

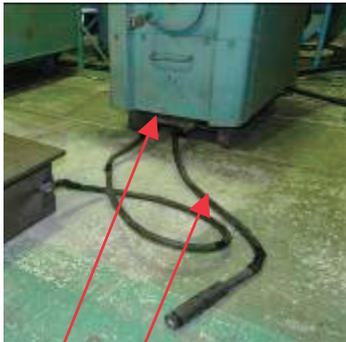
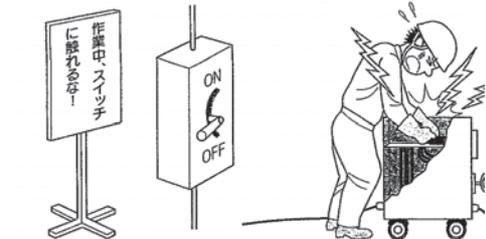
A Safety Manual for Technical Intern Trainees

Preventing Accidents While Engaged in  
Welding and Related Operations

**JITCO**

Every year, nearly 100 technical intern trainees are injured during welding operations. Approximately one-quarter of these injuries are serious. Even the slightest inattention or unsafe behavior may lead to an accident. To ensure that you return to your home countries free of injuries, we have prepared the following accident prevention checklists for arc welding and related work organized by risk type. **Please use the checklists provided below to check your work and work methods. If there are any problems, please read the page on the right and take the necessary corrective measures.**

## 1. Checklist for Preventing Electric Shocks

<p><b>Work check 1</b> Are you wearing protective gear appropriate for arc welding?</p> <p><b>Work check 2</b> Have you made sure there are no water puddles in your work area?</p> <p><b>Work check 3</b> Have you checked the insulation of the cable and holder, and the state of the insulation covering the connections of the arc welder, cable, and holder?</p> <p><b>Work check 4</b> Before you start working, have you checked whether the automatic electric shock prevention device installed on the arc welder is operational?</p> <p><b>Work check 5</b> Do you turn off the power when you are not working? And have you placed a sign instructing others not to touch the on/off switch?</p>	 <p data-bbox="927 909 1327 987">Check insulation on welding machine, cables and holders.</p> 
 <p data-bbox="359 1570 582 1597">Don't touch switches</p>	

## 2. Checklist for Preventing Fire/Explosion Due to Spattering, etc.

<p><b>Work check 1</b> Have you made sure you are not welding next to hazardous or flammable substances? (Ignoring this is extremely risky, even if you are welding for a short time only.)</p>
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## 1. Preventing Electric Shock

Electric currents exceeding 150 amps are generated during AC arc welding. The arc voltage when welding is about 23 to 33 V, but the welder's voltage when not welding is about 85 V if the automatic electric shock prevention device is not turned on, so you must be careful not to get shocked.

Furthermore, electric shocks suffered at elevated locations may cause fall of your body to the floor below, resulting in serious injury or even death.

### About work check 1

Wearing and using protective gear for arc welding is crucial in preventing electric shock. Make sure that the gloves and work clothes you wear are dry.

### About work check 2

Water puddles conduct electric current and become very dangerous because they dramatically increase the risk of electric shock. Contact your technical intern training coordinator or other instructor for instructions on how to perform work safely if you notice water puddles.

### About work check 3

There is a risk of electric shock when there is inadequate insulation covering a welder's cable connections, cable, and holder. Insufficient insulation requires replacement or patching with electrical insulation tape, so make sure to notify your training coordinator rather than trying to fix it yourself. Furthermore, stow the holder away in the designated location. Do not leave it lying around.

### About work check 4

An automatic electric shock prevention device is installed on the arc welder for preventing electric shock during the welding process, so make sure to check functionality before you start working.

### About work check 5

You must turn off power to the welder when you are not working to prevent others from being injured. Furthermore, it is extremely dangerous if someone else mistakenly turns on power while you are not working or while electrical equipment is being repaired, so you must instruct others not to touch the on/off switch.

