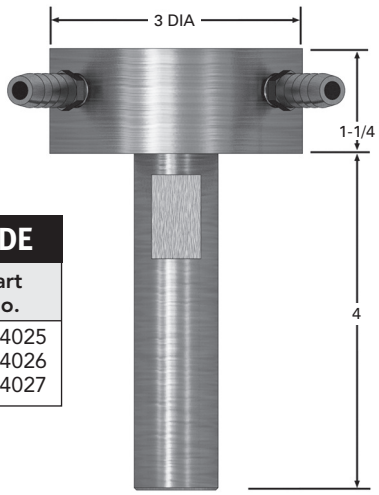
The Trispacer Holder works in the same simple, mechanical way as the Equa-Press Holder: The tip-holding barrels have a limited up-and-down movement, to accommodate work conditions, and are adjusted to deliver equal pressure by the cone-shaped equalizing device in the housing. All current-carrying parts are made of RWMA copper alloys. It is made in two styles: to mount directly to the platen of press-type welders, and with shanks to fit in welder arms.

Trispacer Holders can be used with forces up to 2000 lbs.

## LOWER ELECTRODE

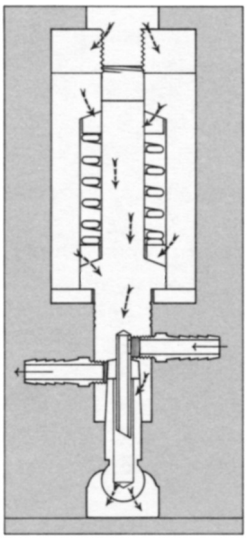
A simple, water-cooled lower electrode is made for use with the Trispacer holder. Its three-inch-diameter face makes it usable with any weld pattern that may be developed for the Trispacer. It comes in three shank diameter models.




| LOWER ELECTRODE | | |
|---|---|---|
| Shank Dia. | Description | Part No. |
| 1 | 4025 | 350-4025 |
| 1-1/4 | 4026 | 350-4026 |
| 1-1/2 | 4027 | 350-4027 |





*Current flow follows dashed arrow through the outer body, two split contact rings, tapered tip socket, and to the electrode.*

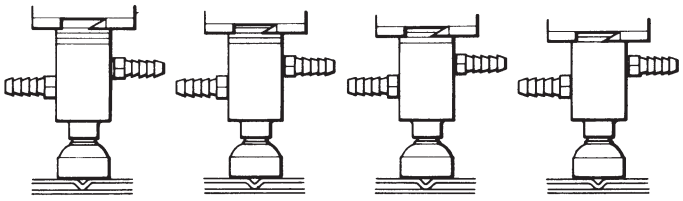
*U.S. Pat. No. 3,632,958 Canada Pat. No. 902,189*

TUFFALOY fast-follow-up (low inertia) holders solve the problem of maintaining adequate weld pressure on rapidly collapsing projection welds-with fewer set-up problems and reduced maintenance.

These holders can be set to deliver fast-follow-up forces of from 140 to 1300 pounds, a range covering 90% of all projection welding operations. They are compact, water cooled, and easy to maintain.

Plus features of the TUFFALOY fast-follow-up holder include: (1) wider range of pressures than any competitive make (2) no flexible shunt-a common cause of holder failure (3) use of standard, unmodified die springs, so if you need a spring of different strength, it's easily available (4) spring forces available are clearly indicated, so it's easy to set up for a specific force (5) three shank sizes, or it can be platen-mounted-the only fast-follow-up holder that can (6) extremely low height permits use where larger units can't be used.

TUFFALOY fast-follow-up holders can be used to limit the weld pressure of any spot welding machine regardless of cylinder size or air pressure. This is better than reducing air pressure, which slows the return stroke and retards production.



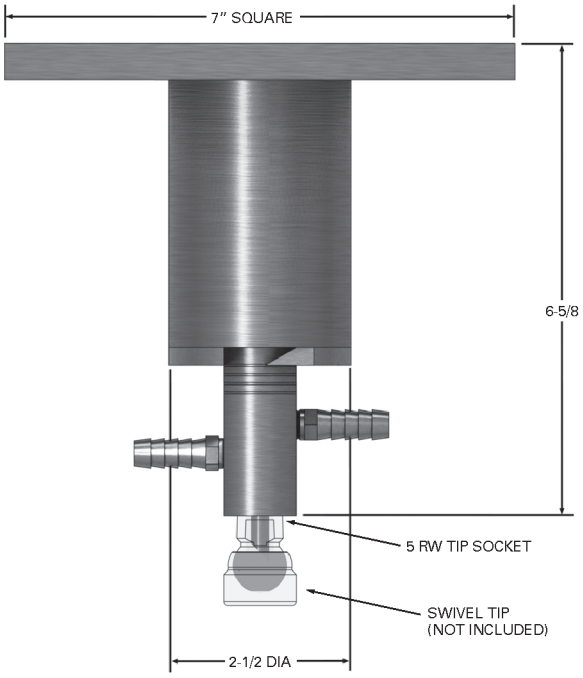
A
No external Compression

B
Compression 1 mark

C
Compression 2 marks

D
Compression 3 marks

*For every one-eighth of an inch that a fast-follow-up is compressed when setting up, a known amount of force is provided, to quickly follow up any reduction in work thickness. Example: at position B, a type MH spring would delivery 310 lb, at C, 440 lb, etc.*




## FAST-FOLLOW-UP FORCE CHART (LBS.)

| Spring Type | 1/8-in. Compression | 1/4-in. Compression | 3/8-in. Compression | 1/2-in. Compression |
|---|---|---|---|---|
| M (300 lbs. max.) | 140 | 200 | 250 | 300 |
| MH (680 lbs. max.) | 310 | 440 | 560 | 680 |
| H (1300 lbs. max.) | 600 | 840 | 1070 | 1300 |

| Mounting Style | 300 LBS MAX. (M SPRING) | | 680 LBS. MAX. (MH SPRING) | | 1300 LBS. MAX. (H SPRING) | |
|---|---|---|---|---|---|---|
| | Descrip-tion | Part No. | Descrip-tion | Part No. | Descrip-tion | Part No. |
| 1" Shank | 4620 | 350-4620 | 4621 | 350-4621 | 4622 | 350-4622 |
| 1-1/4" Shank | 4623 | 350-4623 | 4624 | 350-4624 | 4625 | 350-4625 |
| 1-1/2" Shank | 4626 | 350-4626 | 4627 | 350-4627 | 4628 | 350-4628 |
| Platen-Mtd. | 4629 | 350-4629 | 4630 | 350-4630 | 4631 | 350-4631 |

# TUFFALOY BAR STOCK

TUFFALOY extruded bar stock is used for fabricating special electrodes, platens, adapters, and other conductive parts. Round bar is available in all three alloy classes (1, 2 & 3). The other shapes are made in Class 2 and 3 alloy. Physical properties are superior to those shown on page 52.

Bar stock is priced per pound in random mill lengths, from 8 to 12 feet. Additional charges are made depending on specific weights and lengths ordered. See the TUFFALOY price list.

| | Size In Inches | Weight Pounds Per Foot | Tuffaloy 88 Class 1 Alloy Item No. | Tuffaloy 77 Class 2 Alloy Item No. | Tuffaloy 55 Class 3 Alloy Item No. |
|---|---|---|---|---|---|
| ROUND | 1/8 | .048 | | | 431-0125 |
| | 3/16 | .106 | | 421-0187 | 431-0187 |
| | 1/4 | .189 | | 421-0250 | 431-0250 |
| | 5/16 | .296 | | 421-0313 | 431-0313 |
| | 3/8 | .426 | | 421-0375 | 431-0375 |
| | 1/2 | .758 | | 421-0500 | 431-0500 |
| | 9/16 | .959 | | 421-0562 | 431-0562 |
| | 5/8 | 1.184 | 411-0625 | 421-0622 | 431-0625 |
| | 21/32 | 1.82 | | 421-0656 | |
| | 3/4 | 1.704 | 411-0750 | 421-0748 | 431-0750 |
| | 7/8 | 2.32 | 411-0875 | 421-0872 | 431-0875 |
| | 1 | 3.03 | | 421-1000 | 431-1000 |
| | 1-1/8 | 3.84 | | 421-1125 | 431-1125 |
| | 1-1/4 | 4.74 | | 421-1250 | 431-1240 |
| | 1-3/8 | 5.74 | | 421-1375 | 431-1375 |
| | 1-1/2 | 6.82 | | 421-1500 | 431-1500 |
| | 1-5/8 | 7.97 | | | 431-1625 |
| | 1-3/4 | 9.28 | | 421-1750 | 431-1750 |
| | 2 | 12.12 | | 421-2000 | 431-2000 |
| | 2-1/8 | 13.62 | | | 431-2125 |
| | 2-1/4 | 15.40 | | 421-2250 | 431-2250 |
| | 2-1/2 | 18.97 | | 421-2500 | 431-2500 |
| | 2-3/4 | 23.00 | | 421-2750 | |
| | 3 | 27.15 | | 421-3000 | 431-3000 |
| | 3-1/4 | 32.05 | | | 431-3250 |
| | 3-1/2 | 37.18 | | | 431-3500 |
| HEXAGONAL | 3/8 | .472 | | 422-0375 | |
| | 5/8 | 1.31 | | 422-0625 | |
| | 3/4 | 2.18 | | 422-0750 | 432-0750 |
| | 7/8 | 2.56 | | 422-0875 | 432-0875 |
| | 1 | 3.35 | | 422-1000 | 432-1000 |
| | 1-1/8 | 4.24 | | 422-1125 | 432-1125 |
| | 1-1/4 | 5.25 | | 422-1250 | 432-1250 |
| | 1-1/2 | 7.55 | | 422-1500 | 432-1500 |
| SQUARE | 1/4 | .24 | | | 433-0250 |
| | 3/8 | .54 | | | 433-0375 |
| | 1/2 | .96 | | 423-0500 | 433-0500 |
| | 5/8 | 1.56 | | 423-0625 | 433-0625 |
| | 3/4 | 2.16 | | 423-0750 | 433-0750 |
| | 1 | 3.84 | | 423-1000 | 433-1000 |
| | 1-1/4 | 6.00 | | 423-1250 | 433-1250 |
| | 1-1/2 | 8.64 | | 423-1500 | 433-1500 |
| | 1-3/4 | 11.83 | | 423-1750 | |
| | 2 | 15.46 | | 423-2000 | 433-2000 |

| | Size In Inches | Weight Pounds Per Foot | Tuffaloy 77 Class 2 Alloy Item No. | Tuffaloy 55 Class 3 Alloy Item No. |
|---|---|---|---|---|
| RECTANGULAR | 1/4 x 1/2 | .484 | | 434-0205 |
| | 1/4 x 3/4 | .727 | | 434-0207 |
| | 1/4 x 1 | .96 | 424-0210 | 434-0210 |
| | 1/4 x 1-1/4 | 1.20 | 424-0212 | |
| | 1/4 x 1-1/2 | 1.44 | 424-0215 | 434-0215 |
| | 1/4 x 2 | 1.92 | 424-0220 | 434-0220 |
| | 3/8 x 5/8 | .900 | | 434-0306 |
| | 3/8 x 314 | 1.08 | 424-0307 | 434-0307 |
| | 3/8 x 1 | 1.44 | 424-0310 | 434-0310 |
| | 3/8 x 1-1/2 | 2.16 | 424-0315 | |
| | 3/8 x 2 | 2.88 | | 434-0320 |
| | 1/2 x 3/4 | 1.44 | 424-0507 | 434-0507 |
| | 1/2 x 1 | 1.92 | 424-0510 | 434-0510 |
| | 1/2 x 1-1/4 | 2.40 | | 434-0512 |
| | 1/2 x 1-1/2 | 2.138 | 424-0515 | 434-0515 |
| | 1/2 x 2 | 3.134 | 424-0520 | 434-0520 |
| | 1/2 x 2-1/2 | 4.133 | 424-0525 | 434-0525 |
| | 1/2 x 3 | 5.81 | 424-0530 | 434-0530 |
| | 5/8 x 3/4 | 1.80 | 424-0607 | 434-0607 |
| | 5/8 x 1 | 2.40 | 424-0610 | 434-0610 |
| | 5/8 x 1-1/2 | 3.60 | 424-0615 | 434-0615 |
| | 5/8 x 2 | 4.85 | 424-0620 | 434-0620 |
| | 5/8 x 3 | 7.27 | 424-0630 | |
| | 5/8 x 4 | 9.60 | 424-0640 | |
| | 3/4 x 1 | 2.88 | 424-0710 | 434-0710 |
| | 3/4 x 1-1/4 | 3.64 | 424-0712 | 434-0712 |
| | 3/4 x 1-1/2 | 4.32 | 424-0715 | 434-0715 |
| | 3/4 x 2 | 5.72 | 424-0720 | 434-0720 |
| | 3/4 x 2-1/4 | 6.48 | | 434-0722 |
| | 3/4 x 2-1/2 | 7.20 | 424-0725 | 434-0725 |
| | 3/4 x 3 | 8.64 | 424-0730 | |
| | 1 x 1-1/4 | 4.85 | 424-1012 | 434-1012 |
| | 1 x 1-1/2 | 5.76 | 424-1015 | 434-1015 |
| | 1 x 2 | 7.68 | 424-1020 | 434-1020 |
| | 1 x 2-1/2 | 9.70 | 424-1025 | 434-1025 |
| | 1 X 2-3/4 | 10.56 | 424-1027 | |
| | 1 X 3 | 11.55 | 424-1030 | 434-1030 |
| | 1-1/4 x 1-1/2 | 7.25 | 424-1215 | |
| | 1-1/4 x 1-3/4 | 8.40 | 424-1217 | |
| | 1-1/4 X 2 | 9.60 | 424-1220 | |
| | 1-1/4 X 2-1/2 | 12.06 | 424-1225 | |
| | 1-1/2 x 1-3/4 | 10.09 | 424-1517 | |
| | 1-1/2 x 2 | 11.60 | 424-1520 | 434-1520 |
| | 1-1/2 x 3 | 17.28 | 424-1530 | 434-1530 |
| | 2 x 3-1/4 | 25.15 | 424-2032 | |
| | 2 x 3-3/4 | 29.05 | 424-2037 | |

