

**TEACH YOURSELF HOW
TO WELD**



**DO YOU WANT TO
BECOME SELF
SUFFICIENT AND
NOT HAVING TO
WAIT FOR THE
WELDER
ONBOARD?**

TEACH YOURSELF HOW TO WELD



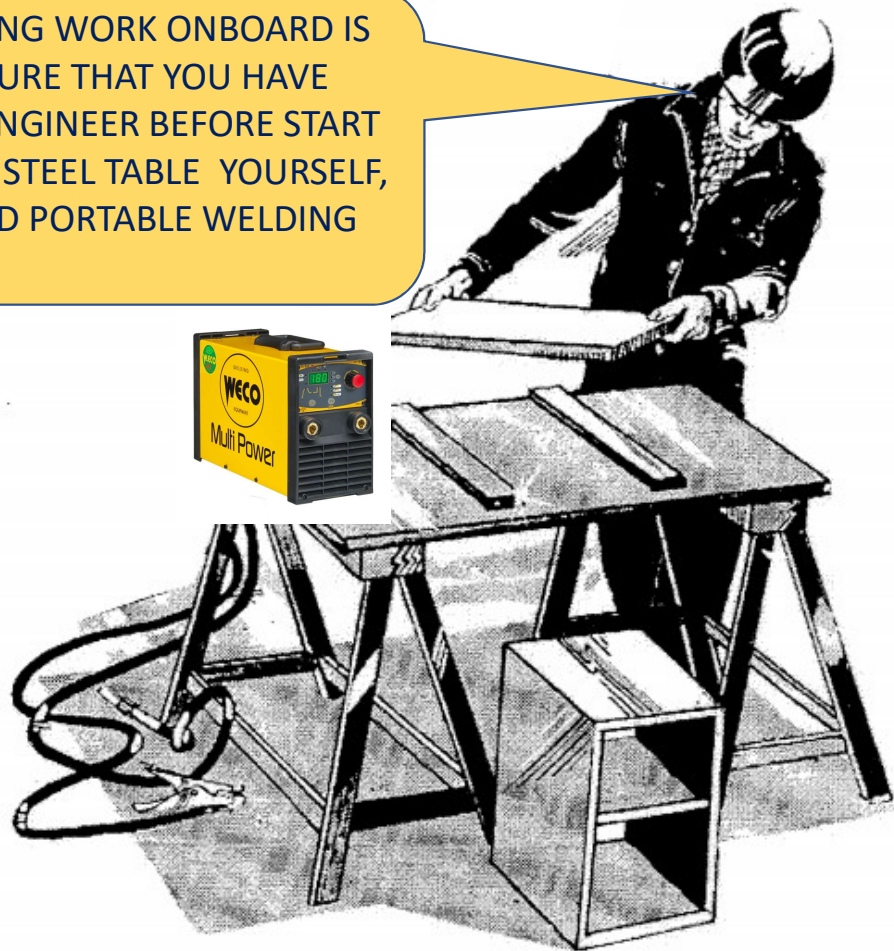
YOU WANT TO LEARN HOW TO WELD?
BEST THING IS TO JOIN A WELDING SCHOOL
SESSION. IF YOU CAN'T, THEN YOU ARE
WELCOME TO TRY THIS "TEACH YOURSELF
HOW TO WELD" LESSON.



BEFORE YOU START, MAKE SURE TO READ THROUGH THE WELDING
MACHINES USER MANUAL AND THAT YOU UNDERSTAND ITS
OPERATION AND SAFETY FEATURES

TEACH YOURSELF HOW TO WELD

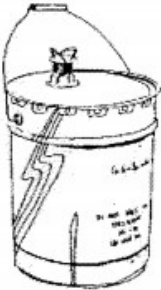
THE BEST PLACE TO DO WELDING WORK ONBOARD IS IN THE WORKSHOP. MAKE SURE THAT YOU HAVE PERMISSION FROM THE CHIEF ENGINEER BEFORE START UP. YOU CAN MAKE A SUITABLE STEEL TABLE YOURSELF, OR YOU CAN USE A DEDICATED PORTABLE WELDING TABLE



TEACH YOURSELF HOW TO WELD



ALWAYS KEEP A FIRE EXTINGUISHER READY WHEN YOU ARE DOING WELDING OR CUTTING WORK. MAKE SURE IT IS IN WORKING ORDER



TIDY UP THE WORK PLACE AND REMOVE ANY FLAMABLE MATERIAL, LIQUIDS OR GASES FROM THE WORKPLACE AND ADJACENT AREA



COVER ANY OPENINGS THROUGH WHICH SPARKS MAY BE LEAD TO OTHER AREAS ONBOARD WHICH HAVE NOT BEEN PREPARED FOR HOT WORK

MAKE SURE THE LOCATION HAVE PROPER VENTILATION TO TAKE CARE OF THE WELDING FUMES



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YOU MUST ALSO PREVENT OTHER PERSONEL BEING HARMED BY THE ULTRA VIOLET RAYS FROM THE WELDING ARC. IF NEED BE, SET UP A WELDING CURTAIN TO BLOCK OUT THE LIGHT.

BY THE USE OF A WELDING SPATTER SCREEN YOU CAN ALSO PROTECT COMBUSTIBLE MATERIALS AND MACHINERY PARTS FROM SPATTER AND SPARKS THAT DEVELOPS DURING WELDING.



