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Modern welding 11th edition textbook pdf free print

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## **Jim Davies**

Specification and Proof in Real-Time CSP

DISTINGUISHED DISSERTATIONS IN COMPUTER SCIENCE



Edgar E. Enocks, Overtown M. G. Jenda RELATIVE HOMOLOGICAL ALGEBRA VOLME 2

EXPOSITIONS IN MATHEMATICS 54



## Modern welding pdf.

Tee Torch Co. Teledyne Precision-Cincinnati Teledyne Readco TEMPIL Therrnadyne Industries, Inc. Explosive Fabricators, Inc. AWS designations for solid electrode ER 70 S- X ELECTRODE ORROD------- -J MINIMUM TENSILE STRENGTH IN KSI--------- -J CHEMICAL.COMPOSITIONANDSHIEL.DINQ-------- 'TABLE6-4 A SUMMARY OF CARBON STEEL ELECTRODES FOR CARBON STEEL Werding Conditions Strength Requirements (as Weld~d) At! Tensile (min, psi). The unmelted portion of the flux can be reused. The electrode is fed into the arc automatically from b coil, The arc is maintained automatically and travel can sta manUal or by machine. The arc is initiated by a fuse-type art or by a reversing feed system. of joint required 2. The surface of the base metal to b welded, whether it is s aly; ru ty, or such, hHS equipment Required 1'h equipment Required 2. The surface of the base metal to b welded, whether it is s aly; ru ty, or such, hHS equipment Required 1'h frs mrautomatt welding or thw Iding torch or automatic welding, (] the gas and water control system for the shl Idlng gas and ooling water wh n 1.1 ed, and (5)' U'. I¥ 1 mechanism and guidance for au tomati Th pow r SOUI; I e 'an b a r tifl r, an inverter, or, for field use, a g n rater w ldlng machine. B tterman Stud \'VI Iding Boeing Aircraft Boeing Petroleum SeM1cesCo., mm In. mm 1/8 3.2 1/8 3.2 1/8 3.2 1/4 6.4 1/4 Amps DC Material Thickness T in. For length of lap greater than ,r to. My thanks to the society. (1el ctrOd bl1faba k orlkcomact Up () stubping thwork. mm Type of Joint 1/8 3.2 square 1 1/32 O.B 3/32 2.4 24 26 325 56 114 6.4 1/4 6.4 1 1/8 3.2 25 27 450-500 26-30 114 6.4 60' vee 1 0 0 3/32 2.4 25-27 375 41 3/8 9.5 3/8 9.5 1 3/32 2.4 26-30 375-500 13 17 1/2 1.27 60 < vee 1 0 0 IIB 3.2 27-30 550 14 3/8 9.5 1 1/8 3.2 28-31 500-575 16-20 3 0 0 IIB 3.2 27-30 550 IB 5/8 15.9 3/32 2.4 26-31 460-475 12 14 11 5/B 15.9 5/8 15.9 Howard Cary wa that kind of man. High utilization - . - '0:002-0.005 0.000-0.002 0.051-0.203 0.203-0,254 0.025-0.127 0.000-0.051 ...Q.127 0.000-0.051 0.051,...Q.127 0.0 br~zil1gfluxes Gas·atmo~n;)here brazing fluxes Minerai braliog fluxes Gas~atmosphere brazing fluxes Mineral brazing fluxes. Because of this, the groove angles can be reduced (Figure 6-38). The clearance between the parts being joined is unportant. Helzer, Scott C. Welding education and training are changing. The weld is submerged under this layer of flux and slag-hence the name submerged arc Welding. 02 01254' O.051..{).127 . Every effort should be made to provide a balanced lap Joint to properly carry the load. Cary Scott C. This broad range of curt nt and voltage encompass s all the variations. at erpillar In . Allow ttl re time [1 r h attng. (6.4 mm). robotic ~ di g is 'U e J,l\.t!ses f uJ!rCllt to Pt;9~U' Sl11:Alt(h"P 11m'; Utl11; ;:r~n;1:l'L.~~ ~ This variation depends on specially designed power sources. Pearson Education, Inc. U.S. Navy Vacuum/Atmospheres Co. Victor quiprnent Co. Magnate h, The DSD Co. Magnetrode COl1"). Maintenance Engineering Corp. Increase the amount of flux used. Roughen the surface slightly, esp cially the surface of cold-drawn or cold-rolled stock. F. ij(ltl~ tt:~· b .,., Pl:tc'm nl of thet11:laffect d JOin1..1)tUte flult 1 the con ain. iii.. The flux and slag normally cover the arc so that it is not Visible. Pearson Education Japan Pearson Education Australia Pty. The major advantages of gas metal arc welding are: • High deposition rates • High deposi and broad application ability Methods of Application and Position Capabilities The most popular method of applying is the semiautomatic m thod, where the welder provides manual travel and guidance of a w lding gun. Thr e major industriesusting brazing are the electricalindustry. The brazing filler metal also has an influence on the clearance. The metal transfer mode is less important in submerged arc welding. The tip-to-work distance affects deposition rates, and as the distance is increased, the preheating of the electrode wire contributes to higher deposition rates. i. mm Volts EP 1 3/32 2.4 24-26 300-350 44-69 6.4 1 3/32 2.4 24-26 350-400 22-24 in. Oa tn argon when welding mJld titeeJ.It IS ;f\0J11 tend d Or 11igh-quallty pt,(~ i i n d.ding for s 'miau~, \1 ellat ' nppU ~ltion r 1tle 'h. Frommelt Safety Products Sellstrom Manufacturing Co. Servo Robot Smith &Associates Smith Welding Equipment, Division of Tescom Corporation Stillwater Technologies Stress Relief Engineering Company Superior Flux Co. General Electric Gulleo International Heckendorn, Larry Henning Hansen Inc. TABLE6-13 WELDING CURRENT RANGE FORFLUX-CORED ELECTRODES Welding Range For E70T-1 with CO2 Shielding (DCEP) Minimum Diameter Maximum Wire Feed Speed in. Thermosolda 3M Company-Industrial Specialities Division Thompson Friction Welding Ltd. This specification must be read carefully. 