## 2. Preventing Fire/Explosion Due to Spattering, etc.

The sparks and spatter that occur during arc welding often cause fires or explosions by igniting flammable materials or explosive materials in the area.

### About work check 1

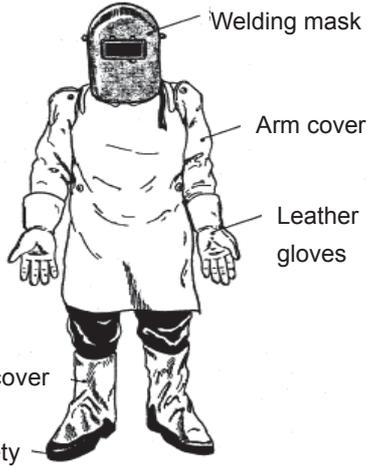
Be aware of the following instructions in order to prevent fire, explosion, and injuries due to Spatter, etc.

- (1) Do not weld where there is the possibility of sparks coming in contact with combustible substances, including paint thinner (organic solvents, etc.) and flammable gases. (If welding cannot be avoided in such areas, remove the hazardous substances and flammable materials and eliminate or ventilate gases.)
- (2) Keep the work site tidy and organized at all times.
- (3) Wear work clothes made of cotton, and avoid those made out of easily combustible materials, such as polyester and nylon.
- (4) Wear safety gear, including protective glasses, a leather protective apron, arm covers, leg covers, and leather gloves to prevent hazards from spatter (high-temperature metal particles) and slag (non-metallic materials).
- (5) Use a spark catcher when working at elevated locations (2 m or higher).
- (6) When welding near insulation made of such as foam polystyrene, shield it with nonflammable boards, sheets, or other such items to protect it from sparks.

### 3. Checklist for Preventing Eye and Skin Injuries Due to Arc Source

**Work check 1**  
Do you always use a welding mask and light-shielding glasses when welding?

**Work check 2**  
Do you wear protective gear to prevent exposure of skin and other parts of the body? Check the photos and illustrations for the protective gear to use.




Welding masks



Light-shielding glasses

### 4. Checklist for Preventing Respiratory Disorders Due to Welding Fumes

**Work check 1**  
Are you wearing a dust mask, air mask, or air-supplied respirator while working?

**Work check 2**  
Have you undergone or are you planning to undergo pneumoconiosis exams?



Dust masks (replaceable filter)      Dust mask (disposable)      Respiratory protective devices with electric fan (face-shield type)



Breathing apparatus      Air-supplied mask      Hose mask

### **3. Preventing Ophthalmia (Eye Inflammation) and Skin Injuries due to Arc Source**

The arc source includes ultraviolet light, and when eyes are exposed to such light for more than a certain length of time, the eyes will begin to feel like sand or foreign objects are inserted in them after a latency period. Acute symptoms (electric ophthalmia) may occur, including difficulty in keeping the eyes open, tearing (i.e. watery eyes), and eyelid spasms. And when the skin is exposed to the arc source, inflammation may occur, including redness with blistering, similar to sunburn.

#### **About work check 1**

Welding masks come in either helmet or hand shield form, but the helmet form is more convenient because it frees up both hands. And use appropriate light-shielding glasses to protect the eyes in case you fail to put the welding mask on.

#### **About work check 2**

Light from the arc source can cause skin burns, so be sure to prevent skin exposure. Be particularly careful not to expose the area around the neck.

### **4. Preventing Respiratory Disorders Due to Welding Fumes**

Welding fumes consist of metal that has been vaporized by arc heat, and when those vapors cool in the air, they form tiny metal oxide particles that look like smoke. Inhaling large quantities of these fumes may cause a high fever (metal fume fever). Recovery normally comes within 24 to 48 hours, but continuous inhalation of fumes for long periods of time without protection may result in pneumoconiosis (impaired lung function).