ALSO MAKE SURE THAT YOU HAVE A WIRE BRUSH AND CHIPPING HAMMER AVAILABLE



TEACH YOURSELF HOW TO WELD



REMEMBER WHEN WELDING THAT PROPER PROTECTION IS ABSOLUTELY NECESSARY IN ORDER TO PROTECT YOURSELF AGAINST ELECTRIC SHOCKS, BURNS, ULTRAVIOLET RAYS OR BITS OF WELDING SLAG.

	Amperage	Filter Shade
B	< 20 A	8-9
B	20-40 A	9-10
B	40-80 A	10
B	80-175 A	11
B	175-300 A	12
B	300-500 A	13
A	Safety Glass	
C	Protection Glass	

YOU MUST WEAR A FACE SHIELD FITTED WITH A FILTER SHADE GLASS WITH SHADE ACCORDING TO THE AMPERAGE BEING USED.



A



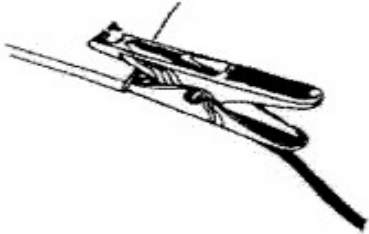
B



C



TEACH YOURSELF HOW TO WELD



PLACE THE WELDING MACHINES RETURN CLAMP (GROUND/EARTH CLAMP) IN DIRECT CONTACT WITH THE WORK PIECE. NEVER USE THE SHIPS HULL AS RETURN



IF YOU DO NOT HAVE ANY AVAILABLE FLAT STEEL FOR THE EXERCISES YOU CAN USE SCRAP STEEL, BUT REMEMBER TO GRIND OR WIRE BRUSH THE SURFACE CLEAN FROM RUST AND PAINT



ALL YOU NEED TO GET STARTED ARE ELECTRODES. BEGIN WITH A E-6012 OR E-6013 TYPE IN 3,2MM SIZE. PLACE THE WELDING ELECTRODE INTO THE WELDING MACHINES ELECTRODE HOLDER

TEACH YOURSELF HOW TO WELD



SET AMPERAGE TO
125 AMP



ELECTRODE HOLDER
TO MINUS (-) POLARITY



FOR THIS FIRST EXERSISE USING A E-6012 OR E-6013 IN 3,2MM (1/8") SIZE ELCTRODE SET THE AMPERAGE ON THE WELDING MACHINE TO 125 AMP. CONNECT THE ELECTRODE HOLDER TO MINUS (-) POLARITY. MAKE SURE THE WELDING MACHINE IS SET FOR "ELECTRODE WELDING" AND NOT TIG WELDING. POINT THE ELECTRODE TIP AGAINST THE STARTING POINT AT A DISTANCE OF 10MM (13/32"). ALSO MAKE SURE THAT THE ELCTRODE ANGLE ARE 80° IN DIRECTION OF TRAVEL AND 90° IN SIDE ANGLE

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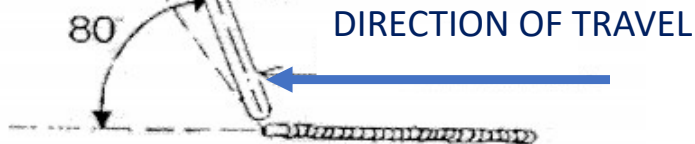
PLACE THE FACE SHIELD IN FRONT OF YOUR FACE. IGNITE THE ELECTRODE BY SCRATCHING IT AGAINST THE PLATE LIKE STRIKING A MATCH. IF THE ELECTRODE STICKS TO THE PLATE YOU CAN FREE IT WITH A SHARP TWIST TO THE SIDE. AT NO TIME, LOOK DIRECTLY AT THE ARC

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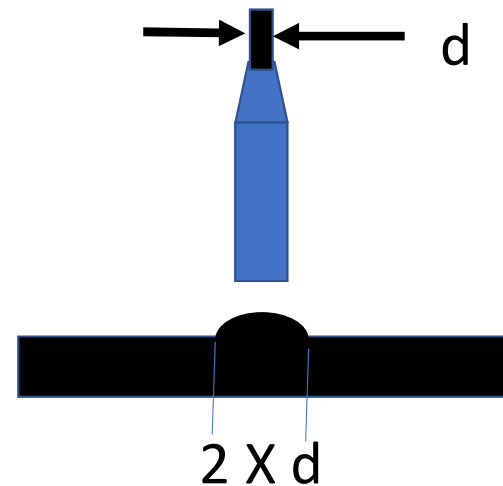


WHEN THE ARC IS ESTABLISHED THE ELECTRODE MUST BE GRADUALLY LOWERED SO THAT THE DISTANCE BETWEEN THE ELECTRODE TIP AND THE PLATE IS APPROXIMATELY 3MM (1/8") AT ALL TIMES. THIS DISTANCE WE CALL THE ARC LENGTH. MOVE THE ELECTRODE TO THE STARTING POINT AND KEEP IT THERE FOR A COUPLE OF SECONDS IN ORDER TO ESTABLISH THE WELD POOL

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MOVE THE ELECTRODE ALONG WITH AN EVEN SPEED OF TRAVEL. REMEMBER THAT THE ELECTRODE MELTS OF CONTINUOUSLY SO IT IS NECESSARY TO LOWER YOUR HAND TO KEEP THE CORRECT ARC LENGTH OF 3MM (1/8"). ALSO CHECK THAT ELECTRODE ANGLES (80° IN DIRECTION OF TRAVEL AND 90° IN SIDE ANGLE) ARE CORRECT. THE WIDTH OF THE DEPOSIT SHOULD BE TWO TIMES THE ELECTRODES CORE DIAMETER