5. cm. I also want to thank the reviewers of this edition for their helpful comments and suggestions: William L. ~ au(~WSWelding () thJn mat rials in all positi< ns. Wire brushing can result in the folding in of oxides and burnishing of the surface. Do a more th0~ ugh clearutlJ.J-job before as- to 4. ESABAutomation, Inc. 41 Zn, 670-1750 910 964 1670-,1750 ' 910...964 AI Zn, 1 Mn, 9 AI 99Cu ," 58 CUt Sn \$9.~ Znl 1 So. 1, Fe, 0.5 Mf1, TABLE 7-4 FILLER METALS FOR BRAZING (CONTINUED) Brazing Temperature Range, AWS Classification Approximate Composition (%) Copper, Copper-zinc, and copper-phosphorus alloys, (continued) R8Culn-D 8CuP-1 8CuP-2 8CuP-3 BCuP-4 8CuP-5 BCuP-6 BCuP-7 48 Cu, 95 Cu, 93 Cu, 89 Cu, 87 Cu, 80 Cu, 91 Cu, 88 Cu, 1720-1800 1450-1700 1350-1550 1325-1500 1350-1850-2000 1950-2200 2100-2200 2100-2200 2100-2200 2100-2250 1066-1204 1077-1204 1010~1177 1010-1177 BNi-9 BNi-iO BNi-11 BCe-1 73.5 Ni, 14 Cr, 3 8,4.5 Si, 5 Fe, 73 Ni, 14 Cr, 3 8,5 Si, 5 Fe, 73 Ni, 14 Cr, 3 8,5 Si, 5 Fe 81.5 Ni, 7 Cr, 3 B, 5 Si, 3 Fe 92 Ni, 3 B, 4.5 Si, 0.5 Fe 92.5 Ni, 2 B, 4 Si, 1.5 Fe 72 Ni, 18 Cr, 10 P 69.5 Ni, 7 Si, 18 Mn, 5.5 Cu 80 Ni, 15 Cr, 3.5 B, 1.5 Fe 63 Ni, 12 Cr, 2.5 B, 3.5 Si, 3 Fe, 16 W 68.5 Ni, 10 Cr, 3 S, 3 Si, 3.5 Fe, 12 W 16 Ni, 19 Cr, 1 Fe, 4 W, 60 Co --TABLE 7-5 ----AWS ~ ~. Berner, Susan Bethl hem Steel ...orp. 611" Ill1gle vee FIGURE 6...50 Welding procedure schedule joint Ibt details. Process diagram for submerged arc welding (SAW). It produces a smooth weld and minimum spatter and has become very popular. That Is the purpose of this book. For certain work the brazer, or one who performs a manual or semiautomatic brazing operation, must be qualified. Mr. Andrew Cullison, the Welding Journal editor, and Mr.Chris Pollock, Director of Education, have been most gracious with granting access to graphics. 50 in.lmin Diameter: 0.030, 0.035,0.045 f4,1f 0.045, \*, \* Uses larger electrode FIGURE6-41 Deposition rates for steady current with different electrode sizes. Needham of Great Britain de:tl'Inined that a high short peak or pulse of current with different electrode sizes. Needham of Great Britain de:tl'Inined that a high short peak or pulse of current with different electrode sizes. metal. If the joint clearance is too small, it will not allow capillary action to cause the filler metal to flow uniformlf throughout the entire joint. he gas metal arc welding process is an all-position pr cess. H w ver, ea h of the variations has its own poillonapabilitf s, d pending on electrod size and metal transfer. Th CO2 welding vartanon, employing large electr d wires. is us d primarily in the flat and honzonral fil 1 t p s tton. The ~pray arc ananon i normally used in the flu~and lrorizontat po. The possibility of gas entrapment. Limited Pearson Education North Asia Ltd. I. t weldment, which is the goal for weldment ff bricators. When larger-diameter electrodes are used with CO2 shielded gas, aircooled guns are also used, since CO2 is a cooling medium for the gun. Second is the fully automatic meth d, where the welding operation is automated. Tht proce s cannot be applied manually. They were his processes and his improvements and his inventions. psi) Percent Metal Elongation 2 ln.) Impact Test 60,000 22 20 at ~20°F 20 at ~2 them. Standard welding procedures have been issued that show the preferred way to make a particular weld. oastal AD and Blueprin In . Reducing groove angles will still allow the electrode to be directed to the root of the weld joint so that complete penetration will occur. C.P ck and . The transition current for spray transfer is relatively high, which cre.'ltes a large molten metal weld pool and deep penetration. Th backgr u.nd :urrent i' \If lctem t m;~ntaln the arc. -. Q Not required TABLE 6-6 VARIATIONS OFTHEGMAW PROCESS Metal Transfer Globular Short~Circuiting Spray Pul~ed~Sptay . Advantages and Major Uses The SUbnlerged arc welding pro ess is one of the older auom. 'II:uly~the illdtlstt~t1s moving rapidly, an I th ', Iding pl'oce '5 1s hnpr()veg and 111 re plodu tly, by r This edition marks the passing of one of welding industry's great talents, Howard Cary. Dil'c 't~ urrent 1 trode u gati eD, "Nstnlight polarity) an be;:t1 dwith spe~'af missi' 'Oat a 'tectrnde wires which provid' f()! better I Ct ron 'missions. I Simply said that we were getting by, and economic times were tough for the welding industry, and Idid not feel comfortable asking for equipment during these times. '11" ffect • Spec {ftcattons 01' OII th ele trod wire service conditions. '. g • nlace. If you listened carefully as Howard spoke, he spoke of many processes and technologies in the first person. Som~thn s all "" pul ed undt», The urrent le 1 ~h, r Ill, inlng time is til b~\ckgrOlU: 