



Dryden Flight Research Center
Edwards, California 93523

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Dryden Centerwide Procedure

Code S

Shop Safety (With changes 05-03-11.)

Electronically approved by
Assistant Director for Management Systems

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1.0 PURPOSE OF DOCUMENT

This document describes procedures and guidelines, delegates authority, and assigns responsibility for managing the Dryden Flight Research Center (DFRC) shop safety program. It provides minimum requirements necessary to eliminate or control occupational injuries and illnesses resulting from shop mishaps. Due to the numerous shop requirements at DFRC, this document cannot elaborate on every task.

2.0 PROCEDURE SCOPE & APPLICABILITY

Scope: This procedure applies to practices necessary to ensure safety in DFRC shops.

Applicability: This procedure applies to all persons at Dryden Flight Research Center (DFRC) and Dryden Aircraft Operations Facility (DAOF) including civil servants, contractors, visitors, and experimenters.

3.0 PROCEDURE OBJECTIVES, TARGET, METRICS, & TREND ANALYSIS

Objective: Reduce or eliminate occupational injuries and illnesses resulting from shop mishaps.

Target: Zero personnel injuries and illnesses resulting from shop mishaps.

Metric: Number of injuries/illnesses.

Trend analysis: All injuries and illnesses are tracked in the IRIS system. Metrics will be analyzed to determine whether procedural objectives have been met.

4.0 WAIVER AUTHORITY

Requests for waivers and variances to DFRC Shop Safety Program will be made to the Office of Safety and Mission Assurance, (Code S) on form [DFRC 117-1f](#). Requests for waivers and variances to NASA safety instructions are made to NASA HQ in accordance with instructions provided by NPR 8715.3, NASA General Safety Program Requirements, Par. 1.13, Safety Variance Process, and Par. 1.6, Risk Assessment and Risk Acceptance.

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5.0 RESPONSIBILITIES

5.1 Directorates and Single Letter Organizations

Directorates and single letter organizations are responsible for ensuring shops within their area of responsibility follow appropriate safety procedures.

5.2 The Chief, Safety, Health, & Environment Office

The Chief of the Safety, Health, and Environment Office has oversight of the Safety and Health Program and, as such, is responsible for

- A. Developing and maintaining a shop safety program for DFRC
- B. Evaluating each shop's safety program as part of safety inspections
- C. Investigating shop mishaps and incidents and reporting findings to DFRC management and required agencies. Follow instructions in NPR 8621.1 NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping as appropriate.

5.3 Shop Supervisors

Shop supervisors' responsibilities include providing and maintaining a safe and healthful work environment. Shop supervisors will ensure that safety procedures are developed and followed. To accomplish this, the shop supervisor, as a minimum will:

- A. Ensure that workers are adequately trained to accomplish their tasks. New employees and those transferred from other locations will receive indoctrination in the Standard Operating Procedures (SOPs) of the shop.
- B. Inform employees of specific hazards associated with their workplace and duties.
- C. Ensure that employees are informed of NASA safety and health programs and of the protection afforded employees through these programs.
- D. Inform employees of the location of the nearest medical treatment facility, procedures for obtaining treatment, and methods for reporting occupational injuries or illnesses.
- E. Ensure safe shop practices are followed.
- F. Instruct employees to report hazardous conditions to their immediate supervisor and/or to the Center safety and health official.
- G. Enforce good housekeeping.

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- H. Provide workers with proper equipment including PPE and ensure they are trained to use it.
- I. Support safety and health personnel in developing a safe and healthful work area.

5.4 Employees

As a condition of employment, employees are responsible for following all safety rules, regulations, and practices. Each shop employee is responsible for

- A. Complying with all safety and health standards, rules, and regulations issued by NASA, Federal, State, and local authorities.
- B. Using established procedures to report suspected safety or health hazards, such as by using form [D-WK 127-8](#), Dryden Safety Report, the DFRC and Agency Mishap Reports link, and the NASA Safety and Hazard Reporting link, all available for download on the DFRC Intranet website.
- C. Beginning a shop task only when knowledgeable of the proper safety procedures required to accomplish the task.
- D. Notifying the shop supervisor of any unsafe condition or practice.
- E. Using PPE when required or directed by supervisors.
- F. Reporting all injuries or accidents to the shop supervisor immediately.
- G. Promptly obtaining necessary emergency medical care as the result of an occupational injury or illness.