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WHEN YOU STOP WELDING, MOVE THE ELECTRODE A BIT BACK IN THE WELD POOL AND THEN QUICKLY AND CONSISTENT UPWARD BREAKING THE ARC. BY PLACING STRINGER BEADS LIKE THIS PARALLEL TO EACH OTHER AND IN OVERLAP YOU CAN REBUILD A WORN DOWN SURFACE. THIS IS CALLED HARDSURFACING SOMETIME REQUIERING SPECIAL HARDSURFACING ELECTRODES. NEVER THE LESS THE WELDING TECHNIQUE IS THE SAME

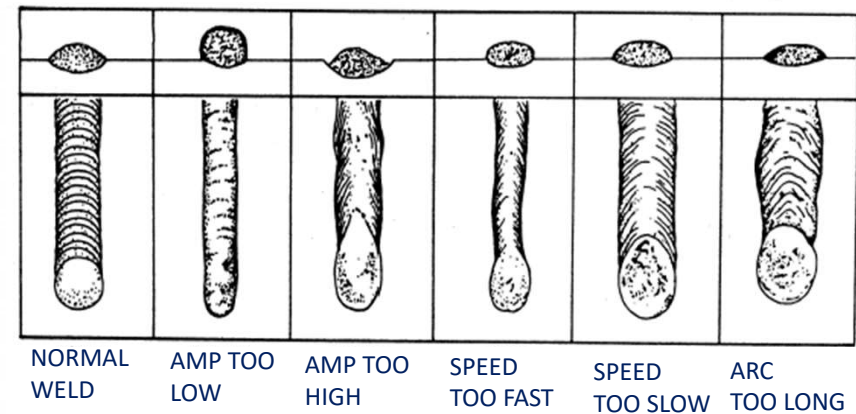
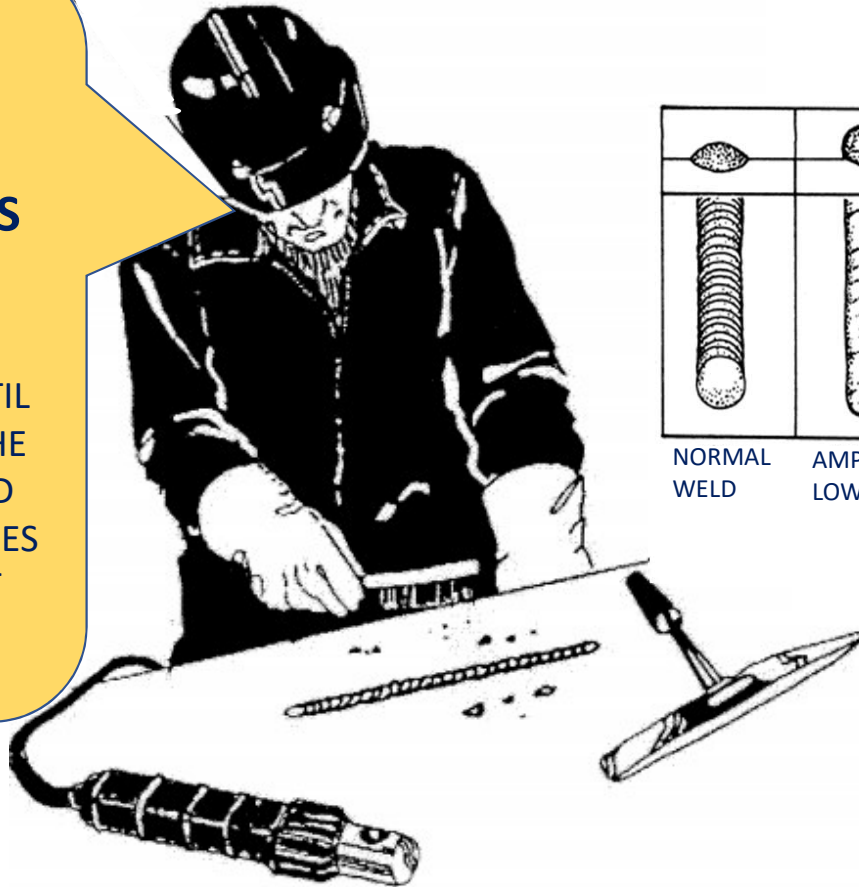


TEACH YOURSELF HOW TO WELD

WHAT IS IMPORTANT TO
REMEMBER IN THIS
EXERCISE IS CORRECT :

ARC LENGTH
ELECTRODE ANGLES
**EVEN SPEED OF
TRAVEL**

REPEAT THE EXERCISE UNTIL
YOU GET A WELD WITH THE
CORRECT COUNTURE AND
EVEN SURFACE. AT ALL TIMES
REMEMBER TO PROTECT
YOUR EYES WHEN
REMOVING THE SLAG



TEACH YOURSELF HOW TO WELD



THE NEXT EXERCISE INVOLVES USING THE MOST COMMON TYPE OF JOINT. ITS ESTIMATED THAT 80% OF ALL WELDS ONBOARD ARE T-JOINTS. TACK WELD TOGETHER 2 PLATES SO THAT THEY FORM A T-JOINT USING THE SAME 3,2MM (1/8") ELECTRODE AS IN THE FIRST EXERCISE. PLATE THICKNESS SHOULD BE 5MM (13/65") TO 10MM (25/64"). TACK WELD IS A SHORT WELD APPROX. 10MM (25/64") LONG. THE TACK WELDS ARE TO KEEP THE PLATES IN PLACE DURING WELDING SO THEY MUST BE OF PROPER QUALITY. FOR THE ACTUAL WELDING USE A E-6012 OR E-6013 TYPE OF ELECTRODE IN 3,2 (1/8") OR 4,0MM (5/32") SIZE