4 currellt I/]), n Wn S low.le1. Clearances range from 0.001 to 0.025 in. In such cases preplaced paste flux may also be required. Through standardizing the qualification and c rtificatton of personnel, public confiden e in welding will increase. AWS has become the weldingauthority in the United Stat s and is provtding ways to ducate welding inspectors, teachers, technictans.and englneers. Thts is done through Increa ed training, testing, and cernncauon of knowldge, based On proficiency testing. ~O~----------~ Q: ;t !l ex: Ie ~ ~ '0 I!: « Cl:l I Ii. y.. Alternating urr nt has not been succe sfully \), d. . Is tl,'d for sur. u: :::J f d '1 tro te w'{' Is more p nsi . it Heat a higher temperature, Iii, t rmine the clearance in th Joint and, if required, rework it 0 be looser or tigh cr. The placement f the flux when us d 6. M "Creery Corp. Torsteknik Trinity Marine Group.Trinity Industries Inc. AW\pti. However, for special variations of the pulsed-spray mode, controllable wire feeders are matched to specially designed power sources. This publication is protected by Copyright and permission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. As part of the group known as the greatest generation, he contributed much to the welding industry. A more thorough understanding Is needed. E70S-2 DeEP CO2 [70S·3 E70S-4 . ISBN u- 13-113029-3 1. Welding has always played an important role in my Ufe: from the first ar. Courtesy of Welding Inspection Technology, American Welding Society. Reposition the assembly so that gravity will help the filler metal flow into the joint. TS227 . Some welding processes have become more popular and others more refined. Above all, make sure that the filler metal alloy is compatible with the base metal and that the proper temperatures and fluxes are employed The recommended shielding gases for different metals and process variations are covered in the chapter for the particular metal being welded. 0.000-:0,051 ~ .. ttion. mm 0 Welding gases for different metals and process variation, air-cooled welding gases for different metals and process variations. to 11:. The brazing ruler metal does not wet the surface and balls up instead of flowing into the joint, i. Provide a reservoir in the joint into which the brazed filler metal can flow. V\letdabf. Lin .oln Electric Co. L-Tcc Lumonics National Processing Corp. lower arbon and lower impurity elements are available with high strengths based on the part! war heat treatment; New st cis for hightemp rature applications have been d veloped, New gmd S 0 stainless St el that ombat ortosion are app arillS. Alloy Steel Filter Metals for Gas Shielded Arc Welding., (15) More information for selecting the proper electrode to match a particular base metal is covered in detail in the chapter on the specific base metal. Steels With. This is the highest priority because of improved materials and fabricating m thods. If the clearance is too great, filler metal may now flow throughout the joint, and a low strength joint will result. Another factor is the length or area of the joint, For smaller areas, a smaller joint clearance can be used. Pitt-Des Moines Steel Co. Pow Con Inc. We must be able to select the proper application of welding to increase productivity, the utensil-manufacturing industry, and the maintenance and r-epair industry, and the maintenance and r-epair industry, and the maintenance and r-epair industry. arc wIding pro 'ess uses dir t Cllr~ rer t. Chemical cleaning can be used to remOve dirt and oils. rCnt at ~I programmed frequency. (6.4 rnrn). All rights reserved. Pearson Educacidn de Mexico, S.A. de C.V. Pearson Educacidn de Mexico, S.A. those employed for shielded metal arc welding. mm of JOint 9,6 60' Num~ of Weld 13 down 1.4 UP 2.3 up 1.6 up 11 down 1 2 3 4 5 3/8 T ravel speed pass RQOI Opening IPM pass 1 Electrode Oi,metllr in. ' 2. The recommended clearances of different groups of brazing filler metals are shown in Table 7-6. C37 2005 671.5'2—dc22 2004017082 Executive Editor: Ed Francis Project Coordinator: Carlisle Publishers Services Production Manager: Deidra Schwartz Marketing Manager: Bryan Iluber Cover Image: Corbis Production Manager: Deidra Schwartz Marketing Marketin Ltd., and printed and bound by Courier Kendallville, Inc. Mineral br'1zlng fluxes G nerat applications flux or atmosphere Free-flowing typefi, tmosphere razing. For welding power sources have continued to get smaller, more efficient, lighter, and more controllable. Nonmetallic materials are advancing. The brazing filler metal melts but does not flow. mm EP OC 3 0 0 .045 1.1 22 II, JP S 3132 2.4 ,045 1.1 22 ISI > \$il1gl1 "fill 1 2504 50" 'inqh' VH : I ~O.,. p. Spe fflca-. 