Stronger, generally harder, and having less conductivity, the refractory metal compositions include copper-tungsten (Classes 10-11), tungsten (Class 13) and molybdenum (Class 14) alloys.

The bars and inserts listed below are made in the following RWMA group B alloys: Class 10 (Tuffaloy 1W), Class 11 (Tuffaloy 10W), and Class 12 (Tuffaloy 20W).

Bars and inserts of Class 13 (Tuffaloy 100W) and Class 14 (Tuffaloy 100M), as well as special sizes and shapes, are priced on request.

## COPPER TUNGSTEN ROUND BARS

Eight inches long, available in the following diameters:

From 1/8" to 2".



## COPPER TUNGSTEN RECTANGULAR AND SQUARE BARS

Eight inches long, available in following dimensions:

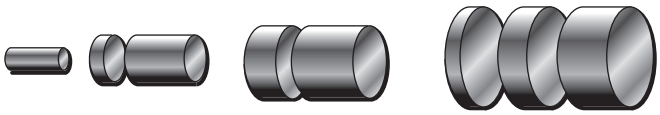
Widths from 1/8" to 2" and Thicknesses from 1/8" to 1".



## COPPER TUNGSTEN ROUND INSERTS

Available in following dimensions:

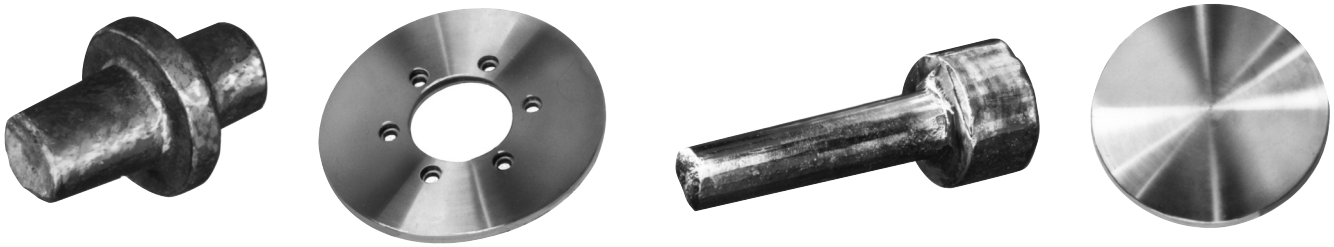
Diameters from 1/8" to 2" and Thicknesses from 1/4" to 1".

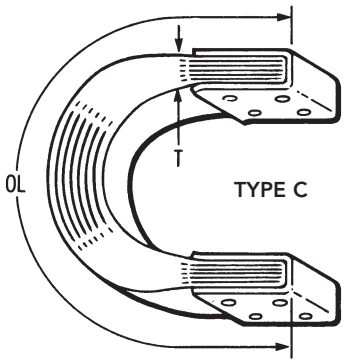


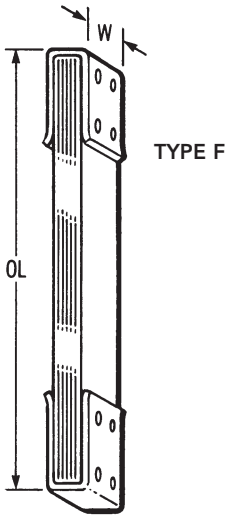
# TUFFALOY FORGINGS

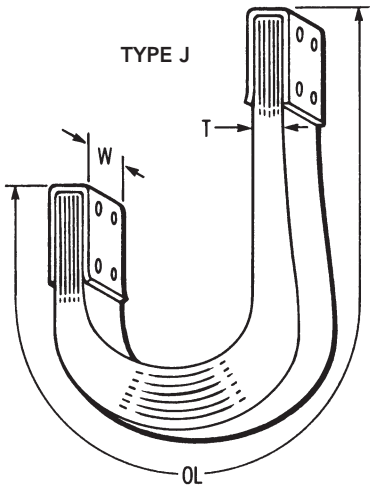
TUFFALOY forgings are used to make seam welder wheels and shafts, butt and flash welder dies, and welder arms and platens. Forgings are superior to castings in physical properties and in absence of porosity. They are available in TUFFALOY 88, 77 and 55 (Class 1, 2 and 3 alloy). All are readily machinable.

When ordering specify whether forging is to be as-forged or finish machined. Regardless of how it is wanted always order by giving finish dimensions.





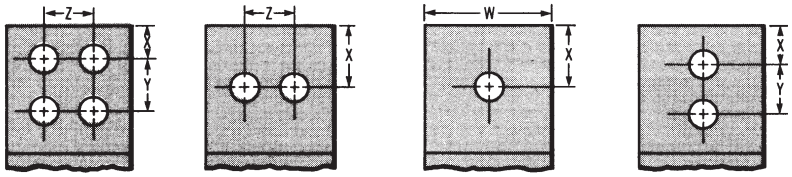




Laminated copper shunts are made to your size and shape specifications. High conductivity electrolytic copper strip is used, and terminal clips are riveted in place.

## HOW TO ORDER

Give the following information:
Type (C, F, or J)
Outside length (OL)
Width (W)
Thickness (less clip) (T)
Hole pattern (specify by letter code)
Hole location (X, Y, Z values)
Hole diameter




HOLE PATTERN A | HOLE PATTERN B | HOLE PATTERN C | HOLE PATTERN E

---

Air-cooled jumper cables are flexible, high-conductivity copper conductors with insulative sleeves. They are made in lengths to suit your needs.

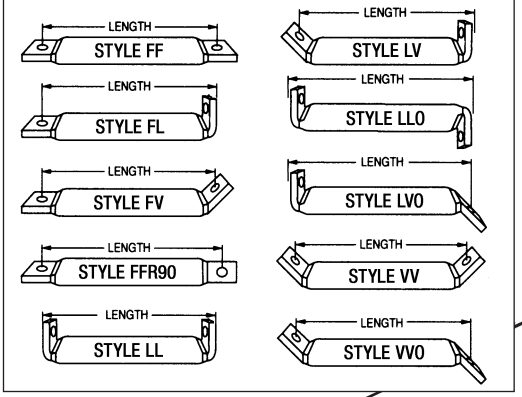
## HOW TO ORDER

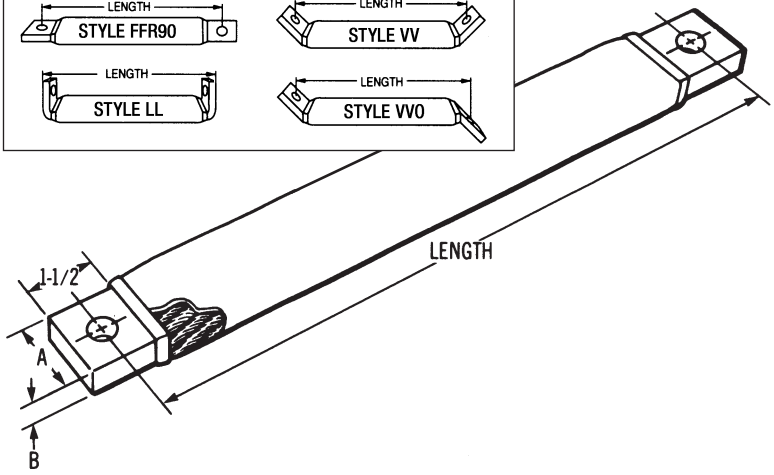
Give the following information:
Conductor rating (MCM)
Length between holes
Terminal orientation style

| DIMENSIONS, INCHES | | | |
|---|---|---|---|
| MCM Rating | O.D. (approx.) | Lug Width A | Lug Thickness B |
| 600 | 1-5/8 | 1-3/8 | .50 |
| 750 | 1-3/4 | 1-3/8 | .60 |
| 1000 | 2 | 1-1/2 | .70 |
| 1200 | 2-1/8 | 1-1/2 | .82 |
| 1500 | 2-1/4 | 1-1/2 | .99 |

*Holes are 17/32 unless otherwise specified.*

**TERMINAL ORIENTATION**



## ELECTRODE TAPER REAMERS & TAP



Hole in reamer center permits water tube entry; no need to dismantle holder. 4 RW; Part No. 601-0004; 5 RW, Part No. 601-0005; 6 RW, Part No. 601-0006; 7 RW, Part No. 601-0007.

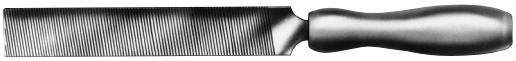
5/8-14 NPT Tap, Part No. 601-0025

## TIP DRESSING TOOL



To remove mushroomed nose material on a pair of tips of 4 or 5 RW size, having pointed or dome noses. Other nose design dressers on special order. Dresser, Part No. 601-0102; Dresser cutter, Part No. 601-0103.

## RADIUS TIP FILE



Tip File

To restore original contours of welding tips use this two-inch radius file. File, Part No. 601-0120; Handle, Part No. 601-0120-H; File & Handle, Part No. 601-0120-A.

## WELDING TIP EXTRACTORS



No. 4 RW and 5 RW at opposite ends, EX-3, Part No. 601-0203



No. 4 RW, EX-1, Part No. 601-0201
No. 5 RW, EX-2, Part No. 601-0202



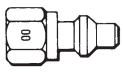
Standard Duty: EX-10-A, Part No. 601-0231
Heavy Duty: SW-250, Part No. 601-SW-250

## TUFFCAP ELECTRODE REAMERS

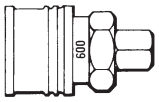
To ream or dress tapers to hold male caps. 4 RW, Part No. 601-0014; 5 RW, Part No. 601-0015; 6 RW, Part No. 601-0016.

## QUICK-CONNECT COUPLINGS
### with automatic shut-off

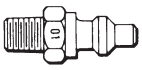
Use these couplings to make up efficient, trouble free coolant systems. Any plug shown will mate with any socket shown. Always put the socket on the upstream side of a connection. Its built-in valve will automatically close upon disconnection.



