VIBRANT INDUSTRIAL TRAINING ACADEMY

WELDING SAFETY
WHAT IS WELDING.?  

The Welding is a process of joining two or more, similar or dissimilar metals by heating them to a desired temperature, with or without the application of pressure, filler materials and flux.
TYPES OF WELDING

- Gas welding (Oxy-Acetylene)
- Arc welding (Metal Arc)
- Resistance welding
- Solid state welding
- Brazing
- Other welding's like flow welding, induction welding, laser beam welding, electro slag welding etc
Gas Welding is a fusion welding process, in which the heat for welding is obtained by the combustion of oxygen and fuel. The gas may be acetylene, hydrogen or propene.

Types:
- Oxy-Acetylene
- Air-Acetylene
- Oxy-Hydrogen
- Oxy-Fuel
OXY ACETYLENE WELDING

- When a combination of Oxygen and acetylene is used in correct proportions to produce an Intense gas flame, the process is known as oxy-acetylene welding.
ARC WELDING

“Arc welding is a fusion welding process in which the heat required to fuse the metal is obtain from the electric arc between the base metal and an electrode.

Types:
- Arc stud welding
- Flux cored arc welding
- Gas metal arc welding
- Gas tungsten arc welding
- Shielded metal arc welding
- Submerged arc welding
1. Conduct an Assessment of the work area and conditions.
2. Post signage & Barricading.
3. Write the Hot work Permit.
4. Check Welder’s competency, machine status, WPS etc (TPC)
5. Follow all other safety procedures PPE, Ventilation, Emergency etc.
6. Continuous supervision and monitoring.
A TOOL BOX TALK SHOULD BE GIVEN BY THE SUPERVISOR PRIOR TO THE JOB

A COPY OF PERMIT AT WORKPLACE.

EACH SHIFT SUPERVISORS MUST RENEW THE PERMIT

CLOSING OF PERMIT AFTER COMPLETION

ANY NON-COMPLIANCE OR EMERGENCY SITUATION ON THE JOB RENDERS THE HOT WORK PERMIT INVALID
Different types of welder certification

WELDERS COMPETENCY REPORT

<table>
<thead>
<tr>
<th>Name of Welder</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Company’s Name</td>
<td></td>
</tr>
<tr>
<td>Qatar ID No/Passport No.</td>
<td></td>
</tr>
<tr>
<td>Assessment’s Location</td>
<td></td>
</tr>
<tr>
<td>Date of Assessment</td>
<td></td>
</tr>
<tr>
<td>Certificate Number</td>
<td></td>
</tr>
<tr>
<td>Date of Issue:</td>
<td>Date of Expiry:</td>
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</tbody>
</table>

TESTING VARIABLES AND QUALIFICATION LIMITS

<table>
<thead>
<tr>
<th>Welding process / Position:</th>
<th>Type: Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filler Metal:</td>
<td>Positions Qualified:</td>
</tr>
<tr>
<td>Thickness Qualified (T):</td>
<td>Root Face:</td>
</tr>
<tr>
<td>Root Opening:</td>
<td>Welding Progression:</td>
</tr>
<tr>
<td>Joint design / Groove angle:</td>
<td>Type of fuel gas: N/A</td>
</tr>
<tr>
<td>Backing: N/A</td>
<td>Transfer mode: N/A</td>
</tr>
</tbody>
</table>

TEST RESULTS

| Visual Examination of Completed Welds | No Relevant indication, Accepted |
| Test coupon Results (NDT) | No Relevant indication, Accepted |
| Porosity | None |
| Undercut | None |
| Acceptable | Yes |

Above mentioned statements in this record are correct and the test coupon was prepared, welded and verified in accordance with the requirements of QCS-2014.
**WELDER QUALIFICATION FOR STRUCTURAL WELDING**

Section 16: Structural Steelworks

Part 05

1. Welders shall be tested to meet the requirements of BS EN 287 Part 1 but, in the case of welders engaged on fillet welding only, BS 4872 Part 1 is an acceptable alternative.

2. As an alternative, when permitted by the Employer, welders may be tested to meet the requirements of the American Society of Mechanical Engineers, ASME IX, or the American Welding Society, AWS D1.1.

**WELDER QUALIFICATION FOR CHILLED WATER PIPELINES**

Section 22: Air Conditioning, Refrigeration and Ventilation

Part 01

Test shall be carried out in accordance with the test procedures laid down in BS 2640 and BS 2971

Each test sample shall be subjected to the following examinations and test.