11. Printed in lhe United States of America. The need to improve weld quality and reduce welding costs continues to drive the welding industry. Mor pow rftd computer ontrols and more rugged senors c re being II d. He responded by asking, "If you could have more modern technology, what would you like to implement in your program?" Three months later a semi pulled up at the university and unloaded my complete reques t, plus more. Placement of the university and unloaded my complete reques t, plus more. the filler metal 5. E70S·5 [705·6 \_f!70\$~7, E70S·~ DCEP CO2 DCEP CO2 DCEP CO2 DCEP DeEP 72,000 72,00 Welding COntinues to be the preferred method of joining metal parts. p14t fabei anon work: J111i iilcltld s th. 'welding of a~~t t~mt shal e ant'! tl I ng; itlldinal Seam of larger 41" all cr, pipe, t'I mam.lfactLl~ of machJn compon nts foi' tl~'YP of heavy inuustry,. PQwer-, o:urlZ.e slp ~e it provides:'l troIs must be used. It provides a controlled weld pool for welding thin materials in any position. It introduces new uses for positions in flat flow, vertical down flow, vertical up flow, horizontal flow, and special positions. The American Welding Society continues to make welding-related occupations more professional. The deposition rates of gas metal arc welding are higher for the same welding currents than are obtained with shielded metal arc welding. r of tb> qualitY of th mOStCOll111')Otl form and is . One day Howard noted that my university welding equipment, and he then chastised me for not letting someone know the needs I had. thine,'s, It is . The welding current Va.riesfr m a low as 20A at a voltage of 18V to as high as 750 A at an arc voltage of 50 V. industrY r. TIle composition and mechanical properties of the base metal are of prtmary importance. if smaller lecrrodes are ernplyyed. The bok in tudes information from many AWS standards and .odes. The list is long and I hope that I have not missed anyone. Disadvantages and Uses The one disadvantages and Uses The one disadvantage to brazing fill r material. ', 11i@", (- Brazill'SConditions For length of lap less than tin. tioru may dictate the lectrode to be used. Electrodes and Shielding Gas FIGURE6-39 Circuit diagram for GMAW. e control is rapidly becoming more widely used. Concepts, Inc, Batelle Columbus I..aboratories Berkeley Davis, Inc. Galvery, jr., Orange Coast College; and Wendall Johnson, Mount Hood Community College. Spray transfer could not be used when welding on thin materials, and the large weld pool could not be ~~~troUed when welding in the vertical or overhead polbon. In the late 19605, J. This mod of metal transfl r i hown in Figure 6-19. fi~c~ in n . Metals .ompctc With plastics, composites, ceo ramtcs, and ny mat rial that will serve the n ed. Deposition Rates and Quality of Welds Each of the variations has a considerable range of deposition rates based on the weld procedure employed. Yes, welding is changing. Modern welding technology / Howard B. it ct curt' 'nt is normally used with t11 el tro posiD.Pr v'r e polarity . H&M Pipe Beveling Machine Company, Inc. Many thanks to each. mm Amperes Volts in.lmin mm/min Amperes Volts in.lmin mm/min 0.045 1.2 1.6 2.0 2.4 2.8 3.2 120 150 200 300 450 550 21 24 26 26 30 32 168 100 95 95 4,267 2,540 2,413 2,413 2,794 2,489 300 425 450 600 750 850 30 31 33 36 38 39 625 400 270 255 237 175 15,875 10,160 6,858 5,477 6.019 4,445 1 1W i4 ~ 8~ t llO 98 Welding Range For E71 T-l1 Self-Shielding WeEN) Maximum Minimum Diameter in. No arc flash. The brazing filler metal flows away from the joint instead of into the process. that I struck at the age of six und r my grandfather's watchful eye and steady hand, to the one r made just yesterday-some 40year later. For example, grit should not become embedded in the surface. With rough surfaces the clearance will be too great to provide optimum strength of the brazed joint. the one that will be bolding tho e parts in place long after I have left this planet. For maximum economy and efficiency, groove welds hould be modified. p~1~11 fll Ill' ad () eJ' th surfnes to b jof.ned. ~Upositions. Pearson Education Ltd. 1 atic processes and was originally used to make the v~ngitudinat seam in large pipe. Flux in the flame may not be satisfactory for large, deep, or complex joints. Bode and Son Ltd. It t wid Iy uS d in ~II e ipbuUdin. Methods of Application .and Position Capabilities Contact Tube '" Path --\_ FIGURE6-52 Direction of Travel -- ... Co. DuPont-Aldyl Piping System DuPont-Metal Cladding Section Dual Draw Clean Air Work Station National Safety Council Nederrnan Inc. Through ut the World many n w alloys are being developed. There are now combinations of welding Section Dual Draw Clean Air Work Station National Safety Council Nederrnan Inc. without bevel preparation Welding positions Flat and horizontal Major advantages Low-cost gas, high travel speed, deep penetration, high deposition Spatter removal sometimes required, high heat Relatively smooth, some spatter Up to 250 in.zrnin Diameter: 0.045, 1«, limitations Appearance of weld Travel speeds Range of electrode wire sizes (in.) Thin material, will bridge gaps, minimum cleanup Uneconomical in heavy th ickness-except out of position Smooth surface, minor spatter Max. Elictridi ',' • Supply