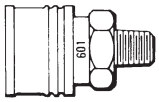

1/8" NPT female plug
Part No. 601-0300



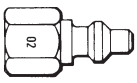

1/8" NPT female socket
Part No. 601-0314



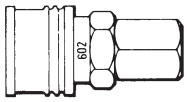

1/8" NPT male plug
Part No. 601-0301



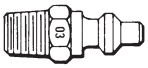

1/8" NPT male socket
Part No. 601-0315



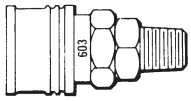

1/4" NPT male plug
Part No. 601-0302



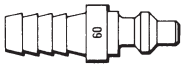

1/4" NPT female socket
Part No. 601-0316



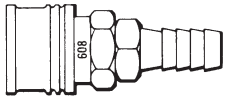

1/4" NPT male plug
Part No. 601-0303




1/4" NPT male socket
Part No. 601-0317




3/8" NPT hose plug
Part No. 601-0309




3/8" NPT hose socket
Part No. 601-0320

## CONDUCTIVE LUBE

Part No. 601-0400
1 lb. container

## WATER HOSE

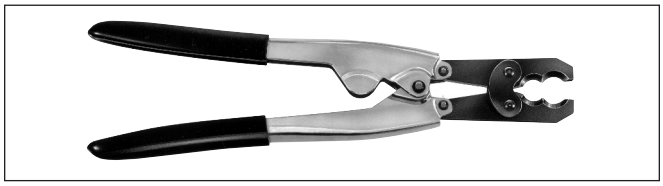
Part No. 601-0350
3/8 ID

## HOSE CLAMP

Part No. 601-0340

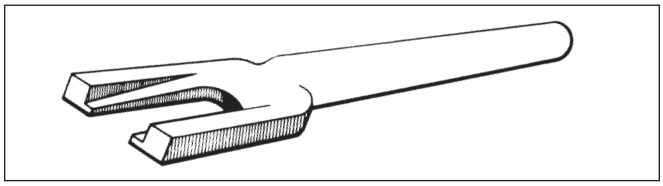
## TUFFCAP EXTRACTORS

Male Caps, 4 & 5 RW, EX-45, Part No. 601-0240
Male Caps, 5 & 6 RW, EX-56, Part No. 601-0242



*Male cap extractor has long lever handles for easier cap removal. In two dual-size models: EX-45 and EX-56.*

Female Caps, 4 RW, EX-4F, Part No. 601-0220 Male Cap 4 RW
Female Caps, 5 RW, EX-5F, Part No. 601-0221 Male Cap 5 & 6 RW
Female Caps, 6 RW, EX-6F, Part No. 601-0222 Male Cap 7 RW



*Female cap extractors are made for three Tuffcap shank sizes: Models EX-4F, EX-5F, and EX-6F.*

# WA2 WELD ANALYZER

- Current meter
- Easy to use
- Easily legible in all lighting conditions
- Positive keypad action
- Suitable for various applications
- Reads wave forms from 50 Hz upwards
- Traceable accuracy
- Data archiving
- Small and lightweight allowing for easy portability
- Calibration services available
- One year warranty











## FEATURES

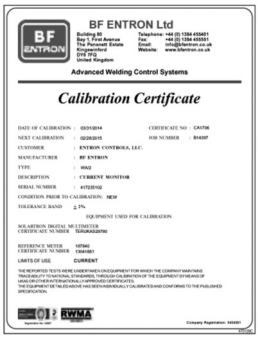
- Intuitive, flexible interface
- LCD 128 x 64 pixels FSTN with yellow/green backlight
- Embossed disc tactile keypad with antiglare display window
- Auto power-off
- Large choice of coils
- AC or MFDC operation
- Calibration certification
- USB connection
- Includes 6 inch flexible coil, batteries and carrying case
- Integrator output for oscilloscope connection
- WA Terminal software

## OPTIONS

- Flexible coil – 3 inch (Part No. 313027) or 12 inch (Part No. 313021) diameter with 6.5 feet lead
- Attenuator – range multiplier for up to 300kA (Part No. 316009)
- Extension cable – 10 meters (Part No. 316010)

# WA2 WELD ANALYZER SPECIFICATIONS

The Weld Analyzer offers the engineering professional the facilities to analyze, fault-find and improve process quality on today's sophisticated welding control systems. Full traceability gives you the confidence in your processes that your customers demand.


BF ENTRON Ltd

Advanced Welding Control Systems

Calibration Certificate




**POWER SOURCE:** Rechargeable NiMH

**DISPLAY:** 128 x 64 pixels FSTN transflective with yellow/green backlight

**CURRENT RANGE:** 2.00 to 60.00 kA

**CURRENT DURATION:** 9999 cycles (AC), 199.9 seconds (DC)

**MONITORED PARAMETERS:**

| Current | Time | Conduction Angle | Position |
|---|---|---|---|
| Peak RMS | Total weld time | Average conduction angle | Position of monitored parameter in weld pulse train |
| Average RMS | Any pulse time | Conduction angle of every sample | |
| Lowest RMS | Number of pulses | Accuracy ± 4º | |
| Accuracy +/- 2% of full scale | Accuracy +/- 0 | | |
| Measures and displays values for each + and - ½ cycle | | | |



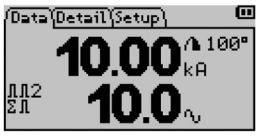
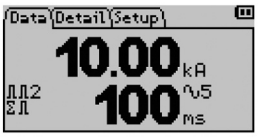
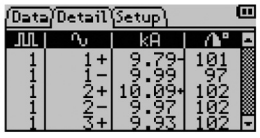
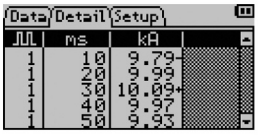
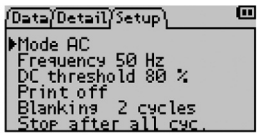
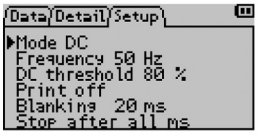

**PROGRAMMABLE PARAMETERS:**

| AC | DC |
|---|---|
| Frequency | Current threshold |
| Blanking | Blanking |
| Weld capture | Weld capture |

**USB DRIVERS:** www.ftdichip.com/Drivers/VCP.htm

**DIMENSIONS:** 3-3/80 w x 1-1/80 d x 6-3/40 h; 1 lb. including batteries

**DISPLAY EXAMPLES:**

| Display | AC | DC |
|---|---|---|
| Data |  |  |
| Detail |  |  |
| Setup |  |  |

# HIGH-ACCURACY WELD FORCE GAUGES AVAILABLE FROM TUFFALOY

Digital-Electronic



DLC Gauge



Digital-Hydraulic



Standard-Hydraulic



## WE OFFER ONE OF THE BROADEST PRODUCT LINES AVAILABLE TODAY

Tuffaloy supplies a broad range of weld force gauges, available with accuracies from 0.5% for Digital-Electronic gauges; to 2% accuracy for the Digital-Hydraulic which has a digital output driven by hydraulics; to our Standard Hydraulic models with 2%-3% accuracy. All are available in English and metric readouts.

Our **Digital-Electronic** gauge supplies the highest accuracy (0.5% for 95% of the gauges range). The gauge has large LCD readouts with peak-hold capabilities. All functions are electronic which prevents variations caused by flexing.

The **Digital-Hydraulic** delivers better accuracy than standard hydraulic gauges but at a lower price than all-digital models. The unit of measureis field selectable between pounds, kilograms, newtons and kilonewtons. The peak-hold feature allows for reading variable forces, which are common in resistance welding machinery. Gauges maintain an accuracy of 2% for 30% to 90% of the gauge's range.

Tuffaloy's **Standard Hydraulic** gauges are the low cost method for obtaining general force measurements. These gauges are available in a standard block style, with extensions. Sizes range from 600 lb. up to 10 tons with accuracy of 2% at the mean and 3% outside of mean for 70% of the gauge's range.

## STANDARD GAUGE DATA

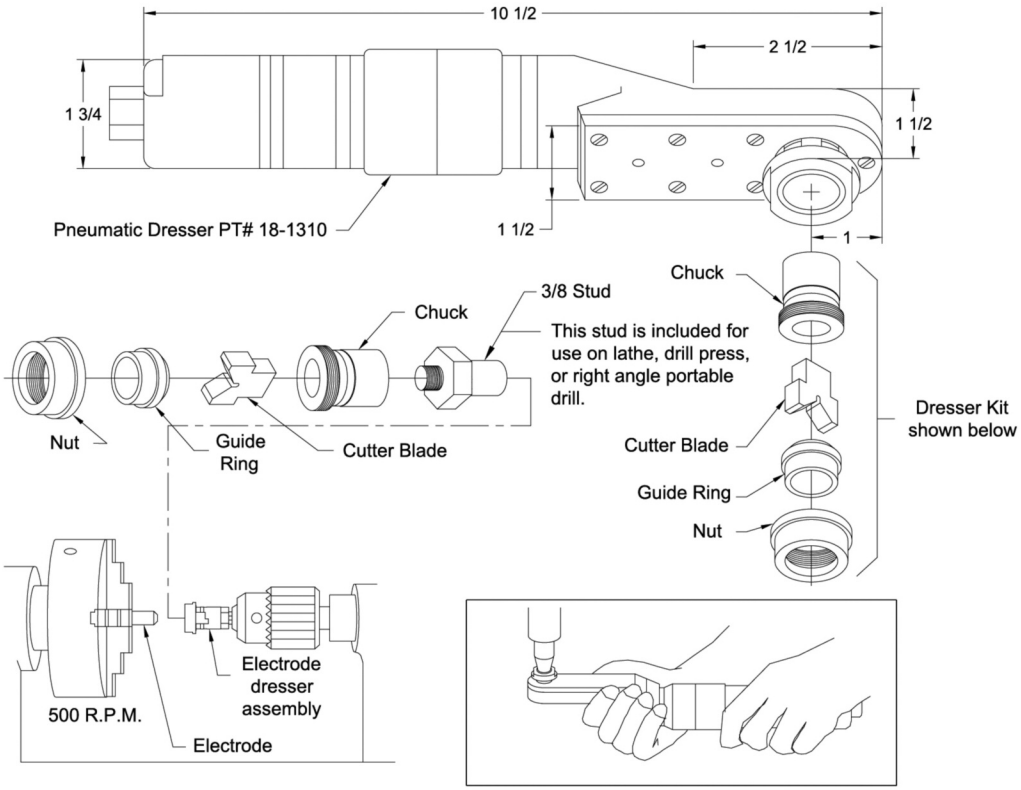
| Description | Features | Item Number |
|---|---|---|
| **Gauge Case**   | • *Convenient padded gauge storage/carrying case*<br>• *4" D x 10" W x 10" L*<br>• *Fits all hydraulic gauges* | 601-8019 |

## STANDARD GAUGE DATA

| Description | Features | Maximum Reading | Increment Every | Opening Required | Extension Length | Item Number |
|---|---|---|---|---|---|---|
| **Digital-Electronic Weld Probe**  | • *Analog output*<br>• *Auto shut-off*<br>• *No-weld setting-not required*<br>• *Accuracy 0.5% over full range* | 0-1000 lbs/<br>0-454 Kg | 1 lb<br>1 Kg | 1/4″ | 10″ | 601-8010MD<br>601-8045MD-KG |
| | | 0-3000 lbs/<br>0-1360 Kg | 1 lb<br>1 Kg | 1/2″ | 10″ | 601-8300MD<br>601-8136MD-KG |
| | | 0-5000 lbs/<br>0-2270 Kg | 1 lb<br>1 Kg | 1.1″ | 10″ | 601-8500MD<br>601-8227MD-KG |
| | | 0-10,000 lbs/<br>0-4540 Kg | 1 lb<br>1 Kg | 1.1″ | 10″ | 601-8100MD<br>601-8453MD-KG |
| **DLC Digital-Electric**  | • *Accuracy 0.50%*<br>• *NIST traceable certification*<br>• *Response time less than 500 ms*<br>• *Field selectable units switch between:*<br>*Pounds*<br>*Kilograms*<br>*Newtons*<br>*Kilonewtons*<br>• *Peak hold feature* | 3000 lb<br>1363 Kg<br>13344 N<br>13.34 KN | 1 lb<br>1 Kg<br>1 N<br>0.01 KN | 9/16″ | – | 601-3000DLC |
| | | 5000 lb<br>2272 Kg<br>2224 N<br>22.24 KN | 1 lb<br>1 Kg<br>1 N<br>0.01 KN | 9/16 ″ | – | 601-5000DLC |
| **Digital-Hydraulic***  | • *Accuracy 2%*<br>• *NIST traceable certification*<br>• *Field selectable units switch between:*<br>*Pounds*<br>*Kilograms*<br>*Newtons*<br>*Kilonewtons* | 0-3000 lbs.<br>0-1360 Kg<br>0-13,300 N | 1 lb<br>1 Kg<br>1 N | 3/4″ | _ | 601-3000DR |
| | | 0-5000 lbs<br>0-2270 Kg<br>0-22,200 N | 1 lb<br>1 Kg<br>1 N | 3/4″ | _ | 601-5000DR |
| | | 0-10,000 lbs<br>0-4540 Kg<br>0-44,500 N | 1 lb<br>1 Kg<br>1 N | 3/4″ | _ | 601-9999DR |
| | | 0-3000 lbs<br>0-1360 Kg<br>0-13,3000 N | 1 lb<br>1 Kg<br>1 N | 3/4″ | 12″ | 601-3000DR-12S |
| **Standard-Hydraulic***  | • *Accuracy 3%* | 0-600 lbs<br>0-1000 lbs<br>0-2000 lbs<br>0-2000 lbs<br>0-3000 lbs<br>0-3000 lbs<br>0-5000 lbs<br>0-6000 lbs<br>0-6000 lbs<br>0-10,000 lbs<br>0-5000 Kg | 10 lb<br>20 lb<br>50 lb<br>50 lb<br>20 lb<br>20 lb<br>100 lb<br>50 lb<br>50 lb<br>100 lb<br>50 Kg | 3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″<br>3/4″ | –<br>–<br>–<br>12″<br>–<br>12″<br>–<br>–<br>18″<br>–<br>– | 601-8006<br>601-8010<br>601-8020<br>601-8020-12<br>601-8030<br>601-8030-12<br>601-5000<br>601-6000<br>601-6000-18<br>601-8100<br>601-8101 |

** Hydraulic gauges should be selected to be used near mid-range.*

## PNEUMATIC POWER HANDLE ELECTRODE DRESSER PART NO. 18-1310

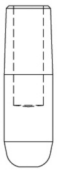
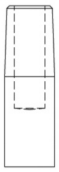
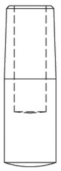
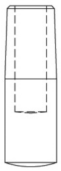
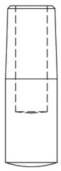
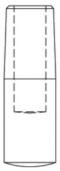
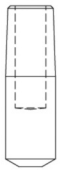





Light weight and rugged construction, this Pneumatic Power Handle requires a clearance of only 1-1/2" with a standard ring and 2" with an extended ring. In most situations this allows dressing of electrodes without removal from the welder. Operating at a cutting speed of 1200 rpm, it enables the operator to dress electrodes quickly and accurately. Cutters and guide rings are easily replaced. These must be matched to the electrode nose and are selected from the chart below.