5.4.1 Employee Access to Information and Participation in the NASA Safety and Health Program (NPR 8715.1)

Employees or their designated representatives will be given the following information with regard to NASA occupational safety and health programs:

- A. Access to documents describing NASA's occupational safety and health programs including the Act, applicable Executive Orders, Federal, State, and local regulations, and standards.
- B. Access to the log and summary of occupational injuries and illnesses, including OSHA Form 300A or its equivalent, subject to the Privacy Act of 1974, as amended, 5 USC 552a.
- C. Access to proposed NASA occupational safety and health standards and encouragement to provide comments to their appropriate representatives or committees.

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- D. Access to inspection reports, job hazard analyses of the work site, associated job safety and health documentation, and accident investigations

5.4.2 Employees Rights & Expectations

- A. NASA-sponsored medical examinations at no cost when the Center or Component Facility occupational health or safety representative identifies significant exposure or significant potential for exposure to a chemical, physical, or biological agent in the work environment.
- B. Safety and health training, appropriate for the degree of hazard associated with their occupation or workplace.
- C. Employees will be represented on Center or Component Facility safety and health committees or their subcommittees.
- D. Employees are empowered to cease any process or operation they believe is unsafe and request analysis by a qualified individual. The qualified individual will determine the corrective actions needed (if any) and when the process or operation may be resumed.
- E. Employees have the right to report unsafe and unhealthful working conditions to appropriate officials.
- F. Employees will be authorized official time to participate in the Agency safety and health programs and in the activities provided for in Section 19 of the Act, Executive Order 12196, and 29 CFR 1960

5.4.3 Dissemination of Program Information

- A. Employees must be made aware of the Center safety and health programs. Copies of Executive Order 12196, 29 CFR Part 1960, details of NASA's Occupational Safety and Health programs, and applicable safety and health standards will be made available, upon request, to employees or employee representatives for review.
- B. A copy of the Center written safety and health program information will be made available to each supervisor, safety and health committee member, and employee representatives.
- C. The Center safety and health official(s) will ensure that a poster (NASA Form 1613, "NASA Occupational Safety and Health Protection For Federal Employees") is conspicuously posted in each major facility informing employees of the provisions of the Act, Executive Order 12196, and NASA's Occupational Safety and Health programs. Individual NASA Centers or Component

Facilities must augment such posters with site specific information, which includes the following:

- 1) Details of the Center procedure for responding to employee reports of potential unsafe or unhealthful conditions.
- 2) Details of NASA's procedure for filing allegations of discrimination or reprisal for participating in the safety or health program or for reporting potential unsafe or unhealthful conditions.
- 3) Locations where employees may obtain information regarding the Center safety and health programs.
- 4) Relevant information about the Center's safety and health committee. An annual summary of occupational injuries and illnesses must be posted no later than 45 calendar days after the close of the fiscal year or otherwise disseminated in written form to all employees of the workplace.

5.5 Basic Shop Safety

Mishaps occur when unsafe work conditions or practices exist. The operation of a safe shop rests primarily on good judgment, common sense, and the practice of following safety guidelines and procedures. Each shop activity should be looked at as a specific task and evaluated for the hazards it presents and, if deemed necessary, a safety analysis conducted and safety procedures written for it.

5.6 General Shop Rules

- A. Shop employees must be knowledgeable of and comply with appropriate safety procedures.
- B. Equipment will be operated only by qualified employees. Equipment will not be borrowed or used by persons whose qualifications are unknown by the shop supervisor.
- C. Employees will seek qualified guidance for tasks when they are unsure of the safety procedures required by the task.
- D. Employees are expected to report any hazardous condition or procedure. A verbal notification to the shop supervisor generally suffices; however, if a more formal notification is indicated, form [D-WK 127-8a](#), Dryden Safety Report, can be filled out and sent to the Safety, Health, and Environmental Office. For immediate notification, contact the Safety, Health, and Environmental Office.
- E. Noninjury mishaps and near misses will be reported to the shop supervisor immediately. Injury mishaps and imminently dangerous

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situations will be reported by use of the 911 emergency telephone system.