Electrode , feed unit 1 self-regulated arc. Shielding gas CO2 CO2 or CO2 + argon (C-25) Metals to be welded Low-carbon and medium-carbon steel, low-alloy high-strength steels Argon + oxygen and others All steels, aluminium and many alloys Metal thickness 10 gauge (0.140 in.): Low-carbon steels, low-alloy high-strength steels, some stainless steels 20 gauge (0.038 in.), up to t in.: economical in heavier metals for vertical and overhead welding All positions (also pipe welding) Argon + oxygen and others Lowcarbon and medium-carbon steels, low-alloy high-strength steels Ho ~ in. TIle wire feeder must match the power source for these applications. The different variation provides extremely deep penetrating qualities; in designing fillet weld is the size of the fillet can be reduced at least one size when converting from shielded metal arc welding. • Tbtcenessand joint design. This can occur when brazing dissimilar metals and when the difference of thermal expansion would create tensile loads on the filler metal during cooling. ci25\*9 wf ' ÿ T • « ÿ - '~=r Modern bf~. hut in many ways it is still the same. The note from Howard said that our future depended on our investment in students, and if we never invested, it would never get better. ' - '5 ? gas and cooling water. Change work position so that gravity wtll help the filler metal fill he joint. Ramstud (USA) Inc. Remove burrs, edges, or other obstacles over which the brazing alloy might not flow. As a result, welding costs should be greatly reduced because standard 'procedures save the expens of duplicating qualifying procedi ..rres and allow the portabilities, and the recommended welding gas. The ANSI/AWS "Standard for Brazing Procedure and Performance Qualification," B2.2, is similar and may be used. The clearan e between til parts 3. mm liB 0 3.2 27-30 Travel speed Weld p.," T ravel speed Weld p.," T greatly improved, and there are now composite beams available to build bridges. West!.ngh us Electr! Div. It'i" al t d on III • pI' plac 'd bl':tzlng 011 ;f materinls ...al'tl2.ing 1')( "n ",,011 b ~ ~t'm.fet; ... thus O1ini.tual need for protective - clothhlg ... Manufa turing Techn logics Inc. Background @ FIGURE 6-20 Pulsed arc transfer power source output waveform. Mtcroweld Products Co. MlJl r Electric Manufacturing o. / +-I tc- ", \_....\ -- t I r- TIME Ip - Peak Current (Pulse Amplitude) tp-Time ~ FIGURE6-19 Peak (Pulse Width) @ Ie - Background Current t, - Time Pulsed-spray transfer mode. n th manl.lfll 'ture ofv s 1\$ h~.~nl(\$ for pre SU!' nnd S orag" l; S . fU nts. Keen Hinkel Inc. Unfortunately, lap joints tend to be unbalanced joints and this produces stress concentrations that adversely affect the joint strength. 0 ... N is i,IT It used bccatl1 .th tnls i e cout d 1.etrod s;tr' nor pOpUL1.f. Tn. 'ho'rtillg ar' v;:trt timl b cam' p dar wh n til • ,V sys 111 .of welding J) W "f WU,' intf{)du'ct:111' , sys-eetn ~cd{rcdth 'omple 'ty - : ell i1', 11cd ' III .,01 ircuits fInd liminnt. 6~6.SUBMERGED ARC WELDING FIGURE 5-31 Submerged arc welding (SAW). Metals and Thickness Range FIGURE 6-38 Weld joint design changes for GMAW. on w'ight bilSis thml Ut solid l' 'tr< d wir .. Solvents, alkaline baths, acid baths, salt bath pickling, and ultrasonic cleaning have all been Used successfully. ii, Mechanically or chemically dean the filler metal if surface oxides are present. When using the pulsed-spray mode of transfer, a constant-speed wire feeder is normally used. The end r sult is th roo t oaomical mat rial for a given applrarion, Many new t and alloys are being welded today, tn Iuding higher str ngth til rmo-mechanl aU processed steels. t j r to C> startIng The mechanism of pulsed-spray metal transfer is bas d on a sp cia1 pulsed waveform of the welding cur- rent, hown in Pigur 6-20, 360 8 Z i II: t ! e TIle CUrrent output j put ed at high speed from a low .IS ,1.. . werso~rrc 't]If.\{. If illso proid d pos; {Cive fIt' . As welding becomes more digital, the technology becomes more complex, but its application as a process becomes simpler and more efficient. Worldwide, welding continues to grow, and that growth is dependent upon the growth of the steel and other metal industry, w wilt miss you, but I will miss you as a friend and as a m ntor. (0.0225 to 0.635 rnm) for clearance when fluxes are involved. an important specific and is given by the AWS"Specification for the process variations. The surface finish of the faying surfaces should be between 30 and 80 microinch s for best joint strength. Aluminum Association American Iron and Steel Institute American Petroleum Institute American Society for Metals American Society for Te ting and Materials American Society of Mechanical Engineers Automated Production. Pearson Education Singapore Pte. — 6th ed. Tl e pm 1ng wav form 3~~tin 1 s ata constt t. t nlannet af aft' .quency ~lg of 300 TRANSITION ZONt t 250 to about 00 p llsesper ; Ode '''Hows the- u sand. All of this has helped take the human welder farth r away from the arc and fumes and ha h lp d cl an up th ;..r kl r' environment. IIItot 1.1igb.