**Electrode Dresser 18-1310 is supplied without blade holder, ring, and cutter blade.** When ordering, specify the "Kit" appropriate for your dressing needs as selected from the table below. "The stud" furnished with the kit is not required when using the Pneumatic Power Handle. It may optionally be used, but will increase the clearance required on the welder for dressing. Additional special cutters can be furnished upon special request.

These kits may also be used for cap electrode dressing.

| Size To Dress | |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nose style | Dome | Pointed | Flat | 2" Radius | 3" Radius | 4" Radius | 10" Radius | Truncated |
| 4 RW .482 Dia | Kit to Order** | 18-1390411 | 18-1390420 | 18-1390410 | 18-1390413 | 18-1390414 | 18-1390415 | 18-1390416 | 18-1390412 |
| | Replacement Blade<br>Replacement Guide Ring<br>(Each for above kit) | 18-139411<br>18-139401 | 18-139420<br>18-139402 | 18-139410<br>18-139401 | 18-139413<br>18-139401 | 18-139414<br>18-139401 | 18-139415<br>18-139401 | 18-139416<br>18-139401 | 18-139412<br>18-139401 |
| 5 RW .625 Dia | | | | | | | | | |
| | Kit to Order** | 18-1390511 | 18-1390520 | 18-1390510 | 18-1390513 | 18-1390514 | 18-1390515 | 18-1390516 | 18-1390512 |
| | Replacement Blade<br>Replacement Guide Ring<br>(Each for above kit) | 18-139511<br>18-139501 | 18-139520<br>18-139502 | 18-139510<br>18-139501 | 18-139513<br>18-139501 | 18-139514<br>18-139501 | 18-139515<br>18-139501 | 18-139516<br>18-139501 | 18-139512<br>18-139501 |

** Note: This kit includes Stud for (for 3/8 Keyed Chuck), Chuck, 1 Guide Ring, 1 Appropriate blade, and Retaining Nut.
Note: Cutters are **NOT** designed to conform to "Electrode Cap" geometries. Caps are intended for value salvage when expended.

# RECOMMENDED USES OF RESISTANCE WELDING MATERIALS

## GROUP A COPPER-BASE ALLOYS

### RWMA CLASS 1 ALLOY • TUFFALOY 88

ZIRCONIUM-COPPER, suited to welding aluminum and magnesium alloys, coated materials, brass and bronze.

Class 1 alloy is superior to pure copper as an electrode material and is recommended as a general purpose material for resistance welding use. It may be used for spot welding electrodes, seam welding wheels and welding fixture components. It is not heat treatable.

### RWMA CLASS 2 ALLOY • TUFFALOY 77 AND Z

TUFFALOY 77 CHROMIUM-COPPER, suited to welding cold- and hot-rolled steels, stainless steel, and low-conductivity brasses and bronzes.

Class 2 alloy is a superior resistance welding electrode material, recommended for high-production operations. It is used for welding electrodes, projection welding electrodes, seam welding shafts and bearings, flash and butt welding electrodes, and current-carrying structural components. Available in forms for use as welding gun arms, welding platens and secondary-circuit structural members. It is heat treatable.

TUFFALOY Z ZIRCONIUM-CHROMIUM-COPPER is suited to welding galvanized steel and other metallic-coated steel.

This is a specially heat-treated alloy which meets the minimum electrical conductivity and hardness specifications of Class 2 alloy.

### RWMA CLASS 3 ALLOY • TUFFALOY 55 AND 55A

BERYLLIUM-NICKEL-COPPER (55) are suited to welding steels having high electrical resistance, such as stainless steel.

NICKEL-COPPER (55A) is a beryllium-free alloy with properties similar to TUFFALOY 55.

Class 3 alloy is recommended for projection welding electrodes, and flash and butt welding electrodes. With its higher strength it is also used on highly-stressed current-carrying parts such as electrode shanks and heavy-duty electrode holders. It is heat treatable.

### RWMA CLASS 4 ALLOY • TUFFALOY 44

BERYLLIUM-COPPER has extremely high hardness, and is recommended for projection, flash and butt welding electrodes. It has lower conductivity than Class 3 alloy but it is harder and more wear resistant. It should be considered where there is concern with high pressure density and severe wear, but where heating, due to its low conductivity, is not excessive.

It is used frequently in the form of inserts, tooling facings, and seam welder bushings. It is available in the annealed condition which is more readily machined and then subsequently heat treated.

## GROUP B REFRACTORY METAL COMPOSITIONS

### RWMA CLASS 10 • TUFFALOY 1W

TUNGSTEN 55% – COPPER 45%, suited for facings and inserts for projection welding electrodes and flash and butt welding electrodes. It is recommended where (relatively) high electrical conductivity and some degree of malleability is desired.

### RWMA CLASS 11 • TUFFALOY 10W

TUNGSTEN 75% – COPPER 25%, suited to similar applications as Class 10, and for facing on electrode forming electrodes. It is harder than Class 10, and is for general use in projection welding electrodes.

### RWMA CLASS 12 • TUFFALOY 20W

TUNGSTEN 80% – COPPER 20%, suited for electro-forming and electro-forging facings, and for electrode facings used to upset studs and rivets. A material for heavy-duty projection welding electrodes.

### RWMA CLASS 13 • TUFFALOY 100W (Pure Tungsten)
### RWMA CLASS 14 • TUFFALOY 100M (Pure Molybdenum)

Class 13 & 14 materials are used primarily for welding or electro-brazing non-ferrous metals having relatively high electrical conductivity. They are suited to cross-wire welding of copper and brass, and for welding copper wire braid to brass or bronze terminals. Special set-ups and procedures are required.

# MINIMUM PHYSICAL PROPERTIES FOR RWMA ALLOYS

## Published Standards of the Resistance Welder Manufacturer's Association

| | | Class | TUFFALOY Number | Proportional Limit Tension P. S. I. | Hardness Rockwell | Conductivity Percent I. A. C. S. | Ultimate Tensile Strength P. S. I. | Elongation Percent In 2′ or 4′ Diameter |
|---|---|---|---|---|---|---|---|---|
| GROUP A Copper Base Alloys | ROUND RODS Up to 1″ dia. | 1<br>2<br>3 | 88<br>77<br>55 | 17,500<br>35,000<br>50,000 | 65-B<br>75-B<br>90-B | 80<br>75<br>45 | 60,000<br>65,000<br>100,000 | 13<br>13<br>9 |
| | 1″ to 2″ dia. | 1<br>2<br>3 | 88<br>77<br>55 | 15,000<br>30,000<br>50,000 | 60-B<br>70-B<br>90-B | 80<br>75<br>45 | 55,000<br>59,000<br>100,000 | 14<br>13<br>9 |
| | 2″ to 3″ dia. | 1<br>2<br>3 | 88<br>77<br>55 | 15,000<br>25,000<br>50,000 | 55-B<br>65-8<br>90-B | 80<br>75<br>45 | 50,000<br>55,000<br>95,000 | 15<br>13<br>9 |
| | BARS Square Rectangular Hexagon Up to 1″ thick | 1<br>2<br>3 | 88<br>77<br>55 | 20,000<br>35,000<br>50,000 | 55-B<br>70-B<br>90-B | 80<br>75<br>45 | 60,000<br>65,000<br>100,000 | 13<br>13<br>9 |
| | Over 1″ thick | 1<br>2<br>3 | 88<br>77<br>55 | 15,000<br>25,000<br>50,000 | 50-B<br>65-8<br>90-B | 80<br>75<br>45 | 50,000<br>55,000<br>100,000 | 14<br>13<br>9 |
| | FORGINGS Up to 1″ | 1<br>2<br>3 | 88<br>77<br>55 | 20,000<br>22,000<br>50,000 | 55-8<br>65-B<br>90-B | 80<br>75<br>45 | 45,000<br>55,000<br>94,000 | 12<br>13<br>9 |
| | 1″ to 2″ | 1<br>2<br>3 | 88<br>77<br>55 | 15,000<br>21,000<br>50,000 | 50-B<br>65-B<br>90-B | 80<br>75<br>45 | 40,000<br>55,000<br>94,000 | 13<br>13<br>9 |
| | Over 2″ | 1<br>2<br>3 | 88<br>77<br>55 | 15,000<br>20,000<br>50,000 | 50-B<br>65-B<br>90-B | 80<br>75<br>45 | 40,000<br>55,000<br>94,000 | –<br>12<br>5 |
| | All sizes | 4 | 44 | 85,000 | 33-C | 20 | 140,000 | .5 |
| | CASTINGS All sizes | 2<br>3<br>4<br>5 | 77<br>55<br>44<br>66 | 20,000<br>45,000<br>60,000<br>12 to 16,000 | 55-8<br>90-B<br>33-C<br>65 to 85-B | 70<br>45<br>18<br>10 to 15 | 45,000<br>85,000<br>90,000<br>65 to 75,000 | 12<br>5<br>.5<br>2 to 10 |
| GROUP B Refractory Metal Compositions | Rods, Bars & Inserts | 10<br>11<br>12<br>13<br>14 | 1W<br>10W<br>20W<br>100W<br>100M | | 72-B<br>94-B<br>98-B<br>69-A<br>85-B | 35<br>28<br>27<br>30<br>30 | 135,000<br>160,000<br>170,000<br>200,000 | Ultimate Compression Strength P. S. I. |

## RECOMMENDED ELECTRODE MATERIALS

The process of resistance welding makes it possible to join most metals, similar or dissimilar. Bonds of adequate strength are obtainable for an extremely wide range of applications. Selecting electrodes of the proper alloy is a most important consideration in producing good welds at the required speed. The chart below is a valuable guide to this selection.

The weldability of two materials as expressed in the following chart has been derived after careful laboratory study and field survey of many factors which influence the welding or resultant weld of the metals. The factors include:

1. Thermal and electrical conductivity
2. Metallurgical properties
3. Nature of resultant weld or alloy
4. Weld strength
5. Relative accuracy in control of welding conditions necessary

The weldability of metals as shown in the chart applies only when conventional spot welding methods are used on similar thicknesses of material. However, many metal combinations which are listed as having a "poor weldability" may be satisfactorily joined by using a special setup or procedure.

There is a CMW® Alloy for each specific welding application. Experienced CMW engineers will provide assistance with special problems.