- F. Barrier tape or barricades will be used to identify and isolate hazardous tasks such as those requiring the use of hazardous materials. Unauthorized persons may not enter an isolated area without approval from the shop supervisor.
- G. Equipment will not be operated until all required safety devices, such as guards, switches, deflection shields, etc., are in place and functional.
- H. Supervisors will ensure that machines having grinding, shearing, punching, pressing, squeezing, drawing, cutting, rolling, mixing, or similar actions in which the employee comes within the danger zone have the appropriate safe guards.
- I. Alterations or major repairs to shop safety equipment such as guards, shields, safety switches, warning device, etc., will not be made unless authorized by the shop supervisor and approved by the Chief, Safety, Health, and Environmental Office. Any damaged or inoperable safety equipment or warning devices will be reported to the shop supervisor immediately and the equipment will be removed from service until repaired.
- J. Equipment in shops will be located in such a manner that one piece of equipment will not pose a hazard to another. Stationary and portable equipment will not be used in a manner that poses a hazard to operations near-by. Portable tools will be stored in a safe manner to preclude a safety hazard or damage.
- K. Good housekeeping is essential to shop safety. All debris will be cleaned up following a task completion. Containers with shop debris will be emptied each work period and will not remain in the building over night. Compressed air will not be used for cleaning unless pressures are less than 30 psi, chip guards are in place, and necessary protective gear is worn. Employees are prohibited from using compressed air to blow themselves (clothes or skin) or others clean. Metal chips will not be vacuumed up.
- L. Shop supervisors will ensure that shop personnel are familiar with procedures in [DCP-X-027](#), Bloodborne Pathogens.
- M. Shop floors will be kept clean. Any substance that causes the floor to become slippery will be cleaned up or barricaded immediately.
- N. Clean-up procedures for hazardous material is found in
 - 1) DFRC procedure on Hazard Communication, and in [DCP-S-102](#), Environmental Management System Chemical Management.

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- 2) [DCP-S-110](#), Environmental Management System Emergency Preparedness and Response for Hazardous Material Release
 - 3) 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. If a hazardous material spill or release is beyond the capability of shop personnel to control, the 911 emergency telephone system will be used to notify appropriate response personnel.
- O. Equipment will not be left running unattended unless designed to do so.
 - P. Equipment operators will not wear jewelry, loose fitting clothes, gloves, neckties, or other apparel that could become entangled in the moving parts of machinery. When working in close proximity to rotating parts, hair will be kept under a hat or contained in such a manner to preclude entanglement.
 - Q. Appropriate PPE will be worn when required. Persons required to use PPE will be trained in its use.
 - R. Manual gauging of work will not be done while the stock is rotating unless a procedure for doing so has been approved.
 - S. Procedures in [DCP-S-062](#), Lockout / Tagout, will be followed before equipment that uses an energy source is repaired or modified.
 - T. Aisles and walkways will be of proper width and clearly marked. Aisles, passageways, corridors, fire lanes, and emergency equipment will not be blocked.
 - U. Practical jokes and horseplay will not be tolerated in a shop environment.
 - V. Careful attention will be taken to avoid over-pressurizing drums or vessels. Pressurization of drums and vessels will be done with the supervisor's knowledge. The Safety, Health, and Environmental Office will be contacted for any questions regarding the pressurization of drums or vessels. See [DCP-S-065](#), Pressure Vessels and Pressurized Systems Safety.
 - W. Operators of lifting equipment such as forklifts, cranes, overhead cranes, manlifts, and scissors lifts will be certified. When lifting equipment is used, the operator will ensure the load is secure and that, if required, ropes, cables, and slings are in place, secured, and in good condition. Traffic will be directed away from the lift area and an adequate number of persons will be available to direct and assist with the lift. See the DFRC procedure on lifting operations, devices, and equipment for details, and information contained in NASA STD 8719.12.