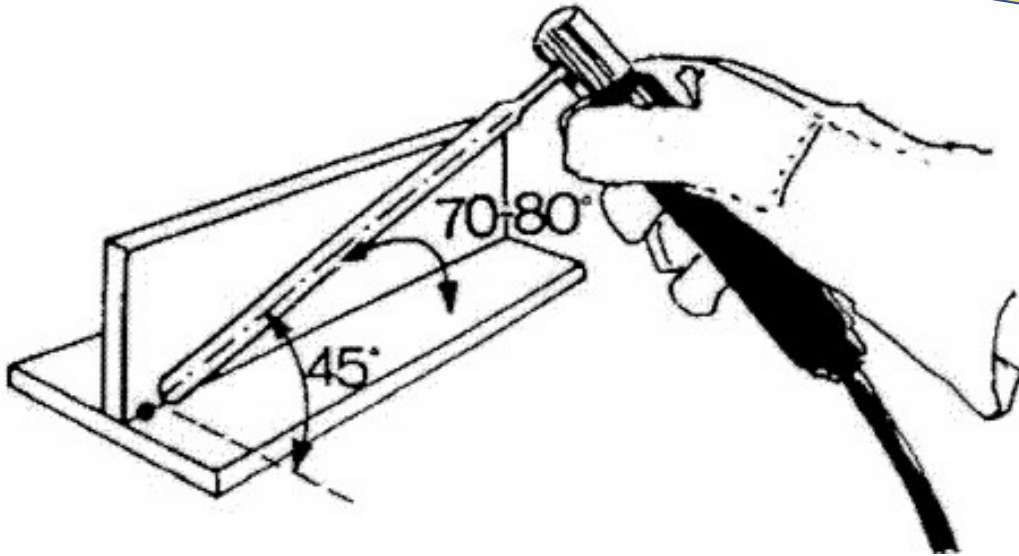
3,2MM (1/8")	USE 135 AMP
4,0MM (5/32")	USE 150 AMP



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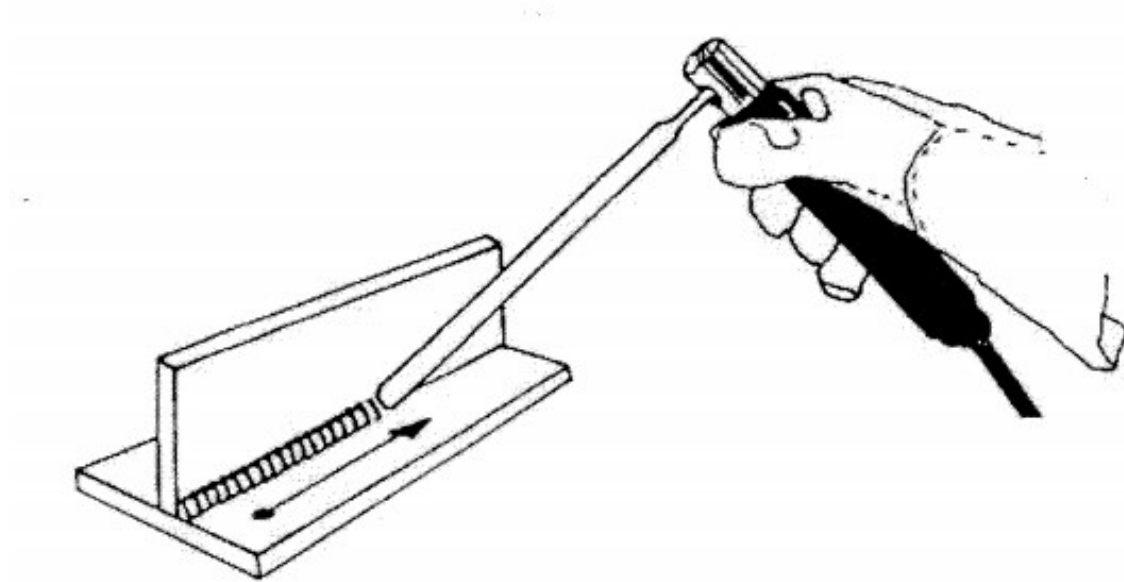


POINT THE ELECTRODE TIP AT THE STARTING POINT. DIVIDE THE ANGLE BETWEEN THE PLATES WITH THE ELECTRODE FORMING A 45° SIDE ANGLE, AND TILT THE ELECTRODE TO 70° - 80° IN THE DIRECTION OF TRAVEL. PLACE THE FACE SHIELD IN FRONT OF YOUR FACE AND IGNITE THE ELECTRODE AS DESCRIBED IN PREVIOUS EXERCISE. AFTER IGNITION, KEEP THE ELECTRODE AT THE STARTING POINT FOR A FEW SECONDS, BEFORE START MOVING



TEACH YOURSELF HOW TO WELD

MOVE THE ELECTRODE WITH AN EVEN SPEED OF TRAVEL. REST THE ELECTRODE TIP LIGHTLY IN THE CORNER SO ITS IN CONTACT WITH BOTH PLATES. REMEMBER TO CHECK YOUR ELECTRODE ANGLES DURING WELDING AND KEEP A SLOW STEADY TRAVEL SPEED.