(a) Pipes up to 100 mm diameter shall undergo visual examination and normal tongue bend test and X-ray test

(b) Pipes over 100 mm diameter shall undergo visual examination and 2 normal tongue bend tests and two reverse bend tests and X-ray tests
HAZARDS

1. ELECTRIC SHOCK
2. FUMES AND GASES
3. FIRES AND EXPLOSION
4. INJURIES DUE TO INSUFFICIENT PPE
5. OTHER HAZARD
ELECTRIC SHOCK

**PRIMARY** - may occur when a welder touches electrically “hot” parts inside the welder case or the electric distribution system to which the welder is connected. This action can lead to a shock of 230 or 460 volts.

**SECONDARY** - The most common type of electric shock is secondary voltage shock from an arc welding circuit, which ranges from 20 to 100 volts. Bear in mind that even a shock of 50 volts or less can be enough to injure or kill an operator, depending on the conditions.
SOLUTION

Wear dry gloves in good condition, never touch the electrode or metal parts of the electrode holder with skin or wet clothing and be sure to insulate themselves from the work and ground, keeping dry insulation between their body and the metal being welded or ground (such as a metal floor or wet surface).

Pre inspection of electrode holders, wires and cables along with machine. Any repairs should be done prior to the welding
Welding “smoke” is a mixture of very fine particles (fumes) and gases. Many of the substances in welding smoke, such as chromium, nickel, arsenic, asbestos, manganese, silica, beryllium, cadmium, nitrogen oxides, phosgene, acrolein, fluorine compounds, carbon monoxide, cobalt, copper, lead, ozone, selenium and zinc, can be extremely toxic.

Short term exposure can cause irritation in eyes, nausea, coughing, bronchitis etc. Where long term exposure may be fatal. It can cause **CANCER, METAL FUME FEVER** (caused by metal oxides eg: ZnO) etc.
SOLUTION

- EXHAUST FANS
- APPROVED RESPIRATORS FOR WELDERS
- MAKING AWARE OF THE THRESHOLD LIMIT VALUES (TLV) & PERMISSIBLE EXPOSURE LIMITS (PEL) FOR THE SUBSTANCES IN WELDING FUME
The welding arc creates extreme temperatures, and may pose a significant fire and explosions hazard if safe practices are not followed. While the welding arc may reach temperatures of 10,000 degrees Fahrenheit (5538 celcius), the real danger is not from the arc itself, but rather the intense near the arc and the heat, sparks and spatter created by the arc. This spatter can reach up to 35 feet away from the welding space.
SOLUTION

- INSPECTION AND REMOVAL OF ALL FLAMABLE MATERIALS FROM WORK AREA (AT LEAST 35FT AWAY)
- PROVIDING FIRE ALARMS, EXTINGUISHERS, FIRE BLANKET ETC
- FIRE WATCHER IN THE AREA
- TRAIN THE WELDER TO OPERATE EXTINGUISHER
INJURIES FROM INSUFFICIENT PPE

Personal protective equipment (PPE) helps keep welding operators free from injury, such as burns – the most common welding injury – and exposure to arc rays.
SOLUTION

- Helmets with side shields & right shade lens
- Even when wearing a helmet, always wear safety glasses with side shields and respirators
- Leather and flame-resistant treated cotton clothing
- Leather boots with 6-to-8-inch ankle coverage
- Heavy, flame-resistant gloves should always be worn
- Ear protection
- Avoid rolling up sleeves or pant cuffs
# Lens Shade

## Shade Numbers for Selected Arc Processes (from CSA W117.2)

<table>
<thead>
<tr>
<th>Process</th>
<th>Electrode Diameter (mm)</th>
<th>Current (Amperes)</th>
<th>Minimum Shade</th>
<th>Suggested Shade</th>
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<tbody>
<tr>
<td>SMAW</td>
<td>&lt; 2.5</td>
<td>&lt; 60</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2.5 - 4</td>
<td>60 - 160</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>4 - 6.4</td>
<td>160 - 250</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>&gt; 6.4</td>
<td>250 - 550</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>GMAW FCAW MCAW</td>
<td>&lt; 60</td>
<td>&lt; 60</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>60 - 160</td>
<td>60 - 160</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>160 - 250</td>
<td>160 - 250</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>250 - 500</td>
<td>250 - 500</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Air Carbon Arc Cutting light heavy</td>
<td>&lt; 500</td>
<td>&lt; 500</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>500 - 1000</td>
<td>500 - 1000</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

*In the United States use ANSI/AWS Standard F2.2 for selecting filter lens shades.*

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VIBRANT INDUSTRIAL TRAINING ACADEMY
OTHER HAZARDS

Due to poor housekeeping, slip trip and fall hazard
Soln- Keep the area clean and tidy