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- X. Walking or working under suspended loads such as those on forklifts and cranes is prohibited.
- Y. Personnel will follow proper ergonomic procedures when lifting. Lifting loads beyond one's ability will not be attempted. Heavy or bulky loads will be lifted and transported with dollies, hoists, and shop lifts instead of being lifted manually whenever possible. Supervisors or employees may request from Code SH to conduct an ergonomic shop or office evaluation to help identify solutions that will minimize repetitive motion injuries.
- Z. Appropriate containers and pallets will be used when needed to protect equipment and material that are being moved or transported.
- AA. Eating, drinking, smoking, chewing, and food utensil storage is prohibited in work areas where toxic materials are used or stored (e.g., chemical cribs, painting booths, hangars, machining or welding shops). Food may only be stored in refrigerators designated for that purpose and consumed in approved areas.

5.7 Hand & Portable Hand Tools

(See 29 CFR 1910 Subpart P, Hand and Portable Powered Tools and Other Hand Held Equipment)

5.7.1 Hand Tool Safety Rules

- A. Only tools that are appropriate for the task will be used. Makeshift tools will not be used unless approved by the shop supervisor.
- B. Tools will be kept in good condition. Inspect tools prior to use. Damaged tools will be repaired or discarded.
- C. Flattened heads on chisels, punches, hammers, etc. will be reshaped to avoid chipping and causing flying particles.
- D. Tools will be cleaned and stored in designated storage containers when not in use.
- E. Shop tools will not be loaned, borrowed, or used by anyone who is not associated with the particular shop without approval of the shop supervisor.
- F. Appropriate PPE will be worn when using hand tools.

5.7.2 Portable Power Tool General Safety Rules

- A. Do not carry the tool by the cord or hose.
- B. Do not yank a cord or hose to disconnect it from its receptacle.
- C. Keep cords and hoses away from heat, oil, and sharp objects.

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- D. Avoid accidental start-up. Disconnect tools from power source when not in use and before servicing or changing accessories such as blades or bits.
- E. Free hands by securing work with clamps, vise, etc.
- F. Keep tools in good working condition and never use damaged tools. Inspect tools prior to use.
- G. Wear proper apparel and use appropriate PPE

5.7.3 Powered Abrasive Wheel Tools

These tools pose a special safety hazard if not used and checked properly. Basic safety cautions:

- A. Ensure the wheel or disc is the proper size for the tool.
- B. Before using, inspect the wheel or disc for cracks or other damage.
- C. During start up, stand outside the plane of rotation to avoid flying particles.
- D. Ensure all safety guards are in place.
- E. Never clamp a hand-held power tool down such as in a vise.
- F. Wear eye protection and other appropriate PPE.

5.7.4 Torque Wrench Procedures

- A. A torque wrench with current calibration will be used when torque values are required. Torque procedures will be followed exactly. A steady pull on the torque wrench will be used. Avoid jerking the torque wrench in an effort to obtain a desired value.
- B. Torque wrench extenders cause false readings and will not be used without a conversion table.
- C. Torquing procedures include determining whether the fastener is to be clean and dry, lubricated, or requires the use an anti-seize or locking compound. Torque value may not be met if correct procedures are not used.

5.7.5 Pneumatic Tools

Inspect tools prior to use. Take precautions to avoid getting hit by the tool's attachment or the fastener being worked on. Never point a pneumatic tool toward someone, and do not "dead-end" it by pressing the tool onto your body. Use screens to protect nearby workers when necessary. Always use eye protection with these tools.

5.7.6 Powder Actuated Tools

Operators of powder-actuated tools will complete a training course and be certified prior to using them. Inspect tools prior to use. All safety precautions applicable to powder-actuated tools will be strictly followed when used at DFRC. See 29 CFR 1910.243 (d) and ANSI A10.3, Explosive-Actuated Fastening Tools, which is incorporated by reference (authoritative).

5.7.7 Hydraulic Power Tools

Hydraulic fluid will be fire resistant and the manufacturer's recommended safe operation pressure for hoses and equipment will not be exceeded. Inspect tools prior to use.