~volt.}, t1le . hang .: fr rna l(}~to 111 igher e1.: lt' 'SI11eldf.ng las R~ufatot SbJaldIng Gas . Cary, Scott C. NASA. The Original oncept of this book hasbeen maintained, with emphasis on the arc w lding pro e s sand t11 use of steel for industrial and onstructions provided the I\WS; It a, Uows t11" ...r~ader~ to keep up-to-date asw kUng techntc~l .itl{Qrt1latiOn "~Uld technology Improvements advan ... FIGURE6-40 wire. Acid pickle parts to remove surface from oxidation or from Other undesirable chemical action during the heating and braZing operation. He certainly exemplified the traits and characteristics of the greatest generation. It is a great step forward. Flux Ct@\$Sification ~81~A tBl-B FBI-C FB2-A rB3-C Ft~3~p tB3~e. F'B3-F Fa3~G FB3"H r93.,1 FLUXES USED FOR SRAllIIIG • • ; Base Metal Common Name" Aluminum Carbon stef) Stainless steel Sta, nlass steel Carbon steel Atu, rnlnum bron/?ie ., \$ AWS Filler Metal BAISi following factors govern the selection of the electrode. It and bused in the vertical ~tld OVi rllead position. normally theconstant ..v lrage ('v) type. A gun or torch is used for dlr - ting the lectrode and shielding gas to til ar area. Figure 7-12 shows the different brazed joints and the joint detail. Information about semiautomatic guns and automatic torches is given in Section 11-1. (Ie; - F ~ • - " Q, \_!!k ~ • J(" tJi? The br4zing alloy does not flow through the joint even though it melts and forms a fill t. Furthermor ! the filler metal will nof distribute itself throughout the complete joint by capillary action if it is too smooth. ni2atin· or when. In general, when using an atmosphere system, smaller joint clearances can be used. It an Used.to w Id tno 't m t Is. It u, esat 1 ast 85% to 90% ~~8rm'ri h shi Idlt1g g. TI1 l?uIsed-spray .of larg r-dhlmetere]cctr d wi:rc. Thic er sections and complex joint designs require filler metals that proide high weld metal du tility; • Surface conduions. 01' the hort, CirCUitInga~ var:iation a. If the surfaces are toO rough only th high points may be prop rly brazed. lb.ey are designed to keep cleaned joints clean during the brazing operation. They will combine with, dissolve, or inhibit the formation of chemical compounds that might interfere With the quality of the brazed joint. Braze Quality Close adherence to ~O". The current density on the small-dtameter electrode wires is much higher than with covered electrodes, which (:00tributes to the higher deposition rates for the same welding current. It was developed to proIde high-quality depo Ired weld metal by shielding the a~and the molten rn tal from the ontaminating effects the air. The major advantages of the process are: • High-ql1a.llty weld metal • trem Iy high d po ltlon rat and peed .. Like the satisfaction y u f, el when you raise your helmet and ee rh w Id that you just 1 reduced, the one tho t: Is the right size, the right size and BCuZn BAg 1600 1200-1£00 1050-1600 1050-1600 1050-1700 1400 ...2200 '140,0~200 580...615 565-870 Powder Powd~r Powder Powd~r Powder Powd~r Powder Powd~r Powder Powd~r Powder Powder Powd~r Powder Powd~r Powder Powd~r Powder Powd~r Powder Powd~r Powder Powder Powd~r Powd~r Powder Powd~r important to compensate for unequal expansion and contractton of a joint design. However, in every case care must be taken to make sure that the surface is clean. Joint Designs When designing a joint for brazing, the following six factors must be considered: L The type . with no preparation; maximum thickness practically 'unlimited Thin to unlimited thickness Flat and horizontal with small electrode wire all positions Smooth surface, deep penetration, high travel speed All positions Smooth surface, minimum spatter Up to 150 in.lmin Diameter! ~, t.r, ~, t up to ~ in New processes have been born, and others have gotten married. The Welding Journal has allowed the use of many new photos in this edition. to bused. 200~A machitl" is normally used. Krall, Linda Krautkramer Branson Laramy Products Co. Leybold Vacuum System, Inc. ii. Helzer, PhD Upper Saddle River, New Jersey Columbus, Ohio Library of Congress Cataloging-in-Publication Data Cary, Howard B. When ~~Uired, investigate the design factors, filler metal selecand cleanliness will ensure quality the joint does not exhibit the quality using the following troubleshooting 'lUltS: 1. To determine the strength of a brazed joint, the standard method should be used. The AWS standard AWS C3.2 outlines the procedure to be used for making tests that are comparable to others. KATBAK·GuUco Inti. Mitsllb1 hi Las r Mot:oman In . Nor laU • th 'onstant·sp cd wir d r is used ~ itll' it QtIstattt· o1tttge. 