## Electrode Materials For SPOT WELDING Similar and Dissimilar Metals

| | Tungsten Molybdenum | Magnesium | Nickel Alloys | Nickel | Stainless Steel | Chrome Steel | Cadmium Plate | Galvanized Steel Zn. Plate | Terne Plate | Tin Plate | Scaly Steel | C. R. Steel | Phosphor Bronze | Silicon Bronze | Nickel Silver | Cupro Nickel | Brass Yellow | Brass Red | Copper | Aluminum Alloys | Aluminum | C. P. Titanium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commercially Pure Titanium | | | | | | | | | | | | | | | | | | | | | | A II (1) / II (1) 1 |
| Aluminum 2S-3S | | C I 1 5 | E II 2 5 | E II 2 3 | H I 2 3 4 | H II 3 8 | E I 3 4 9 | D I 3 4 9 | D I 3 4 9 | D I 3 4 9 | | E II 3 4 | D II 2 5 | D II 2 5 | | | D II 5 | E II 2 | H V 2 | C I 1 | C I 1 | |
| Aluminum Alloys Duralumin 52S-17S-24S | | C I 1 5 | E II 2 | E II 2 3 | H I 2 3 4 | H II 3 8 | E I (1) 3 4 9 | D I 3 4 9 | D I 3 4 9 | D I 3 4 9 | | E II 3 4 | D II 2 5 | D II 2 5 | | | D II 6 | E II 2 | E V 2 | D 1 | | |
| Copper—Pure | H II V 3 | H I V 5 | E II V | E II V 3 6 | H I V 2 3 4 | H II V 3 4 | H I (1) V 3 9 | H I V 3 4 9 | H I V 3 4 9 | H I V 3 4 9 | | H II V 3 4 | D II V 5 6 | D II V 5 6 | D II V 5 6 | D II D 5 6 | D II V 6 | E II V 6 | K V V 2 | | | |
| Brass—Red 5-25% Zinc | | H I II 5 | D II V 6 | D II V 6 | H II V | H II V | H I (1) V | H I V 6 | H I V 6 | H I (1) V 6 | | H II 3 4 | D II V 6 | D II V 6 | D II V 6 | D II V | D II II | E II II 5 6 | | | | |
| Brass—Yellow 25-40% Zinc | | E I II 5 | D II IV 6 | D II II 6 | H II IV | H II IV | E I (1) IV 6 | E I IV 6 | E I IV 6 | E I (1) IV 6 | | E II 3 4 | C II IV 1 | C II IV 1 | C II IV 1 | C II IV 1 | C II II | | | | | |
| Cupro-Nickel | | D I 2 5 | C II II | C VI II | E I (1) II 2 | E II 2 8 | E I (1) II 2 | E I II 2 | E I II 2 | E I (1) II 2 | H I (1) II 7 | E II 3 | C II II 1 | C II II 1 | C II II | B II II 1 | | | | | | |
| Nickel Silver | | D I 2 5 | C II II | C VI II | E I (1) II 2 | E II 2 8 | E I (1) II 2 | E I II 2 | E I II 2 | E I (1) II 2 | H I (1) II 7 | E II 3 | C II II 1 | C II II 1 | B II II 1 | | | | | | | |
| Silicon Bronze | | D I 2 5 | C II II | D II II | E I (1) II | E II 8 | E I (1) II | E I II | E I (1) II | H I (1) II 7 | D II 3 | C II II 1 | B II II 1 | | | | | | | | | |
| Phosphor Bronze Grades A, C, & D | | E I 2 5 | D II II | D II II | E I (1) II | E II 8 | E I (1) II | E I II | E I (1) II | H I (1) II 7 | D II 3 | B II II 1 | | | | | | | | | | |
| C. R. Steel H. R. Steel—Clean | D II II 3 | | | D II II 3 | D II II 3 | B II III | B II II 8 | C II II | C I II | B I II 6 | C I II | E I (1) II 7 | A II II 1 | | | | | | | | | |
| Scaly H. R. Steel | H II (1) 3 7 | | | | | D I (1) II 7 | D II (1) 7 8 | D II (1) 7 | D II (1) 6 7 | D I (1) 6 7 | D I (1) 6 7 | D I (1) 6 7 | E I (1) 7 | | | | | | | | | |
| Tin Plate | E II I 9 | E I I 5 9 | D I I 3 9 | D II I 9 | C I (1) I | C II I 8 | D I (1) I 9 | C I I 6 9 | D I (1) I 6 9 | D I I 6 9 | | | | | | | | | | | | |
| Terne Plate | E II (1) 9 | E I I 5 9 | D I I 3 | D II I 9 | C II I | C II I 8 | C I (1) I | C I I 6 | C I I 6 | | | | | | | | | | | | | |
| Galvanized Steel Zinc Plate | E II I 9 | E I (1) 5 9 | D I (1) 3 | D II II 9 | C II I | C II I 8 9 | C I I 9 | C I (1) 9 | | | | | | | | | | | | | | |
| Cadmium Plate | E II I 9 | E I I 5 | D I I 3 | D II I 9 | C II I | C II I 8 | C I I 9 | | | | | | | | | | | | | | | |
| Chrome Plate | D I I 8 | | | D II II 8 | D II II 8 | B III (1) II 8 | B II II 8 | | | | | | | | | | | | | | | |
| Stainless Steel 18-8 Type | D I I 2 5 | | | D II II | D III (1) II | A III (1) II 1 | | | | | | | | | | | | | | | | |
| Nickel Grade A | D II II 2 5 | | | C II II 1 | B II II 1 | | | | | | | | | | | | | | | | | |
| Nickel Alloys Monel Nichrome (High Res.) | D II II 2 5 | | | B II II 1 | | | | | | | | | | | | | | | | | | |
| Magnesium Alloys | D I I 1 5 | | | | | | | | | | | | | | | | | | | | | |
| Molybdenum Tungsten | D II II 2 5 | | | | | | | | | | | | | | | | | | | | | |

**WELDABILITY**

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

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

**ELECTRODES**

I - Class 1
II - Class 2
III - Class 3
IV - Class 11
V - Class 14*
VI - Class 10

*100 W may be substituted.

OElectrode materials in circles are second choice.

**BLOCK INTERPRETATION**

| WELDABILITY | ELECTRODE AGAINST |
|---|---|
| ELECTRODE AGAINST | SPECIAL INFORMATION |

**ELECTRODES**

I - Class 1
II - Class 2
III - Class 3
IV - Class 11
V - Class 14*
VI - Class 10

*100 W may be substituted.

OElectrode materials in circles are second choice.

**SPECIAL INFORMATION**

1. Good weld strength.
2. May be welded under special conditions.
3. Low weld strength.
4. No actual weld nugget occurs, a "stick" is obtained.
5. Welding conditions must be accurately controlled.
6. Keep electrode clean to prevent sticking to the work.
7. Good practice recommends cleaning steel before welding.
8. Use one flat tip to minimize distortion or discoloration.
9. Coating may dissolve in other metals or burn away.

This Chart shows graphically the importance of Electrode maintenance. This is not only important from the quality of the weld, which is of first importance, also extra load added to the welding machine and equipment. Read the data on the chart, you can then draw your own conclusions.

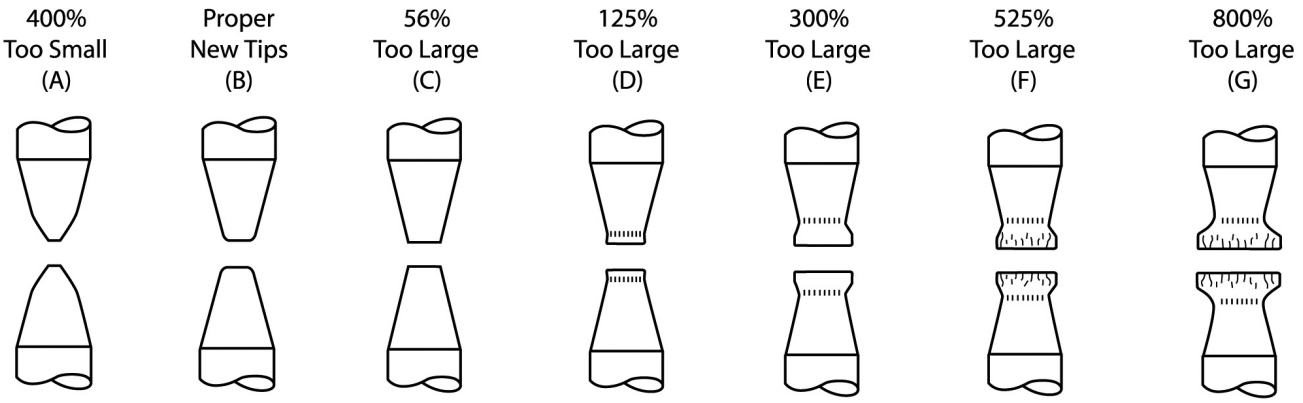
**YOU CAN'T AFFORD TO NEGLECT YOUR ELECTRODES!**

Keep your Electrodes dressed for maximum production and quality welds.

**A TIP DRESSER WILL PAY DIVIDENDS!**

We can supply you with hand operated Tip Dressers or Pneumatic Power Driven Dressers. Design or type will depend on your production requirements. Pages 45 & 50.

## RESISTANCE WELDING



| 400% Too Small (A) | Proper New Tips (B) | 56% Too Large (C) | 125% Too Large (D) | 300% Too Large (E) | 525% Too Large (F) | 800% Too Large (G) |
|---|---|---|---|---|---|---|
| Approx. .012 sq. in. at 1/8" Dia. | Approx. .049 sq. in. at 1/4" Dia. | Approx. .077 sq. in. at 5/16" Dia. | Approx. .110 sq. in. at 3/8" Dia. | Approx. .197 sq. in. at 1/2" Dia. | Approx. .307 sq. in. at 5/8" Dia. | Approx. .442 sq. in. at 3/4" Dia. |
| 2,460 amperes only would be required (†) | 9,823 amperes would be required (†) | 15,337 amperes would be required (†) | 22,100 amperes would be required (†) | 39,300 amperes would be required (†) | 61,350 amperes would be required (†) | 88,500 amperes would be required (†) |
| 127,640 lbs. sq. in. pressure (*) | 31,960 lbs. sq. in. pressure (*) | 20,470 lbs. sq. in. pressure (*) | 14,200 lbs. sq. in. pressure (*) | 7,990 lbs. sq. in. pressure (*) | 5,120 lbs. sq. in. pressure (*) | 3,500 lbs. sq. in. pressure (*) |
| **RESULT:** Four times too much pressure, current. Very severe indentation and spitting from high current density. **CORRECTION:** Cut pressure to 1/4 Cut current to 1/4 | **RESULT:** Correct pressure, current, tips. Excellent weld. This is the size tip (new) for which the pressure, time, and current are adjusted. | **RESULT:** Only 60% of proper pressure, current. Borderline weld. Lower strength. Last diameter size tolerated unless current and pressure were set between the 1/4 and 5/16 size tips. | **RESULT:** Only 45% of the required pressure and current. Welds would be unacceptable. If the current or time were increased with tips in this condition a large weak weld would result. | **RESULT:** Only 25: of required current and pressure. No weld would be made if tips were left in this condition. | **RESULT:** Only 16% of required current and pressure. This is a very serious condition and the only cure is to dress the tips back to (B) condition. | **RESULT:** Only 11% of needed current and pressure. This is an absurd (though often seen) condition that only heats a spot. |

(†) Current density required for this gage to be 200,000 amps per sq. in. Setting is 9,900 amps for condition (B)

(*) Five inch diameter air cylinder A 80 lbs. air pressure—1570 lbs. on ram.