5.7.8 Safety Switches & Controls

- A. All hand-held powered circular saws that have a blade diameter greater than 2 inches, electric, hydraulic or pneumatic chain saws, and percussion tools without positive accessory holding means will be equipped with a constant pressure switch or control that will shut off the power when the pressure is released. All hand-held gasoline powered chain saws will be equipped with a constant pressure throttle control that will shut off the power to the saw chain when the pressure is released.
- B. All hand-held powered drills, tappers, fastener drivers, horizontal, vertical, and angle grinders with wheels greater than 2 inches in diameter, disc sanders with discs greater than 2 inches in diameter, belt sanders, reciprocating saws, saber, scroll, and jig saws with blade shanks greater than a nominal one-fourth inch, and other similarly operating powered tools will be equipped with a constant pressure switch or control, and may have a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.
- C. All other hand-held powered tools, such as, but not limited to, platen sanders, grinders with wheels 2 inches in diameter or less, disc sanders with discs 2 inches in diameter or less, routers, planers, laminate trimmers, nibblers, shears, saber, scroll, and jig saws with blade shanks a nominal one-fourth of an inch wide or less, may be equipped with either a positive "on-off" control, or other controls as described by paragraphs A and B above.

5.7.9 Jacks

Jacks will:

- A. Have an up-limit stop.
- B. Be used within manufacturer's recommended load limits with the load limit marked on the jack.
- C. Not be used to hold lifted loads. Lifted loads will be blocked up.
- D. Be placed on a firm level surface and correctly centered before use.
- E. Be lifted from the jack head that is on a level point, with the lifting force being applied evenly.
- F. Be inspected before each use. For further information, refer to NASA STD 8719.9, Ch. 13.

5.7.10 Ladders

Ladders present a definite safety hazard when not used correctly. Shop supervisors will ensure that persons using ladders are trained and follow ladder safety rules. Ladders will be used, inspected, and stored in accordance with the following guidelines:

- A. Heavy loads or loads that could cause a person to become unbalanced will not be carried when ascending or descending ladders. Total weight of user and load will not exceed the load rating of the ladder. Lifting devices, rope and bucket, etc., will be used to raise and lower items. Both hands will be free, one step will be taken at a time, and always face the ladder when ascending or descending.
- B. Metal ladders are not recommended for use at DFRC. Existing metal ladders will not be used near electrical sources and will have a warning label like or similar to:

WARNING
DO NOT USE NEAR
ELECTRICAL EQUIPMENT

- C. Wooden ladders will not be painted.
- D. Defective ladders will be discarded. Repairs are not permitted.
- E. Ladders will be set on solid, level, and unmoving footings and leaned against a stable unmoving backing.
- F. In windy conditions, extra care will be taken to secure ladders.

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- G. Do not set a ladder in front of a door that could open into it.
- H. The proper type ladder for the task will be used.
- I. Ladders will not be ascended further than 3 rungs from the top. The top of a stepladder is not to be used as a step.
- J. Makeshift devices are not to be used in place of ladders.
- K. Inspect ladders for damage and missing parts prior to each use in accordance with manufacturer's instructions.

See the following directives and guidelines for further information for the proper use and care of ladders:

- 29 CFR 1910.25 Portable wood ladders.
- 29 CFR 1910.25 Portable metal ladders
- 29 CFR 1910.27 Fixed ladders
- ANSI A14.1 to A14.5 General ladder safety
- Manufacturer's Instructions

5.8 Machinery and Machine Guarding

(See 29 CFR 1910 Subpart O)

5.8.1 General Machine Guarding Requirement for All Machines

- A. One or more methods of machine guarding will be provided to protect employees in the machine area from hazards such as those created by point of operation, nip points, rotating parts, flying chips, and sparks.
- B. Guards will be affixed to the machine where possible and secured elsewhere if unable to be connected to the machine itself.
- C. A machine guard may not create an added hazard.
- D. The "point of operation" of machines whose operation exposes an employee to injury will be guarded. Examples of machines requiring point of operation guarding are
 - Guillotine cutters
 - Shears
 - Alligator shears
 - Power presses
 - Milling machines
 - Power saws
 - Jointers
- E. Revolving drums, barrels, and containers will be guarded by an enclosure that is interlocked with the drive mechanism.

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- F. Fan blades less than 7 feet from the floor must have a screen guard with opening no greater than ½ inch.
- G. Fixed machines will be anchored to prevent walking or moving.