11 so i ty 1 as graciously allowed the us of this IOiofQ'l4tl n to help 1.18 all communicate welding Infer.nl tton mote accurately. mcinna ti Milacror eRe Automatic Dearman Div. o., 1'l' duct :on,I:tl~d., clition, liquid flux can be introduced into the fuel gas and supplied to the flame for torch brazing at the point where it is needed. Welding Circuit and Current 111c welding circuit employed for gas metal arc welding (Figur6-39) 1..1 es a wire fJ eder system that controls the electrode wit f, ed and welding are, as well as th flow of shieldtng.;, \_ riA ' Joint Cleanliness It is important to have extremely clean surfaces for the brazed joint. Mechanical surface preparations such as ~inding, sandblasting, wire brushing, filing, and rnachinl1lg can be used. Weld Mold Co. Weld Mold Co. deposition rates for the steady current and different electrodes. TRW Nelson Stud Welding Jefferson National Park Service Jet Line Engineering Inc. The basis for selecting the shielding gas involves the electrode, the welding position, the variation of the process.and the desired weld quality. Pearson pic Prentice Hall"6 is a registered trademark of Pearson pic Prentice Hall"6 is a registered trademark of Pearson Education, Inc. For example, the laser is more widely used, especially for cutting, and a new process, stir friction welding, is starting to be used to join aluminum for automotive and space applications. CBI Industries; Inc. 1 WELDING BACKGROUND, 1-1 1-2 1-3 1-4 1-5 3~3 3~4 3-5 1 The Importance of Welding, 1 Welding, 1 Welding, 1 Welding, 1 Welding, 1 Welding, 2 Historical Development of Welding, 1 Welding, WELDING, 2-1 2-2 2-3 2-4 2-5 Where Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods, 33 Qualifying and Certifying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 22 Welding Processes and Crouping, 20 Methods of Applying Welding, 20 4-6 4-7 4-8 Personnel Protection and Safety Rules, 41 Electrical Shock Hazard, 45 Arc Radiation Hazard, 45 Arc Radiation Hazard, 57 Compressed Gases Hazard, 57 Compressed Gases Hazard, 57 Compressed Gases Hazard, 58 ARC WELDING WITH A, NONCONSUMABLE ELECTRODE, 66 o I \ ...... This technique ~rOduces droplets of approxnnar ly the same or mailer lZ than the electr de diameter. A major breakthrough has been accomplished by the joint American WelcUng Society CAWS) and the Welding Research Council program for providing the optimum way to make a quality weld Welding TECHNOLOGY SIXTH EDITION Howard B. Wire Feed Speed mm Amperes Volts in/min mrn/min Amperes Volts in/min mrn/min 0.045 1.1 r\ 1.6 1.7 2.0 2.4 95 100 125 150 200 13 15 17 18 17 65 47 49 47 40 1,651 1.193 1,245 1,193 1,016 180 300 300 300 350 18.5 22 23 22.5 22 200 189 184 124 93 5,080 4,800 4,673 3,149 2.410 0.068 A ~ duty :y I ,'111eelectrode wires have a higher rate of utiHz(tion, and rnor e .onornl 'at weld joint d tails can be mploy d. Where fluxes are required, the clearances are normally larger. proc ss. tii. pUdngand abo ating sUQ' u !holJe, and by:many other lntlustries wh re steels ar . Finally, I want to thank the many other people who furnished information and pictures. Qualification is in accordance with Section IX of the "ASMEBoiler and Pressure Vessel Code." Part C pertains to brazing ferrous and nonferrous materials. Olt1st Industriar Us .and Typic JAppric~tions H Mild steel with backup Flat -t .. i T -T T I \_t Weld Size (5) Material Thicknen T Number of Passes Electrode Diameter Welding Power Travel \$peed IMP fperpM1) in. The filler metal may not wet the surfaces completely if they at too smooth. · h pnIs '(!.ell r. ot v ritttioo. r' 'IU1f s a s1' inl i? Ltd. Edison Welding Institute Engelhard Corp. Iwas fortunate to have had him help shape my career and my vision for the welding indll try as a younger person Semiautomatic welding has largely replaced manual welding, and automatic and robotic welding gas to the arc. Prestolite Electric Power Preston-Easton Inc. Today there is less emphasis on skill training. for manual welding, but more emphasis on technology training. TABLE7-4 FILLERMETALS FOR BRAZING Brazing Temperature Range AWS Classification OF Silver alloys BAg-1 BAg-2 BAg-2 BAg-2 BAg-2 BAg-26 BAg-26 BAg-26 BAg-27 BAg-26 BAg-27 BAg-28 BAg BAg-28 BAg-33 BAg-34 Gold Alloys BAu~1 BAu..2 I3Au·3 BAu\*4 BAu.5 8Au~6 ~-.; °C Approximate Composition (%) 45 Ag, 15 Cu, 16 In, 18 Cd 30 Ag, 27 Cu, 23 In, 20 Cd 50 Ag, 15 Cu, 15 In, 16 Cd, 3 Ni 40 Ag, 30 Cu, 28 In, 2 Ni 45 Ag, 30 Cu, 25 Cd 50 Ag, 34 Cu, 16 In 56 Ag, 22 Cu, 17 In, 5 Sn 72 Ag, 28 Cu 72 Ag, 27 Cu, 0.4 Li 65 Ag, 20 Cu, 15 In 70 Ag, 20 Cu, 15 In 70 Ag, 20 Cu, 15 In 70 Ag, 20 Cu, 10 In 54 Ag, 40 Cu, 5 In, 1 Ni 56 Ag, 42 Cu, 2 Cd 60 Ag, 30 Cu, 10 Sn 92.5 Ag, 7.25 Cu, 0.25 li 30 Ag, 28 Cu, 22 5 Ni, 6 Sn 49 Ag, 16 Cu, 23 5 Ni, 7 Mn 85 Ag, 15 Mn 50 Ag, 20 Cu, 28 In, 3 Ni 25 Ag, 38 Cu, 32 In 63 Ag, 28.6 Cu, 2.5 Ni, 6 Sn 49 Ag, 16 Cu, 23 5 Ni, 7 Mn 85 Ag, 15 Mn 50 Ag, 20 Cu, 10 In 54 Ag, 40 Cu, 5 In, 1 Ni 56 Ag, 42 Cu, 2 Cd 60 Ag, 30 Cu, 10 Sn 92.5 Ag, 7.25 Cu, 0.25 li 30 Ag, 28 Cu, 22 5 Ni, 6 Sn 49 Ag, 16 Cu, 23 5 Ni, 7 Mn 85 Ag, 15 Mn 50 Ag, 20 Cu, 15 In 70 Ag, 20 Cu, 10 In 54 Ag, 40 Cu, 5 In, 1 Ni 56 Ag, 42 Cu, 2 Cd 60 Ag, 30 Cu, 10 Sn 92.5 Ag, 30 Cu, 20 28 Zn, 2 Sn 25 Ag, 30 Cu, 27.5 In, 17 