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# SPOT WELDING DATA

## OPTIMUM CONDITIONS

## SCHEDULES FOR SPOT WELDING LOW CARBON STEEL—SAE 1010

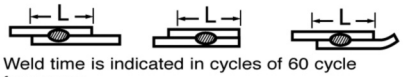
| Thickness of Thinnest Outside Piece (Inches) | Electrode Diameters and Shape* Flat Face Maximum d (Inches) | Flat Face Min. D (Inches) | Radius Face Radius R (Inches) | Recommended Minimum Standard Electrode Size | Weld Force (Lbs.) | Weld Time (Cycles) (60 Cycles per Sec.) | Hold Time (Cycles) Min. | 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.) Dw (Inches) | Minimum Weld Spacing S (Inches) | Minimum Contacting Overlap L (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 | 1-5/16 | 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 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thickness of Each of the Two Work Pieces Inches | Electrode Diam. & Shape Min. D Inches | Max. d Inches | Min. Weld Spacing (Note 4) Inches | Min. Contacting Overlap (Note 6) Inches | Weld Time (Note 7) Cycles | Electrode Force Pounds | Welding Current Amps. | Diam. of Fused Zone Inches | Average Tensile Shear Strength ±14% Pounds | Weld Time (Note 7) Cycles | Electrode Force Pounds | Welding Current Amps. | Diam. of Fused Zone Inches | Average Tensile Shear Strength ±17% Pounds | Weld Time (Note 7) Cycles | Electrode Force Pounds | Welding Current Amps. | Diam. of Fused Zone Inches | Average Tensile Shear Strength ±20% Pounds |
| .010 | 1/2 | 1/8 | 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 | 5/16 | 1-1/8 | 11/16 | 21 | 1100 | 13300 | .31 | 3225 | 36 | 650 | 10400 | .30 | 3025 | 58 | 325 | 7900 | .28 | 2900 |
| .094 | 5/8 | 5/16 | 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 | 1-5/16 | 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 |

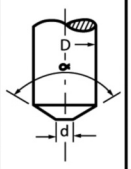
**NOTES:**

1. 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.
2. Electrode Material is RWMA Class 2.
3. Surface of steel is lightly oiled but free from grease, scale or dirt.
4. 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.
5. 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" | 5/8" | 3" |
| | .030" to .058" | 1" | 4" |
| | .059" to .115" | 1-1/2" | 5" |
| | .116" to .190" | 2" | 6" |

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

**Spot welding galvanized low-carbon steel**

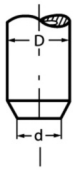
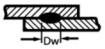
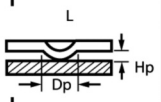
| Material Thickness notes 1, 2, & 3 | Electrode Diameter And Shape note 4 | | | Net Electrode Force | Welding Current (Approx.) | Weld Time | Weld Nugget Size | Minimum Tension-Shear Strength | Minimum Weld Spacing | Minimum Contacting Overlap |
|---|---|---|---|---|---|---|---|---|---|---|
| |   | | | | |   | | |   | |
| | D | d | Oc | | | | | | | |
| Inches | In. | In. | Deg. | Lb. | Amps. | Cycles | In. | Lb. | Inches | Inches |
| 0.022 | 5/8 | 3/16 | 120 | 300 | 13000 | 8 | 0.15 | 550 | 5/8 | 5/8 |
| 0.030 | 5/8 | 3/16 | 120 | 400 | 13000 | 10 | 0.16 | 1000 | 5/8 | 5/8 |
| 0.036 | 5/8 | 1/4 | 120 | 500 | 13500 | 12 | 0.19 | 1180 | 3/4 | 5/8 |
| 0.039 | 5/8 | 1/4 | 120 | 650 | 14000 | 13 | 0.21 | 1400 | 3/4 | 5/8 |
| 0.052 | 5/8 | 1/4 | 120 | 725 | 14500 | 18 | 0.22 | 1700 | 7/8 | 11/16 |
| 0.063 | 3/4 | 1/4 | 120 | 850 | 15500 | 22 | 0.24 | 2500 | 1-1/8 | 3/4 |
| 0.078 | 3/4 | 5/16 | 120 | 1200 | 19000 | 24 | 0.28 | 3200 | 1-1/4 | 7/8 |
| 0.093 | 3/4 | 3/8 | 120 | 1400 | 21000 | 30 | 0.34 | 4200 | 1-1/2 | 1 |
| 0.108 | 7/8 | 3/8 | 120 | 1750 | 20000 | 37 | 0.40 | 5900 | 1-3/4 | 1-1/8 |
| 0.123 | 7/8 | 3/8 | 120 | 2000 | 20000 | 42 | 0.48 | 7200 | 2 | 1-1/8 |

**NOTES:**

1. Material must be free from dirt, grease, paint etc. prior to welding, but may have light oil.
2. Two equal metal thicknesses of each gage.
3. Commercial coating weight is 1.25 oz. per square foot.
4. Electrode Material-RWMA Group A, Class 2.
5. Water Cooling: 2 gallons per minute.

Projections should be larger in diameter for galvanized than for uncoated material.

**Projection welding galvanized low-carbon steel**

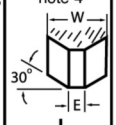
| Material Thickness notes 1, 2, & 3 | Electrode Diameter And Shape note 4 | | Net Electrode Force | Welding Current (Approx.) | Weld Time | Weld Nugget Size | Minimum Tension-Shear Strength (For Single Projections Only) | Projection Size | |
|---|---|---|---|---|---|---|---|---|---|
| |   | | | | |   | |   | |
| | D | d | | | | | | | |
| Inches | In. | In. | Lb. | Amps. | Cycles | In. | Lb. | Diameter In. | Height In. |
| 0.039 | 5/8 | 3/8 | 250 | 10000 | 15 | 0.15 | 925 | 0.187 | 0.041 |
| 0.063 | 5/8 | 7/16 | 400 | 11500 | 20 | 0.25 | 2050 | 0.218 | 0.048 |
| 0.078 | 3/4 | 1/2 | 550 | 16000 | 25 | 0.25 | 2700 | 0.250 | 0.054 |
| 0.093 | 3/4 | 1/2 | 750 | 16000 | 30 | 0.30 | 4300 | 0.250 | 0.054 |
| 0.108 | 7/8 | 1/2 | 950 | 22000 | 33 | 0.31 | 4900 | 0.250 | 0.054 |

**NOTES:**

1. Material must be free from dirt, grease, paint etc. prior to welding, but may have light oil.
2. Two equal metal thicknesses of each gage.
3. Commercial coating weight is 1.25 oz. per square foot.
4. Electrode Material-RWMA Group A, Class 2.
5. Pressure-tight joints require stripping the zinc coating prior to welding.
6. Nominal electrode diameter ranges between 8 to 10 inches.

From American Welding Society "Recommended Practices for Resistance Welding."

**Seam welding galvanized low-carbon steel**

| Material Thickness notes 1, 2, & 3 | Electrode Width And Shape note 4 | | Net Electrode Force | Welding Current (Approx.) | Weld Time | | Welding Speed | Welds Per Inch | Minimum Contacting Overlap |
|---|---|---|---|---|---|---|---|---|---|
| |   | | | | Heat Time | Cool Time | | |   |
| | W | E | | | | | | | |
| Inches | In. | In. | Lb. | Amps. | Cycles | Cycles | In./Min. | W/In. | Inches |
| 0.015 | 3/8 | 1/4 | 900 | 15000 | 2 | 2 | 120 | 7.5 | 3/8 |
| 0.036 | 1/2 | 1/4 | 1100 | 18000 | 4 | 2 | 60 | 10.0 | 1/2 |
| 0.039 | 1/2 | 1/4 | 1200 | 19000 | 4 | 3 | 60 | 9.0 | 1/2 |
| 0.052 | 1/2 | 1/4 | 1350 | 20000 | 5 | 1 | 90 | 7.0 | 9/16 |
| 0.063 | 1/2 | 5/16 | 1500 | 19800 | 8 | 2 | 54 | 7.0 | 5/8 |
| 0.078 | 5/8 | 5/16 | 1850 | 23000 | 10 | 7 | 30 | 7.0 | 11/16 |

# PROJECTION WELDING DATA

## DESIGN AND WELDING DATA FOR PROJECTION WELDING LOW CARBON STEELS

| Thickness of Thinnest Outside Piece Inches | PROJECTION DESIGN: Base Diameter of Projection Dp Inches | PROJECTION DESIGN: Height of Projection H Inches | ELECTRODE DIAMETERS (d=2 x Projection Diameter): Minimum d Inches | ELECTRODE DIAMETERS (d=2 x Projection Diameter): Minimum D Inches | 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 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 | 5/8 | 480 | 13 | 14 | 6,500 | 0.169 | 1,080 | 9/32 |
| 0.050 | 0.119 | 0.028 | 0.250 | 5/8 | 580 | 16 | 16 | 7,100 | 0.225 | 1,500 | 9/32 |
| 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 | 11/16 |
| 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:**

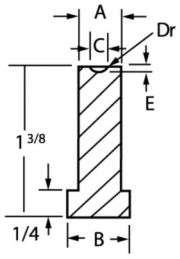
1. Type of Steel—Low Carbon SAE 1010—0.15% Carbon Maximum.
2. Material free of scale, oxide, paint, dirt, etc.
3. Size of projection determined by thickness of thinnest piece and projection should be on thickest piece.
4. Data is based on thickness of thinnest sheet for two thicknesses only. Maximum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

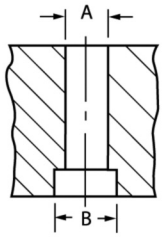
| Dimension | Thickness Up to 0.050" | Thickness Over 0.050" |
|---|---|---|
| Diameter "D" | ±0.003" | ±0.007" |
| Height "H" | ±0.002" | ±0.005" |

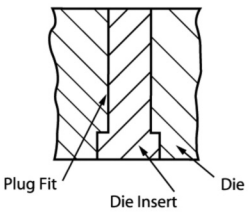
9. Electrode Material: RWMA Class 3, Class 11 - 10 W

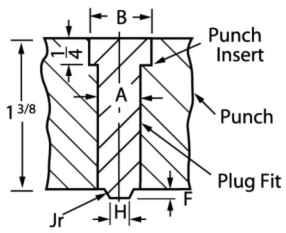
From American Welding Society "Recommended Practices for Resistance Welding"

## PUNCH AND DIE DESIGN FOR FORMING WELDING PROJECTIONS




| Mat Thickness | Pt. No. | A | B | ±.002 C | Dr | ±.001 E | ±.001 F | ±.001 H | Jr |
|---|---|---|---|---|---|---|---|---|---|
| 0.010-0.015 | 1 | 3/8 | 9/16 | .055 | .033 | .015 | .015 | .035 | .005 |
| 0.016-0.021 | 2 | 3/8 | 9/16 | .067 | .042 | .017 | .020 | .039 | .005 |
| .025 | 3 | 3/8 | 9/16 | .081 | .050 | .020 | .025 | .044 | .005 |
| .031 | 4 | 3/8 | 9/16 | .094 | .062 | .022 | .030 | .050 | .005 |
| .034 | 5 | 3/8 | 9/16 | .094 | .062 | .022 | .030 | .050 | .005 |
| .044 | 6 | 3/8 | 9/16 | .119 | .078 | .028 | .035 | .062 | .005 |
| .050 | 7 | 3/8 | 9/16 | .119 | .078 | .028 | .035 | .062 | .005 |
| .062 | 8 | 3/8 | 9/16 | .156 | .105 | .035 | .043 | .081 | .005 |
| .070 | 9 | 3/8 | 9/16 | .156 | .105 | .035 | .043 | .081 | .005 |
| .078 | 10 | 3/8 | 9/16 | .187 | .128 | .041 | .055 | .104 | .010 |

| Mat Thickness | Pt. No. | A | B | ±.002 C | Dr | ±.001 E | ±.001 F | ±.001 H | Jr |
|---|---|---|---|---|---|---|---|---|---|
| .094 | 11 | 1/2 | 11/16 | .218 | .148 | .048 | .065 | .115 | .010 |
| .109 | 12 | 1/2 | 11/16 | .250 | .172 | .054 | .075 | .137 | 1/64 |
| .125 | 13 | 1/2 | 11/16 | .281 | .193 | .060 | .085 | .154 | 1/64 |
| .140 | 14 | 1/2 | 11/16 | .312 | .217 | .066 | .096 | .172 | 1/64 |
| .156 | 15 | 5/8 | 13/16 | .343 | .243 | .072 | .107 | .191 | 1/64 |
| .171 | 16 | 5/8 | 13/16 | .375 | .265 | .078 | .118 | .210 | 1/64 |
| .187 | 17 | 5/8 | 13/16 | .406 | .285 | .085 | .130 | .229 | 1/64 |
| .203 | 18 | 11/16 | 7/8 | .437 | .308 | .091 | .143 | .240 | .020 |
| .250 | 19 | 13/16 | 1 | .531 | .375 | .110 | .175 | .285 | .025 |

Material: Tool Steel. Finish all over and harden to 65-68 Rockwell "C" scale. Note: All working surfaces of die unit must be polished.