Falls from elevation due to carelessness or electric shock
Soln- Provide handrails, Safety harness or any kind of fall restraint system

Falling of gas cylinders from the frame
Soln- Provide chain locks to secure the cylinder
OTHER HEALTH RISKS

Eye damage- More than 5% of all eye injuries in the construction industry are associated with welding, cutting, and brazing
• damage to retina
• damage to cornea, resulting in cataracts
• permanent eye damage
Invisible UV light can cause “arc eye” or “welders’ flash”

May include sandy or gritty eye, blurred vision, intense pain, tearing, burning and headache
Problem with the paint

Arc welding and cutting are dangerous if paint finish coating has high UV reflectivity. Always use paints with pigments like titanium dioxide or zinc dioxide which has low reflectivity to UV radiation
TRANSPORTATION OF CYLINDERS

When transporting cylinders by a crane:
Use a cradle or suitable platform
Never use slings or electric magnets
Valve-protection caps always in place
TRANSPORTATION OF CYLINDERS

• Never use valve-protection caps to lift cylinders from one vertical position to another
Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet (6.1 m).
ENGINEERING CONTROLS AND PRACTICES

- Welding booths should be painted with dull finishes so they don’t reflect UV light
- Acoustic shields between the worker and noise sources can reduce exposures
- Noisy machinery can be totally enclosed
ENGINEERING CONTROLS AND PRACTICES

- Use cadmium-free silver solders
- Use asbestos-free electrodes, gloves, and hot pads
- Use work area barriers to protect others working in the same general area
WELDING IN CONFINED SPACES

• Gas cylinders must be located outside to avoid possible contamination of the space with leaking gases
• Power sources for welding should be outside too
• Lighting requirements – low voltage 12v or if 110v is required & the circuit must be fire proof and protected
• Enough ventilation (oxygen percentage-19.5% to 23.5%)
• Continuous monitoring and emergency rescue devices should be in place

• AND ALWAYS CONFINED SPACE PERMIT!!!!!
GUESS WHATS WRONG.
Cylinder laying in a horizontal position.

Electrical cord in Contact with the cylinder
Cylinders are not protected from falling. Note that the Chain is not secured across.
1. Cylinder not secured
2. Electrical cord draped over.
1. Small cylinder not tied off
2. Combustibles stored with cylinders

3. Bad housekeeping

4. Acetylene and Oxygen stored too close together and no chain.
1. Cylinder with no valve or cap installed

2. Laying horizontal on the ground

3. Subject to damage
Cylinder is damaged. Should be taken out of service immediately!
Cylinder should be in storage protected from damage and not laying on the ground regardless if it is full or empty
Old, corroded cylinder that should have been disposed of a long time ago.
1. Cylinders laying on the ground and improperly stored
2. Subject to damage from forklift operation in vicinity
1. Unsecured acetylene cylinder  2. Exposed to damage
Regulator left pressurized after use
Improper Storage
Improper storage of cylinders-acetylene and oxygen stored next to each other
Evidence of smoking next to acetylene cylinders
This cylinder should be taken to storage and housekeeping should be improved.
Cooking equipment within 20 ft of containers
Cylinder not in use with regulators still on the cylinder.

Free standing cylinder.
Free standing cylinder
Free standing cylinders
AFTER WELDING

A visual examination of weld by a competent person.
Followed by a Non destructive test of weld joints

- Liquid Penetrant –SURFACE DEFECTS
- Magnetic-SURFACE & MID SURFACE DEFECTS
- Ultrasonic- SUB-SURFACE DEFECTS
- Radiography-SUB-SURFACE DEFECTS
- Eddy Current
LPT

- CLEANER
- PENETRANT
- SOLVENT
The part is magnetized. Finely milled iron particles coated with a dye pigment are then applied to the specimen. These particles are attracted to magnetic flux leakage fields and will cluster to form an indication directly over the discontinuity. This indication can be visually detected under proper lighting conditions.
Crack Indications
Film Radiography

The part is placed between the radiation source and a piece of film. The part will stop some of the radiation. Thicker and more dense area will stop more of the radiation.

The film darkness (density) will vary with the amount of radiation reaching the film through the test object.

- Light area = less exposure
- Dark area = more exposure
Images
Ultrasonic Inspection

High frequency sound waves are introduced into a material and they are reflected back from surfaces or flaws.

Reflected sound energy is displayed versus time, and inspector can visualize a cross section of the specimen showing the depth of features that reflect sound.
Application of NDT

» Inspection of Raw Products
» Inspection Following Secondary Processing
» In-Services Damage Inspection
THANK YOU