Cd 38 Ag, 32 Cu, 28 ln, 2 Sn 1145-1400 1295-1550 1310-1550 1270-1500 1435-1650 1370-1550 1370-1550 1370-1550 1370-1550 1370-1550 1425-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1425-1650 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1425-1650 1410-1600 1325-1550 1410-1600 1325-1550 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1325-1550 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1410-1600 1425-1650 1260-1400 1330-1550 618-760 635-760 702-843 710-843 688-816 779-899 743-843 774-871 652-760 779-899 766-871 718-843 877-982 766-871 802-899 699-830 970-1038 750-843 800-870 745-860 710-843 681-760 721-843 1860-2000 1635-1850 1885-1995 1740-1840 2130-2250 1915-2050 1016-1093 891-1010 1029-2091 949-1004 1166 ...1232 1046-1121 37.5 Au, 62.5 Cu 80 Au, 20 35 Au, 62 cu, 3 Ni 82 Au, 18 Ni 30 Au, 34 Pd, 36 Ni 69 Au, 8P 22 Ni 1110-1150 1060-1120 1090:-1120 599-621 571....-604 588-604 588-604 588-604 588-604 588-801-7 Si, 1 Fe, 91.5 AI 10 Si, 4 Cu, 84.5 AI 1281,87 AI 1080-1120 582-604-12 Sf, 87 AI 1090-1].20 1120-1160 5Se,...604 1051,'1.5 Mg, 87 604",;627 88 Mg. 2 ?OOO-2100 ~OOO-~IOO 2000-alOO z-, co o, 10 si, 88,5 AI 10 SI, 1,5 Mg,.S7.5 AI 1093-...1149 99.9 Cu 1093...1149 99.9 Cu 1093...1149 99.9 Cu 1093...1149 86.5 Cu 59, cu. Copyright 0 2005, 2002, 1098, 1994, 1989 by Pearson Education, Inc., Upper Saddle River, New Jersey 07458. N.a:~ionalJotnt Steamfitt. +Pipefitter Apprentice

Cornmitte hlp Penton Public orp.j Industrial Bquipn; Yaskawa ElecrricAm ri a.Inc. . The surfa e finisb. of the raying surfaces 4. For information regarding permissions Department. When inert gas or argon oxygen mixtures are used for spray or pulsed-spray welding, the gun must be water cooled if high current is employed. A travel system r quir d for m chanical welding. mooth, Uniform finlsIred weld with no spatt t - Little r no smoke ... These higher rates occur because there is no electrode coating that must be melted. Welding Design and Pabricatton, TIIe Welding Institute Welding Services, Inc, Wi I dine Automation Weldmatic, Inc. Accra-Weld Controls Advanced Manufacturing Engineering Technologies AGA Gas, Inc. with mixtur' of 1 lium, hyls~g fl, 0 yg fl, 10 C~, allows the \1 e of froul 5% to m ~. v. ~bii it from being used for some applications. Two materials are used for spray or pulsed-spray welding, the electrode will requirements of the deposited weld metal, as well as to the composition. The service requirements that 111 weldment will no untec, for 'W Lais. A hym unst be active to the employed. The electrode will require a solution to be employed. The electrode weld metal, as well as to the composition if sp cifications are not involve 1, nslder the service requirements that t11 weldment will no untec, for 'W Lais. A hym urrent p ak, known as jleak urrent is known as peak time (fl]. Taylor Diving & Salvage Co., Inc. BAg, BeLl, I3Nf, SAtl. These joint details are given in Chapter 19. • . Metal to be welded. mm 11 down 2 3 up 3 4 5 6 3.5 up 2.1 up 2.7 up 2 up 7 1.8 up 8 9 1.4 up 1.3 up , VollS Amps PaSSII1 in. el urrent. InTech R&D IIWWelding Products-McKay TAFA, Inc. Manpuhlt e skills not involved .t 'I11esubmergedav pro ess is-wid Iy u ed ill heavy st. ~Qra w'ilc:Ung ana S;pt1lytransfer HTC.' wJdiflgJ higher IU1:entpow r soure p.t., up to 500 A, thr used. I:'Of pulse 1. w lding, spc ial pOW"t our • Wi h QmpJexcon• 11 b' rc tifJer or in rt r l11a 'hin .1fhevoJt..amper 'hU11t(''1 'risti 'urve of the machtn

2022/05/26 · The Asahi Shimbun is widely regarded for its journalism as the most respected daily newspaper in Japan. The English version offers selected articles from the vernacular Asahi Shimbun, as well as ... General Emergencies: See the Emergencies page: Your Scheme: Please Login to see scheme specific contacts: Client Meeting Hours: 6PM to 9PM weekdays: Your Strata Manager: See this page for contact details: Our ABN: 31 064 030 324 An ebook (short for electronic book), also known as an e-book or eBook, is a book publication made available in digital form, consisting of text, images, or both, readable on the flat-panel display of computers or other electronic devices. Although sometimes defined as "an electronic version of a printed book", some e-books exist without a printed equivalent. Enjoy millions of the latest Android apps, games, music, movies, TV, books, magazines & more. Anytime, anywhere, across your devices. Dear Twitpic Community - thank you for all the wonderful photos you have taken over the years. We have now placed Twitpic in an archived state. Technology is the continually developing result of accumulated knowledge and application in all techniques, skills, methods, and processes used in industrial production and scientific research. Technology is embedded in the operation of all machines, with or without detailed knowledge of their function, for the intended purpose of an organization. The technologies of society consist ...

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