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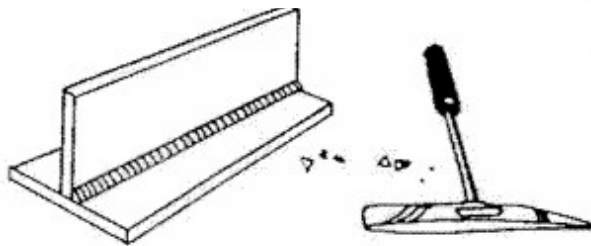
BREAK THE ARC IN A SIMILAR MANNER AS IN THE FIRST EXERCISE. HERE ARE SOME OF THE MOST COMMON MISTAKES. COMPARE YOUR RESULT AND DO THE NECESSARY ALTERATIONS



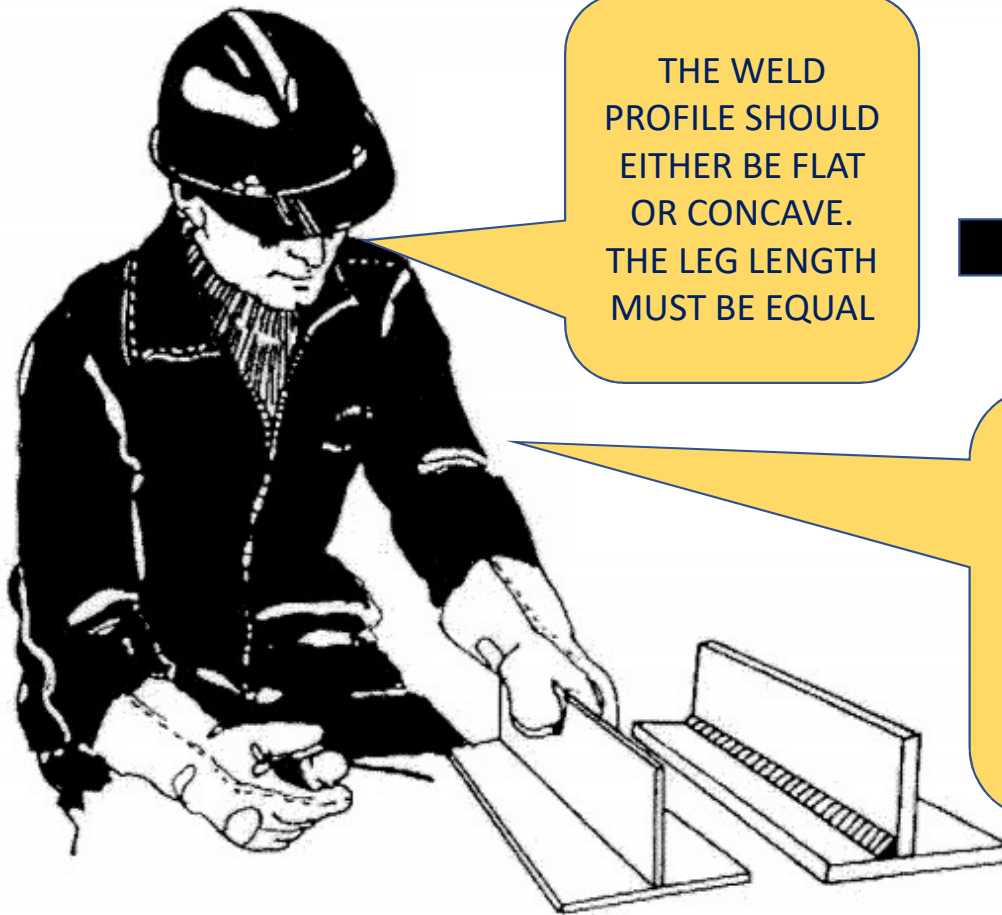
CONVEXS PROFILE:
TOO LOW AMPERAGE

UNDERCUTT:
TOO HIGH AMPERAGE

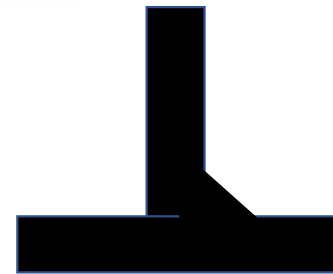
FLAT WELDING PROFILE:
WRONG ELCTRODE SIDE
ANGLE



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THE WELD PROFILE SHOULD EITHER BE FLAT OR CONCAVE. THE LEG LENGTH MUST BE EQUAL