#### **About work check 1**

When welding in confined spaces, be sure to operate a local exhaust system, ventilation system, or some other similar system. Also, be sure the dust mask you put on is a certified one.

#### **About work check 2**

When the organization implementing technical intern training holds pneumoconiosis exams, make sure to participate.

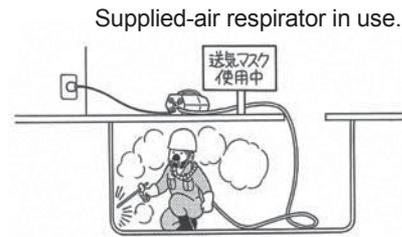
## 5. Checklist for Preventing Carbon Monoxide Poisoning

### Work check 1

Is there adequate ventilation during CO<sub>2</sub> arc welding?

### Work check 2

In locations with inadequate ventilation, are you wearing an air respirator or air-line mask?



Use of a supplied air respirator

## 6. Checklist for Preventing Heatstroke

### Work check 1

Are work site ventilation, air circulation, and air supply adequate?

### Work check 2

Is intake of water and salt adequate?

### Work check 3

Are you wearing a cooling vest or similar garment?

### Work check 4

Are you taking breaks in a cool location?



Cooling vest

### Emergency measures

These conditions are considered emergencies requiring immediate attention: (1) Body temperature rises; (2) Body does not sweat, is hot to the touch, and the skin is red and dry; (3) A severe headache; (4) Dizziness and/or vomiting; (5) Impaired consciousness, including confused responses or no reaction when called.

In any of these cases, **call for an ambulance** and then take the following emergency measures:

(1) Move victim to a cool environment.

Move the victim into an environment with good air circulation, preferably one with air conditioning.

(2) Cool body.

Remove clothing to help the victim's body cool down. Moisten the skin with water and cool the body with fanning. If an ice pack or similar item is available, apply it to the neck area, underarm area, and lower pelvis (base of the thigh and hip area) to aid cooling. It is important to start the cooling process immediately, even before emergency medical technicians arrive.

(3) Furnish liquids and salt.

If the victim is able to drink, furnish sports drinks, salt water (0.8%), juice, or other electrolyte-containing drinks. However, it is dangerous to place liquids in the mouth of victims that may be suffering from impaired consciousness.

## 5. Preventing Carbon Monoxide Poisoning

CO<sub>2</sub> arc welding, generates carbon monoxide due to the thermal decomposition of the CO<sub>2</sub> shield gas. Work conducted in areas lacking adequate ventilation or in confined spaces runs a major risk of carbon monoxide poisoning.

Initial symptoms of carbon monoxide poisoning include headache, shortness of breath, and dizziness, and in more severe cases, it can lead to ataxia of gait (inability to coordinate leg muscles), fainting, coma, or respiratory arrest.

### About work check 1

When working in confined spaces, such as inside tanks, or indoor locations with inadequate air circulation, you must ensure adequate ventilation and keep the concentration of airborne carbon monoxide to 50 ppm or less at the work site.

### About work check 2

Dust masks are ineffective in preventing carbon monoxide poisoning, so when working in locations where the concentration of airborne carbon monoxide cannot be maintained at 50 ppm or less, always use an air respirator (hose mask), air-line mask, breathing apparatus, or other such device.

## 6. Preventing Heatstroke

Arc welding often entails working in confined spaces that are hot and humid, as well as performing physical activity for relatively long stretches of time. As a result, heatstroke is a particular risk during the hot summer months between June and September.

In high temperature environments, heatstroke can cause disruptions in the body's balance of moisture and salt and lead to a breakdown in the body's regulatory functions or even death.

### About work check 1

Ensuring adequate ventilation, air circulation, and air supply, as well as improving the work environment are crucial in preventing heatstroke. Report to your training coordinator if you notice that the ventilation or air supply is inadequate.

### About work check 2

Appropriate intake of water and salt is crucial to prevent heatstroke, but be careful not to drink too much water.