5.8.2 Specific Machine Guarding Requirements

The magnitude of printed material regarding specific machine guarding prevents it from being incorporated into this document. Definitions and specific information may be obtained from the following documents:

- 29 CFR 1910.211 Machinery and Machine Guarding Definitions.
- 29 CFR 1910.213 Woodworking machinery requirements
- 29 CFR 1910.215 Abrasive wheel machinery
- 29 CFR 1910.217 Mechanical power presses
- Manufacturer's instructions

Any questions regarding machine guarding will be resolved before the machine is operated.

5.8.3 Unfired Pressure Vessels

Unfired pressure vessels that are common in shops include

- A. Portable and stationary air compressors
- B. Compressor units found on systems such as
 - air conditioners
 - vacuum systems
 - flexible air hose
 - pipes
 - pressurized liquid systems
 - cryogenic systems
 - hydraulic systems
 - certain welding units

These pressure units contain stored energy and, therefore, create a potential hazard to surrounding people and the environment. See [DCP-S-065](#), Pressure Vessels & Pressurized Systems Safety, for application, exclusions, and references on the proper use, inspection, certification, and training required to operate these systems.

5.9 Welding

(See 29 CFR 1910 Subpart Q, Welding, Cutting, and Brazing)

5.9.1 Welding, Cutting, and Brazing Permits

A Welding, Cutting and Brazing permit (AF Form 592) is required for any operation involving open flames or producing heat and/or sparks. This includes, but is not limited to, brazing, cutting, grinding, soldering, thawing pipe, Torch-Applied Roofing, and Cadwelding. These permits are issued by the Safety, Health, and Environmental Office.

5.9.2 Welding Safety

- A. Only qualified welders, trained in specific types and techniques of welding will be allowed to perform such tasks.
- B. The Safety, Health, and Environmental Office will inspect unfired pressure vessels or containers that have held hazardous or explosive materials to ensure pressures are released and hazardous chemicals or materials have been removed before approving welding on the vessel.
- C. An appropriate class fire extinguisher will be available near each welding job.
- D. For indoor welding operations, local exhaust ventilation is required to reduce build-up of toxic fumes and vapors. Direct rays from arc welding can damage the eyes; therefore, exposure to these rays will be avoided. Both the welder and assistant(s) will wear arc-welding hoods, and it is recommended that they wear clear safety glasses under the hood to protect the eyes from slag when the hood is removed.
- E. The area around the arc-welding site must be screened off to protect persons in the vicinity from receiving eye injuries.
- F. Welding areas will be barricaded or roped off when welding is being conducted.

5.9.3 Welding Health Hazards

Materials that can cause health hazards when heated or are the products of welding include:

- Acetylene
- Beryllium
- Cadmium
- Chlorinated Hydrocarbon Solvents
- Lead
- Mercury
- Nitrogen Oxides
- Ozone

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- Fluorides
- Iron Oxide
- Phosgene Gas
- Zinc

5.9.4 Physical Hazards

Physical Hazards caused by welding operations may include:

- Compressed Gas Release
- Ruptured Pressure Hoses, Gages, etc.
- Ultraviolet Radiation
- Infrared Radiation
- Intense Visible Light
- Fire/Explosive

5.10 Carpentry

5.10.1 General Carpentry

Carpentry tools pose a special hazard when not used properly. Some common mishaps that occur in carpentry include dismemberment of fingers, cuts, eye injury, and blunt trauma injuries.

5.10.2 Carpentry Tools

A. Personnel will:

- 1) Be familiar with safety procedures for machinery and tools that they are required to use.
- 2) Ensure that correct tools are used to accomplish the task.
- 3) Keep tools in good working condition.
- 4) Wear proper PPE for the tools being used.

B. Equipment will not be used unless all required safety devices are installed and functional. Safety devices may include kickback guards for circular saws, shields, emergency shut-off switches, etc.

C. Pusher sticks will be used to feed material through power saws and cutters. Care must be taken not to force or jam material and cause "kick-backs."

D. Power nailers will not be pointed toward people. They will be pointed downward or in a safe direction until put into use.

E. Power tools will not be left running unattended unless designed and approved to do so.

- F. Stock will be inspected for hazards such as embedded nails and defects before power tools are used on it.