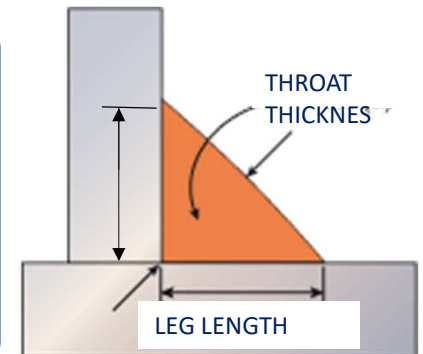
FLAT PROFILE



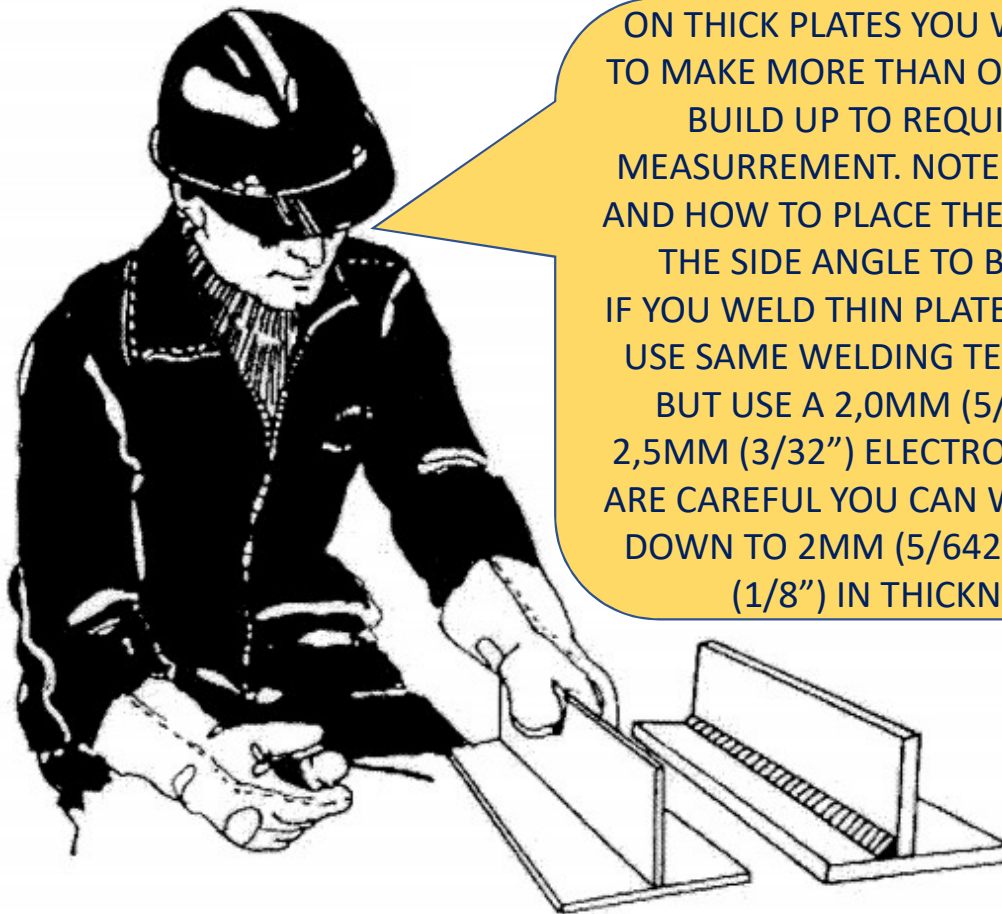
CONCAVE PROFILE



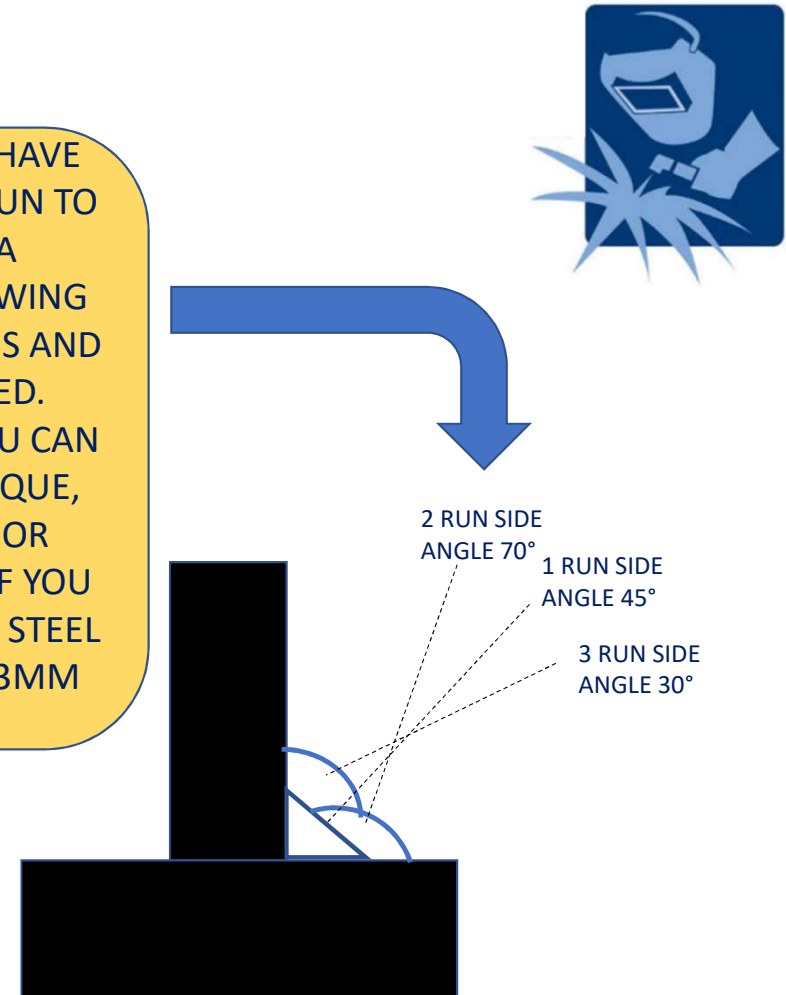
THE THROAT THICKNESS (A-MEASUREMENT) IS TO BE :
THE THICKNESS OF THE THINNEST PLATE X 0,7.
IF WELDED ON BOTH SIDES X 0,5



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ON THICK PLATES YOU WILL HAVE TO MAKE MORE THAN ONE RUN TO BUILD UP TO REQUIRED A MEASUREMMENT. NOTE DRAWING AND HOW TO PLACE THE RUNS AND THE SIDE ANGLE TO BE USED. IF YOU WELD THIN PLATES YOU CAN USE SAME WELDING TECHNIQUE, BUT USE A 2,0MM (5/64") OR 2,5MM (3/32") ELECTRODE. IF YOU ARE CAREFUL YOU CAN WELD STEEL DOWN TO 2MM (5/642) TO 3MM (1/8") IN THICKNESS