### About work check 3

If the work environment cannot be adequately improved, consider wearing working clothes with a cooling device (cooling vest). Note that sweating increases the risk of electric shock, therefore regulating body temperature is crucial.

### About work check 4

When working in hot and humid locations, suitable breaks are needed to help prevent the onset of heatstroke.

The "Emergency measures" section on the left page describes the conditions requiring emergency measures when heatstroke occurs, as well as detailed information on those measures.

## 7. Checklist for Preventing Anoxia (Oxygen Deficiency)

### Work check 1

Have you noticed locations where there is a risk of anoxia (for example, inside tanks)?

### Work check 2

At locations where there is a risk of anoxia, are you measuring oxygen concentrations before commencing work?

### Work check 3

When there is an oxygen concentration under 18%, are you introducing fresh air before work begins or wearing an air respirator, air-line mask, or similar device?

## 8. Checklist for Handling High-Pressure Gas Cylinders

### Work check 1

Have you made sure gas cylinders are not being used on their sides?

### Work check 2

Have you secured cylinders to prevent them from falling over?

### Work check 3

Is a handle attached to the gas cylinder's valve?

### Work check 4

Is the gas flow meter installed vertically so as to be read easily?

## **7. Preventing Anoxia (Oxygen Deficiency)**

Air contains 20% to 21% oxygen, but when the oxygen concentration drops, the brain, which particularly requires oxygen, may suffer damage that may even lead to death. Confined spaces surrounded by steel panels may be oxygen deficient. Great care is required, as oxygen-deficient locations are difficult to identify because there is no particular color or odor distinguishing them.

### **About work check 1**

The air inside damp tanks may undergo a drop in oxygen concentration when rusting iron leaches oxygen from the air. Particular care must be taken because such locations run the risk of becoming oxygen deficient.

### **About work check 2**

Always measure oxygen concentrations if you suspect that oxygen may be deficient.

### **About work check 3**

Oxygen concentrations below 18% are dangerous. Always adopt the measures described in “Work check 3” before commencing work.

## **8. Handling High-Pressure Gas Cylinders**

Semi-automatic welding work may use high-pressure gas cylinders. Mishandling of high-pressure gas can cause accidents if a cylinder ruptures.

### **About work check 1**

Always store cylinders in an upright position.

### **About work check 2**

Take precautions to prevent upright cylinders from falling over.

### **About work check 3**

Make sure that a handle is installed on cylinder valves so that they can be immediately shut off in an emergency.

### **About work check 4**

Gas flow meters should be installed correctly as they cannot be properly read when installed at an angle.

## 9. Checklist for Preventing Accidents During Grinding Associated with Welding

### Work check 1

Make sure you check the maximum usable speed of the grinding wheel (grindstone) before each use. Is the RPM/speed of the grinder set within the maximum usable speed?

### Work check 2

Is the grinder enclosed within a sturdy cover, excluding the portion used for grinding?

### Work check 3

Be sure to perform a one-minute test run in a safe location before starting to grind, and verify that there are no abnormal sounds or vibrations during the test run.

### Work check 4

Has a shield or protective panel for protection against grinding particles been installed? Is it being replaced regularly?

### Work check 5

Do you always wear safety glasses before starting to work?

### Work check 6

Be sure to use a ventilation system or dust arrester when grinding, and wear a dust mask while working.

### Work check 7

When using a handheld grinder, do you make sure it has come to a complete stop before putting it down on a table or floor?

### Work check 8

When using a handheld grinder, do you use it by pulling motion with the grinding wheel (grindstone) at an angle of no more than 30 degrees from a horizontal position?