From American Welding Society "Recommended Practices for Resistance Welding"

## 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 | WELDING CURRENT (Approx.) AMPS | | MINIMUM CONTACTING OVERLAP | MINIMUM WELD SPACING (See Note 6 Below) | DIAMETER OF FUSED ZONE | MINIMUM SHEAR STRENGTH LB. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Ultimate Tensile Strength of Metal | | |
| | D, IN., Min. | d, IN., Max. | | CYCLES (60 Per Sec.) | Tensile Strength Below 150000 Psi | Tensile Strength 150000 Psi and Higher | | ℄ to ℄ | | 70000 Up to 90000 Psi | 90000 Up to 150000 Psi | 150000 Psi and Higher |
| INCHES | | | LB. | | | | IN. | IN. | IN. Approx. | | | |
| 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 | 5/16 | 0.088 | 280 | 300 | 380 |
| 0.018 | 1/4 | 1/8 | 380 | 4 | 3500 | 2800 | 1/4 | 5/16 | 0.093 | 320 | 360 | 470 |
| 0.021 | 1/4 | 5/32 | 400 | 4 | 4000 | 3200 | 5/16 | 5/16 | 0.100 | 370 | 470 | 500 |
| 0.025 | 3/8 | 5/32 | 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 | 9/16 | 0.150 | 800 | 920 | 1100 |
| 0.040 | 3/8 | 3/16 | 900 | 6 | 7800 | 6300 | 7/16 | 5/8 | 0.160 | 1000 | 1270 | 1400 |
| 0.044 | 3/8 | 3/16 | 1000 | 8 | 8700 | 7000 | 7/16 | 11/16 | 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 | 9/16 | 7/8 | 0.210 | 1700 | 2000 | 2450 |
| 0.062 | 1/2 | 1/4 | 1500 | 10 | 11000 | 9000 | 5/8 | 1 | 0.220 | 1950 | 2400 | 2900 |
| 0.070 | 5/8 | 1/4 | 1700 | 12 | 12300 | 10000 | 5/8 | 1-1/8 | 0.250 | 2400 | 2800 | 3550 |
| 0.078 | 5/8 | 5/16 | 1900 | 14 | 14000 | 11000 | 11/16 | 1-1/4 | 0.275 | 2700 | 3400 | 4000 |
| 0.094 | 5/8 | 5/16 | 2400 | 16 | 15700 | 12700 | 3/4 | 1-1/2 | 0.290 | 3550 | 4200 | 5300 |
| 0.109 | 3/4 | 3/8 | 2800 | 18 | 17700 | 14000 | 13/16 | 1-1/2 | 0.290 | 4200 | 5000 | 6400 |
| 0.125 | 3/4 | 3/8 | 3300 | 20 | 18000 | 15500 | 7/8 | 2 | 0.300 | 5000 | 6000 | 7600 |

**NOTES:**

1. Types of Steel—301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347 & 349
2. Material should be free from scale, oxides, paint, grease and oil.
3. Welding conditions determined by thickness of thinnest outside piece "T."
4. Data for total thickness of pile-up not exceeding 4 "T". Maximum ratio between two thicknesses 3 to 1.
5. Electrode material, RWMA Class 2, Class 3, or Class 11.
6. 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.

## SCHEDULE FOR SEAM WELDING STAINLESS STEEL

| THICKNESS "T" OF THINNEST OUTSIDE PIECE (See Notes 1, 2, 3 and 4 Below) | ELECTRODE WIDTH AND SHAPE (See Note 5 Below) | ELECTRODE FORCE | ON TIME CYCLES (60 Per Sec.) | OFF TIME FOR MAXIMUM SPEED (Pressure-Tight) CYCLES | | MAXIMUM WELD SPEED IN. PER MINUTE | | WELDS PER INCH | | WELDING CURRENT (Approx.) | MINIMUM CONTACTING OVERLAP (See Note 6 Below) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 "T" | 4 "T" | 2 "T" | 4 "T" | 2 "T" | 4 "T" | | |
| INCHES | W, IN., Min. | LB. | | | | | | | | AMPS. | IN. |
| 0.006 | 3/16 | 300 | 2 | 1 | 1 | 60 | 67 | 20 | 18 | 4000 | 1/4 |
| 0.008 | 3/16 | 350 | 2 | 2 | 2 | 67 | 56 | 18 | 16 | 4600 | 1/4 |
| 0.010 | 3/16 | 400 | 3 | 2 | 2 | 45 | 51 | 16 | 14 | 5000 | 1/4 |
| 0.012 | 1/4 | 450 | 3 | 2 | 2 | 48 | 55 | 15 | 13 | 5600 | 5/16 |
| 0.014 | 1/4 | 500 | 3 | 2 | 3 | 51 | 46 | 14 | 13 | 6200 | 5/16 |
| 0.016 | 1/4 | 600 | 3 | 2 | 3 | 51 | 50 | 14 | 12 | 6700 | 5/16 |
| 0.018 | 1/4 | 650 | 3 | 2 | 3 | 55 | 50 | 13 | 12 | 7300 | 5/16 |
| 0.021 | 1/4 | 700 | 3 | 2 | 3 | 55 | 55 | 13 | 11 | 7900 | 3/8 |
| 0.025 | 3/8 | 850 | 3 | 3 | 4 | 50 | 47 | 12 | 11 | 9200 | 7/16 |
| 0.031 | 3/8 | 1000 | 3 | 3 | 4 | 50 | 47 | 12 | 11 | 10600 | 7/16 |
| 0.040 | 3/8 | 1300 | 3 | 4 | 5 | 47 | 45 | 11 | 10 | 13000 | 1/2 |
| 0.050 | 1/2 | 1600 | 4 | 4 | 5 | 45 | 44 | 10 | 9 | 14200 | 5/8 |
| 0.062 | 1/2 | 1850 | 4 | 5 | 7 | 40 | 41 | 10 | 8 | 15100 | 5/8 |
| 0.070 | 5/8 | 2150 | 4 | 5 | 7 | 44 | 41 | 9 | 8 | 15900 | 11/16 |
| 0.078 | 5/8 | 2300 | 4 | 6 | 7 | 40 | 41 | 9 | 8 | 16500 | 11/16 |
| 0.094 | 5/8 | 2550 | 5 | 6 | 7 | 36 | 38 | 9 | 8 | 16600 | 3/4 |
| 0.109 | 3/4 | 2950 | 5 | 7 | 9 | 38 | 37 | 8 | 7 | 16800 | 13/16 |
| 0.125 | 3/4 | 3300 | 6 | 6 | 8 | 38 | 37 | 8 | 7 | 17000 | 7/8 |

**NOTES:**

1. Types of Steel—301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347 & 349.
2. Material should be free from scale, oxides, paint, grease and oil.
3. Welding conditions determined by thickness of thinnest outside piece "T."
4. Data for total thickness of pile-up not exceeding 4 "T" . Maximum ratio between two thicknesses 3 to 1.
5. Electrode material, RWMA Class 3.
6. For large assemblies minimum contacting overlap indicated should be increased 30 per cent.

From American Welding Society "Recommended Practices for Resistance Welding"

Many factors affecting electrode cost and useful electrode life are briefly outlined below.

## PART TO BE WELDED

Lay out the part for resistance welding. Designing engineer, welding engineer and production man in charge of welding should cooperate in securing a better product at lowest cost.

Correct design permits the use of standard straight electrodes: or standard offset or standard angular holders if the straight approach is not possible. Special shaped electrodes cost more, and the difficulty of cooling the electrode is amplified. Single spot, multiple spot, projection, or other method may be accurately chosen to achieve lowest cost. Consult the R.W.M.A Manual.* PN: RWMA-BOOK

## MATERIAL TO BE WELDED

The weldability of the materials can be determined by consulting your material supplier, and by reviewing recommendations covered in the R.W.M.A Manual.*

Surface conditions, rust, oil, dirt, and, on many articles, oxide film and even handling marks have a decided effect on weld quality. Cleaning may have to be a part of the welding job in some cases.

## WELDING EQUIPMENT AND CONTROL

A welding machine of reputable quality purchased for a particular application will be correctly designed both electrically and mechanically, and will be supplied the correct control equipment and electrodes for the work.

On machine change-overs make sure of adequate electrical and mechanical capacity, and see that the necessary controls are provided. Consult us when redesigning or revising your choice of electrodes.

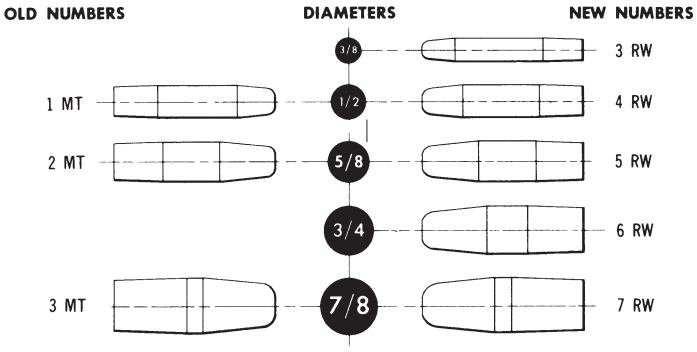
## STANDARD GAGE CHART

**Thickness in Decimals of an Inch**

| Gage No. | Manufacturer's Standard | Gage No. | Manufacturer's Standard | Gage No. | Manufacturer's Standard |
|---|---|---|---|---|---|
| 3 | 0.2391 | 12 | 0.1046 | 22 | 0.0299 |
| 4 | 0.2242 | 13 | 0.0897 | 23 | 0.0269 |
| 5 | 0.2092 | 14 | 0.0747 | 24 | 0.0239 |
| 6 | 0.1943 | 15 | 0.0673 | 25 | 0.0209 |
| 7 | 0.1793 | 16 | 0.0598 | 26 | 0.0179 |
| 8 | 0.1644 | 17 | 0,0538 | 27 | 0.0164 |
| 9 | 0.1495 | 18 | 0.0478 | 28 | 0.0149 |
| 10 | 0.1345 | 19 | 0.0418 | 29 | 0.0135 |
| 11 | 0.1196 | 20 | 0.0359 | 30 | 0.0120 |
| | | 21 | 0.0329 | | |

** Resistance Welding Manual, published by the Resistance Welder Manufacturers Association. PN: RWMA-BOOK*

The RWMA tip numbering system has generally replaced the old Morse taper numbers with new "RW" numbers, and has added two new sizes, as the chart illustrates.




## ELECTRODE LIFE SAVERS

1. Use standard Tuffaloy electrodes with Tuffaloy ejector type, self-adjusting tube, water-cooled electrode holders wherever possible. Avoid special or irregular shapes for lowest cost.
2. Use ample cold cooling water as close as practical to the welding contact surface, properly circulated at a minimum of 30-psi pressure, and supplied at a rate of at least 1-1/2 gallons per minute.
3. Be sure to select the proper type and size of electrode, taking into consideration electrode pressure, contact area of electrode, gauge, and nature of material to be welded. Consult the RWMA Manual* or your Tuffaloy field engineer regarding recommended practices. Overloading as well as overheating shortens electrode life.
4. Good welds depend upon properly maintained electrodes which assure an accurate surface contact. Keep tapers clean and dress electrode faces with lathe, emery paddle or fine file. Use castor oil or graphite grease to facilitate tip removal, and avoid application of insulators such as teflon tape and other materials.

## RESISTANCE WELDING MACHINE SETUP

**TO DETERMINE SPOT WELDING SCHEDULE**

*CURRENT = 2T x 100,000 = AMPERES*

*TIME = 2T x 100 = CYCLES*

*PRESSURE = 2T x 6000 (LB) = FORCE REQUIRED (LB)*

*T = THICKNESS OF THE THINNEST PIECE*

**APPROXIMATE PRESSURE EXERTED BY AIR CYLINDER SIZE**

| DIAMETER | | CYLINDER AREA SQ. INCHES | | | | |
|---|---|---|---|---|---|---|
| 4" | = | 12.5 | x | WELDER GUAGE PRESSURE | = | ELECTRODE FORCE PRESSURE |
| 5" | = | 19.5 | x | | = | |
| 6" | = | 28.0 | x | | = | |
| 8" | = | 50.0 | x | | = | |