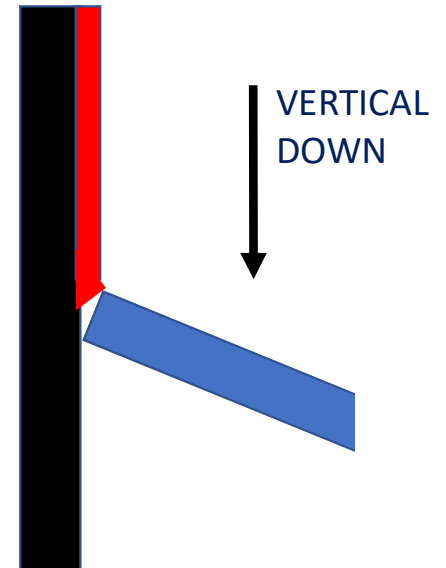


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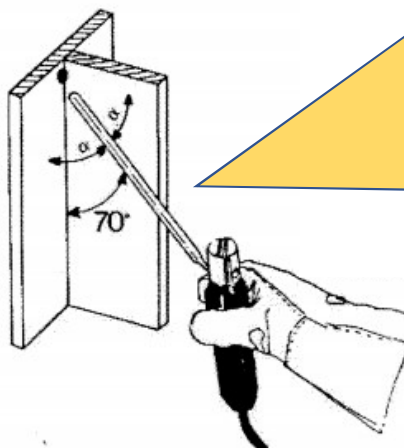


SOMETIME YOU NEED TO WELD IN VERTICAL POSITION. START BY TACKING TOGETHER 2 PLATES LIKE IN PREVIOUS EXERCISE. FASTEN THE ASSEMBLY SECURELY TO THE PLATE EDGE. IT IS EASIER TO WELD VERTICAL DOWN THAN VERTICAL UP. MOST E-6012, E-6013 AND E-6010 ELECTRODES CAN BE USED VERTICALLY DOWN. SET THE AMPERAGE TO 150 AMP

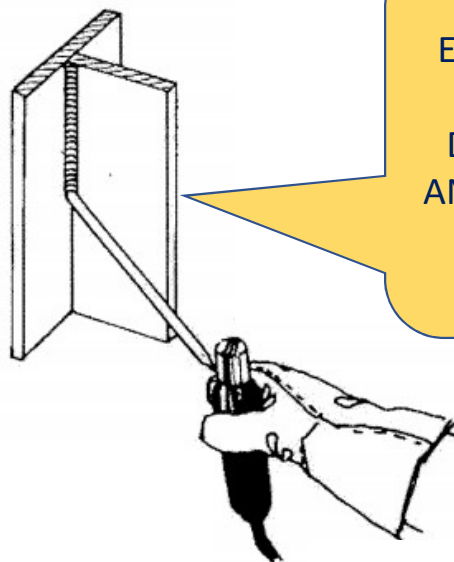
KEEP THE ELCTRODE IN CONTACT WITH THE BASE MATERIAL AND DRAG IT VERTICALLY DOWN



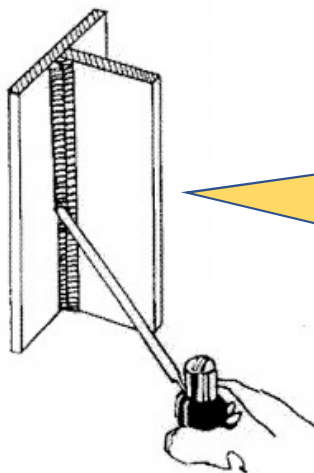
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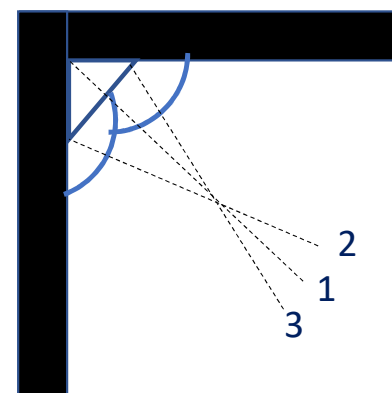
POINT THE ELECTRODE AGAINST THE STARTING POINT AND 10 MM (13/32") FROM THE CORNER. ADJUST THE ANGLE FOR DIRECTION OF TRAVEL TO 70° AND SIDE ANGLE 45°



IGNITE THE ELECTRODE AND MOVE IT DOWNWARDS AND IN CONTACT WITH THE CORNER



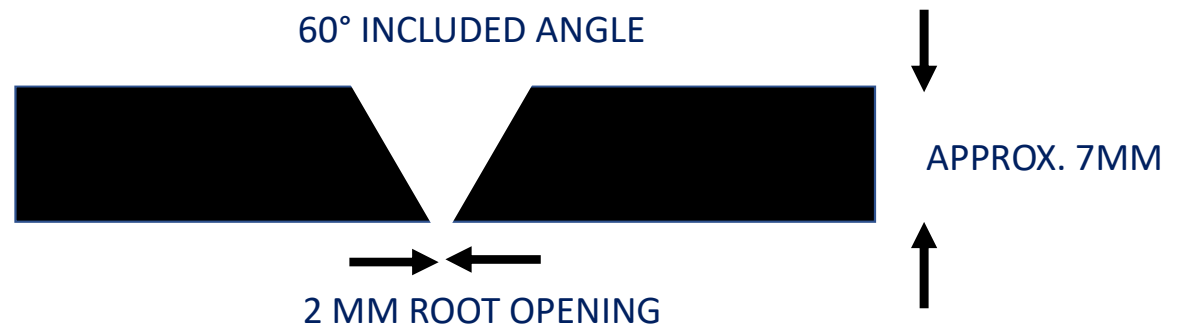
MOVE THE ELECTRODE IN A STRAIGHT LINE WITHOUT WEAVING. IF ONE RUN IS NOT SUFFICIENT YOU CAN PLACE A SECOND AND THIRD RUN HALFWAY OVER THE FIRST RUN AS ON THE DRAWING