## 10. Do You Understand These Safety and Health Signs?



禁煙  
(No smoking)



接觸禁止  
(Don't touch)



火氣嚴禁  
(No open flames)



立入禁止  
(Keep out)



一般注意  
(Caution)



感電注意  
(High voltage)



障害物注意  
(Watch your step)



頭上注意  
(Low clearance)



安全帶使用  
(Safety harness required)



保護帽着用  
(Hardhat required)



緊急時出口  
(Emergency exit)



消火器  
(Fire extinguisher)

## 9. Preventing Accidents during Grinding Associated with Welding

Grinding wheels will be damaged or broken if excessive force is applied. Because they spin at a high speed, exceeding their cohesive strength will cause them to fail catastrophically. This can lead to serious accidents and even death.

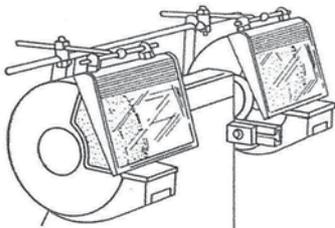
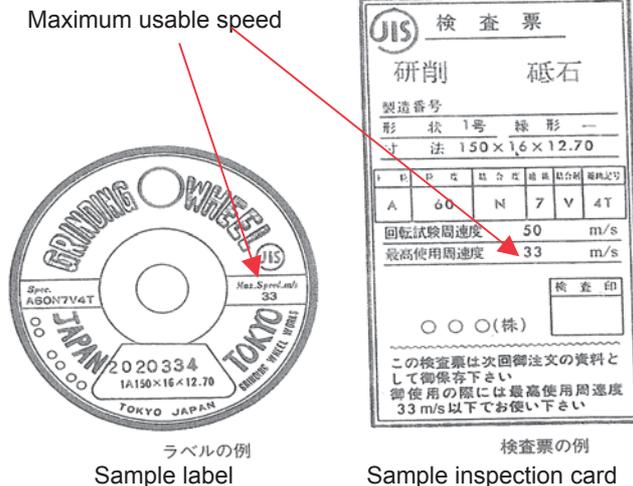
There are also an extremely large number of accidents caused by flying grinding chips, as well as many accidents caused by contact or entanglement with the grind wheel. Attention must also be paid to preventing hazards caused by the inhalation of grinding dust.

**About work check 1** — The maximum usable speed is as shown in the figures to the right. It is recorded on the grinding wheel's label and inspection card. Using a grinding wheel exceeding its maximum usable speed runs the risk of rupturing it.

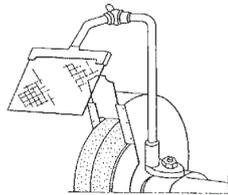
**About work check 2** — The grinding wheel cover is extremely important in preventing hazards in the event the grinding wheel ruptures. It also helps prevent contact between the wheel and the user.

**About work check 3** — Check for any irregular noise, vibration or other abnormality of the grinding wheel by performing a test run in a safe location. Report any abnormalities to a training coordinator.

**About work check 4** — Safety glasses and a clear plastic shield are required in front of the grinding surface to prevent dust from getting in your eyes. The shield tends to get scratched up and cloudy, so it must be regularly replaced. Have a training coordinator do the installation/replacement work.



Shield attached



Safety glasses

**About work check 5** — To prevent eye injuries, safety glasses with side protection must be used.

**About work check 6** — Ventilation systems or dust arresters are measures to prevent health problems associated with exposure to grinding dust and other debris.

**About work check 7** — Putting the grinder down on a table or floor while it is still moving will cause it to spin around and may result in injuries.

**About work check 8** — To prevent the grinding wheel from gouging into the work piece and causing the grinder to spring away as a result of the recoil, pull the handheld grinders with the grinding wheel at an angle of no more than 30 degrees from a horizontal position, especially when the grinding wheel is brand new.

## 10. Understanding and Obeying Safety and Health Signs

Safety and health signs are an effective method for ensuring worker protection. There are a variety of accepted signs based on international standards and Japanese Industrial Standards (JIS), as well as those that differ by industry and company. The signs shown on the left are typical of those based on international standards and Japanese Industrial Standards (JIS). In addition to these, there are other signs created by various training organizations, so make sure to understand and obey them.

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