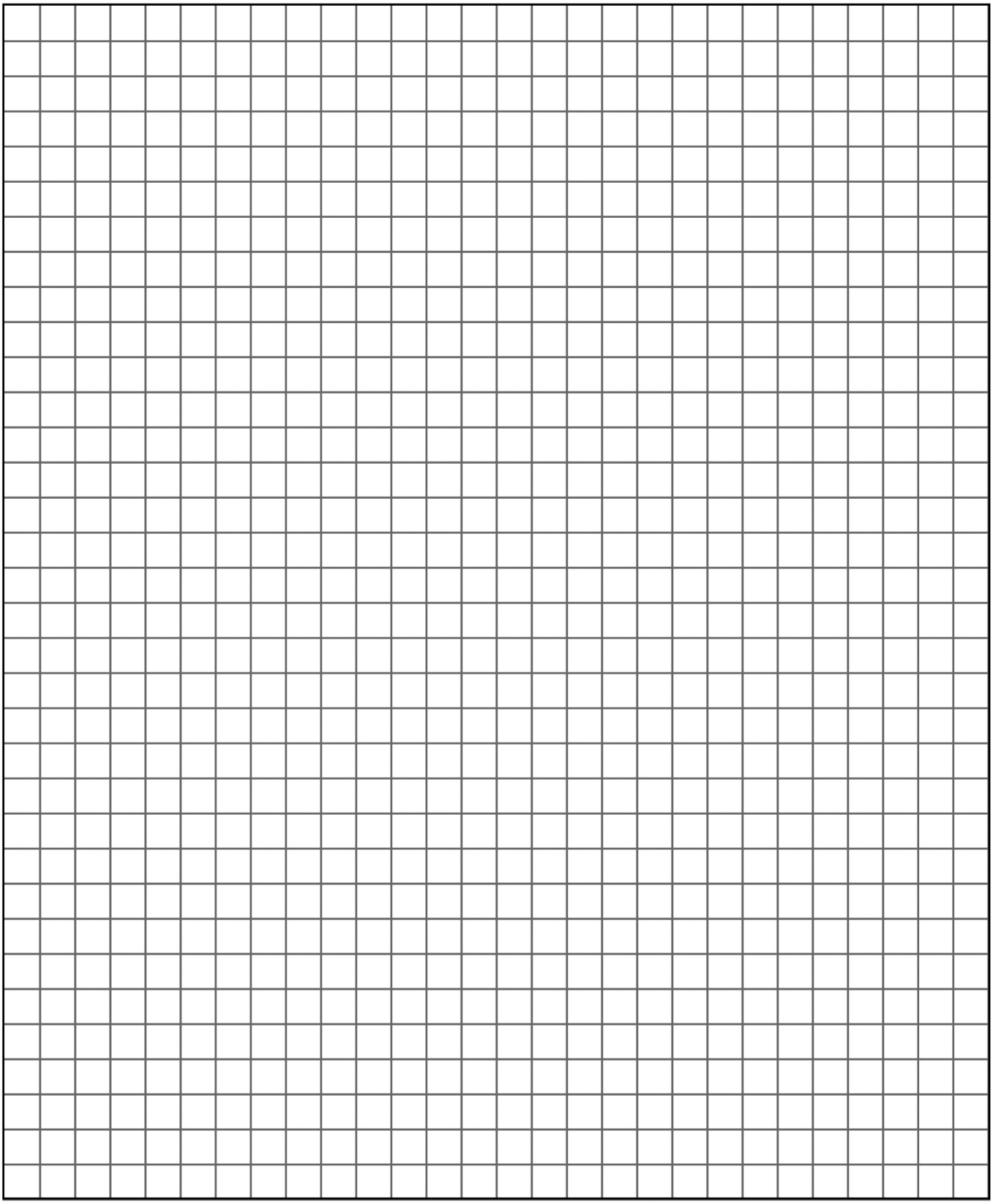
# RESISTANCE WELDING

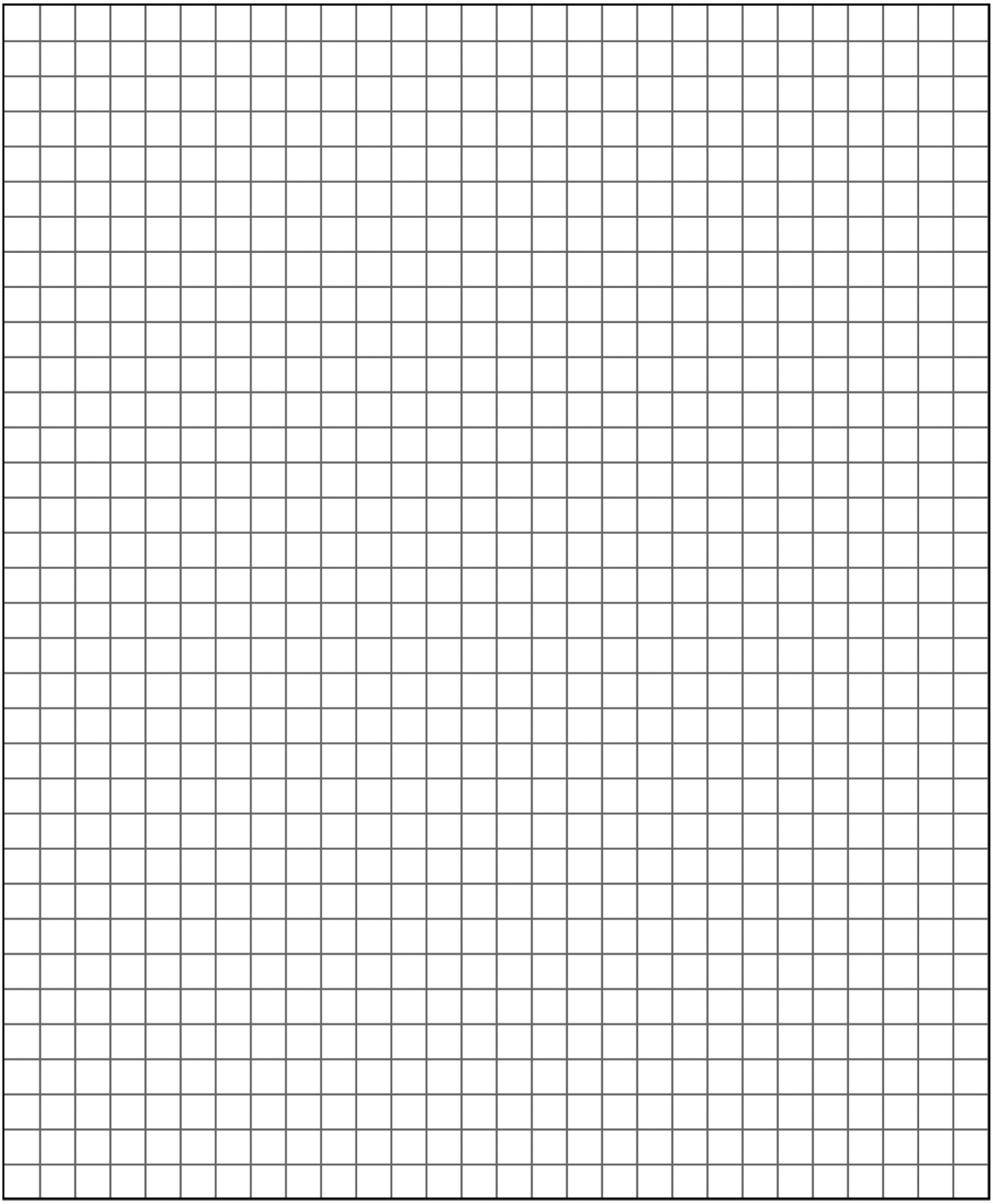
## DO'S

- Use the RWMA recommended electrode material for the job you are running.
- Use RWMA standard electrodes whenever possible.
- Use the appropriate electrode diameter for the material being welded.
- Use open sight drains or have water flow gauges on out bound side to easily confirm water flow.
- Connect the water inlet hose to the proper holder inlet to insure water flows through the center cooling tube first.
- Recommended water flow for the electrodes is 1.5 gallons per minute of cold water.
- Insure that the water tube extends within 0.25" of the bottom of the electrode water hole.
- Adjust the water tube position when changing to another length electrode.
- Check water tube ends to insure they are not damaged and have an angled cut at the end to prevent water restriction.
- Use ejector type holders to simplify electrode removal.
- Keep the electrode and holder tapers clean to ensure good leak free conduction.
- Dress electrodes frequently to insure good quality welds.
- Dress electrodes in a lathe to their original contour whenever possible.
- Use raw-hide or hard rubber hammers for alignment of electrodes.
- Provide cooling water on the exit side top and bottom of seam welding applications.
- Use properly designed knurling wheels to insure continuous dressing of the seam welding wheel.
- Lock out the machine when performing any type of maintenance.

## DON'TS

- Never use unidentified electrodes or materials.
- Avoid special, offset, or irregular electrodes when the job can be done with standard electrodes.
- Do not use small electrodes on heavy gauge welding jobs or large electrodes on small gauge materials.
- Do not forget to turn the water on full force before starting to weld.
- Never use water hoses that do not fit the water fitting properly.
- Do not allow water connections to become leaky, clogged or broken.
- Avoid holders with leaking or deformed tapers.
- Never use holders that do not have adjustable water deflector tubes.
- Never use pipe tape or similar product to stop a leak.
- Do not let your electrode mushroom excessively.
- Do not dress electrodes with a file.
- Do not use a steel hammer to adjust any part of a welding machine.
- Avoid the use of seam welder wheels too thin to stand the heat or pressure of your job.
- Do not permit seam welding wheels to run off the edge of the work piece.
- Do not enter a work cell or reach into a welder without using your lockout.





# QUOTE REQUEST SPECIALS AND CUSTOMS

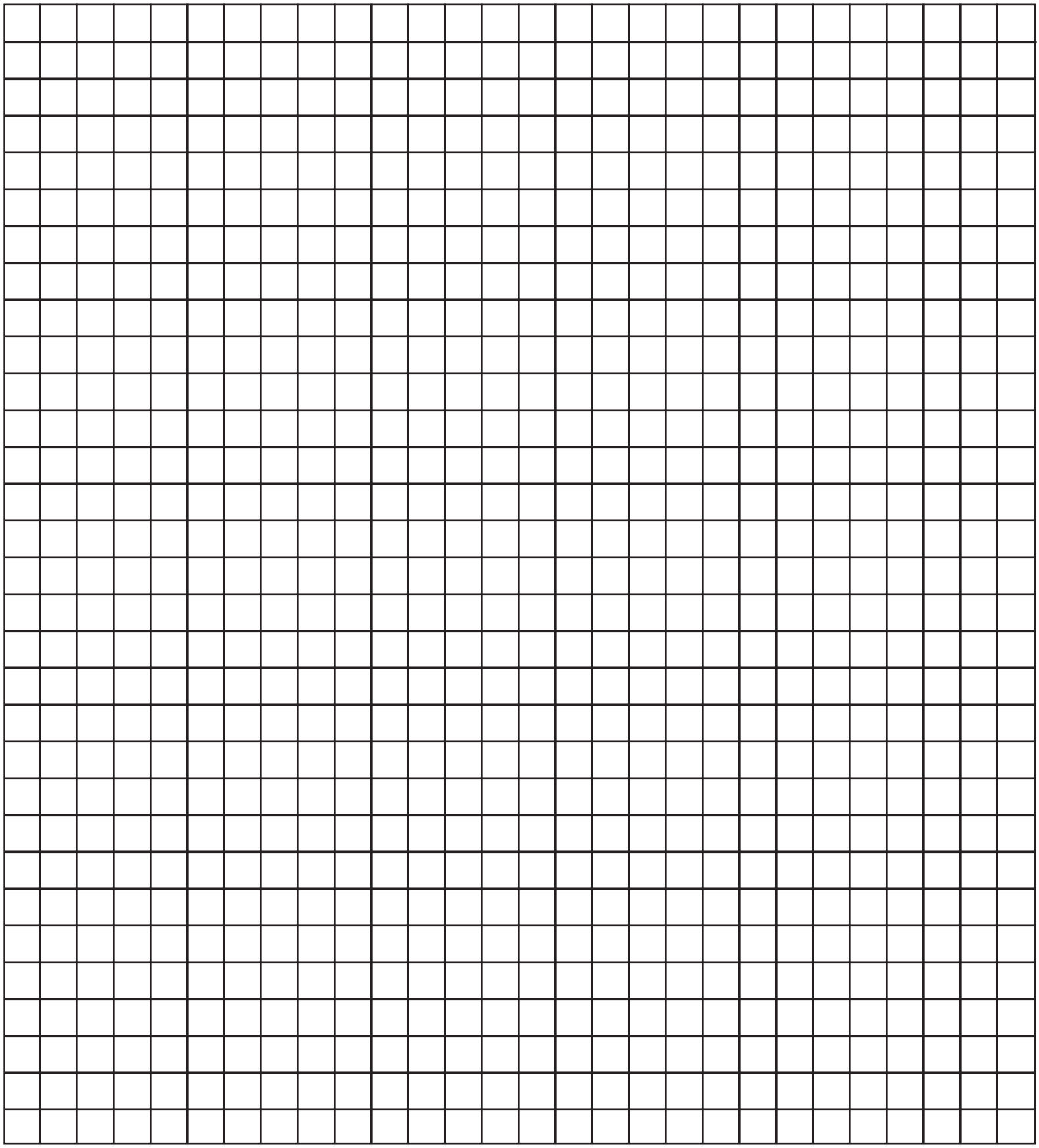
Contact Name: _____ Company: _____

Address: _____

Phone: _____ Fax: _____ Email: _____

Part Information: _____ Material/Alloy: _____

Part Number or Description: _____



Please send a photo of part laying on the grid area of this completed page to – customerservice@tuffaloy.com




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