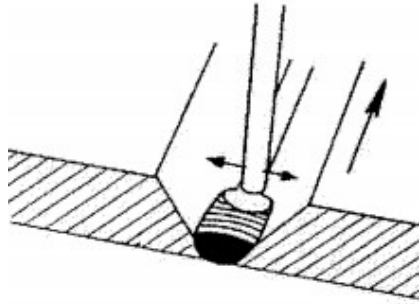
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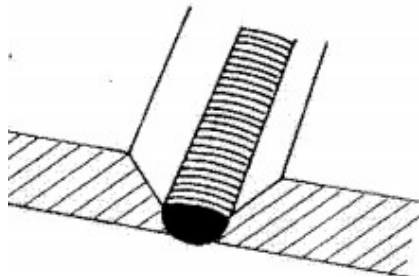
NEXT EXCERSISE IS BUTT JOINT WELDING IN HORIZONTAL POSITION. TRY USING 7MM (9/32") STEEL PLATES AND CUT OR GRIND A 30° BEVEL GIVING A 60° INCLUDED ANGLE. TACK WELD THE TWO PLATES TOGETHER WITH A DISTANCE (ROOT OPENING) OF 2MM (5/64"). FOR THE FIRST RUN (THE ROOT RUN) USE A E-7018 OR E-7016 ELECTRODE IN 2,5MM (3/32") SIZE AND 70 AMP + POLARITY



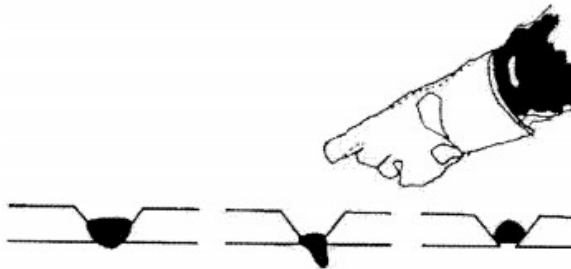
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IGNITE THE ELECTRODE USING THE SAME TECHNIQUE AS IN PREVIOUS EXERCISES. MOVE THE ELECTRODE DOWN IN THE ROOT OPENING AND WITH A SLIGHT WEAVING MOTION BRIDGE THE GAP



CONTINUE WEAVING FROM SIDE TO SIDE MOVING GRADUALLY ALONG IN THE BOTTOM OF THE GROOVE. THE FIRST RUN IS CALLED THE ROOT RUN AND A SUCCESSFUL RESULT DEPENDS ON TWO FACTORS: WELDING TECHNIQUE AND EDGE PREPARATION



NO.1 OK NO.2 BURN TROUGH NO.3 INCOMPLETE PENETRATION

RESULT NO.2 IS CAUSED BY TOO HIGH AMPERAGE OR TOO SLOW TRAVEL SPEED. RESULT NO. 3 IS CAUSED BY TOO LOW AMPERAGE, TOO FAST TRAVEL SPEED OR THAT ELECTRODE IS KEPT TOO FAR UP IN THE GROOVE

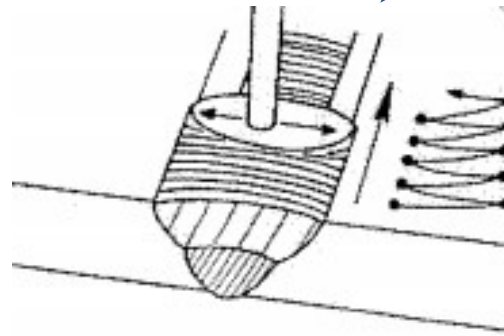
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REMOVE ALL SLAG FROM FIRST RUN. THE SECOND RUN IS PLACED IN ORDER TO FILL UP THE JOINT. USE A E-7018 OR E-7016 ELECTRODE IN 3,2MM (1/8") SIZE. INCREASE THE AMPERAGE TO 120 AMP + POLARITY TO ELECTRODE HOLDER. USE SAME ELECTRODE ANGLES AS FOR FIRST RUN



MOVE THE ELECTRODE FROM SIDE TO SIDE, SLIGHTLY PAUSING ON EACH SIDE. MAKE SURE TO MELT THE TOP PLATE EDGE. GRADUALLY MOVING FORWARD FILLING UP THE GROOVE. MAKE SURE THAT THE FINAL WELD HAS A SLIGHT REINFORCEMENT OF 1-2MM (3/64"-5/64")



TEACH YOURSELF HOW TO WELD



LIKE MOST OTHER THINGS IN LIFE, ONE NEEDS PRACTISE AND TRAINING TO BECOME A GOOD WELDER. ALSO MAKE SURE TO LOOK AFTER YOURSELF AND TAKE ALL THE MENTIONED SAFETY PRECAUTIONS. REMEMBER THAT WELDING ONBOARD IS MUCH MORE DANGEROUS THAN WELDING LAND BASED



IF YOU HAVE FUTHER QUESTIONS OR WELDING PROBLEMS, DO NOT HESITATE TO CONTACT ME ON www.teandersen.com