5.11 Plumbing

- A. Plumbing tasks in spaces where entry and exiting are difficult or where hazardous may exist or be caused by the plumbing operation will follow confined space procedures. See the DFRC procedure on confined space.
- B. Personnel from the Safety, Health, and Environmental Office will inspect pipes and vessels before plumbing activity is allowed on them.
- C. Pipes or pressure vessels containing hot materials will be allowed to cool and pressures released before plumbing activity is allowed on them.
- D. Extensions will not be used on plumbing wrenches.
- E. Teeth on pipe wrenches and other grasping tools will be kept sharp. To prevent injury, plumbing wrenches should be pulled instead of pushed.
- F. A Welding, Cutting, and Brazing permit, AF Form 592, will be obtained from the Safety, Health, and Environmental Office when torches are used in plumbing operations such as for brazing or “sweating” copper joints.

5.12 Painting

When DFRC personnel use the spray booth, they will follow the safety rules required by 29 CFR 1910.107, Spray Finishing Using Flammable and Combustible Materials and NFPA 33, Spray Applications Using Flammable or Combustible Materials. When using the AFFTC spray booth, Air Force directives will also be followed.

5.12.1 General Painting Procedures

- A. Local exhaust hoods will be used in every instance possible when toxic, environmentally damaging, or flammable spray paints or similar materials are used to paint, cover, or clean items.
- B. Paint thinners and solvents will be stored in approved storage containers.
- C. Approved metal waste cans will be provided wherever rags or wastes are impregnated with finishing materials. The contents of these waste cans will be disposed of when full and at the end of each shift. All hazardous waste containers that are created are managed by the Code SH Environmental Management

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office. Prior to collecting any hazardous waste, notify the EM office at X7403 or X3630 to arrange for an approved and labeled hazardous waste container.

- D. When required by the Material Safety Data Sheet (MSDS), an approved respirator will be used for paint or others materials being sprayed.
- E. Confined space procedures will be followed when painting in an area designated as a confined space, or if due to painting operation, the space becomes a permit required confined space. See the DFRC procedure on confined space safety.
- F. Paints will be used in accordance with the Chemical Use Permit, the MSDS, and manufacturer's recommendations. The MSDS and Chemical Use Permit for the paint to be used will be on file and reviewed before painting operations begin.

5.13 Ventilation

Shop activities can cause various types of fumes, gasses, abrasive materials, and dust; therefore, adequate shop ventilation is essential.

5.13.1 Ventilation Requirements

A local exhaust ventilation system will be provided and used to maintain employee exposures within prescribed limits whenever dry grinding, dry polishing, buffing, or other operations are conducted that:

- A. Cause hazardous material to be released.
- B. Cause employee exposure without regard to the use of respirator or respiratory protection.
- C. Exceeds the permissible exposure limits prescribed in 29 CFR 1910.1000.

5.13.2 Ventilation Systems

Only use ventilation systems that have a current exhaust ventilation survey card posted. For new or existing exhaust systems without a survey card, contact Industrial Hygiene to arrange for testing. The construction, installation, inspection, and maintenance of exhaust systems will conform to the principles and requirements of ANSI Z9.2, Design and Operation of Local Exhaust Ventilation Systems. Guidelines established by the American Conference of Governmental Industrial Hygienist (ACGIH), Industrial Ventilation

and National Fire Codes (NFC) as listed in National Fire Protection Association (NFPA) documents may also be used.

5.14 Personal Safety

5.14.1 Reduced Ability

Reduced ability caused by an illness or fatigue, etc., can jeopardize the safety of the worker as well as others; therefore, shop personnel will not operate shop equipment when there is a question of their ability to operate shop equipment safely.

5.14.2 Medication

Medications, either prescription or nonprescription, that have potential adverse side effects will not be used by shop personnel unless approved by a health professional. Such medications can cause impairment of thought processes, increased reaction time, and, therefore, increase the possibility of a mishap.

5.14.3 Intoxicants

The possession of alcoholic beverages, narcotics, and illegal substances is strictly prohibited at DFRC. Employees will not report to work under the influence of intoxicants.

5.14.4 Hygiene

Volatile, irritating, or flammable chemicals such as gasoline, kerosene, paint thinners, etc. will not be used to clean the skin.

5.15 Personal Protection Equipment (PPE)

PPE will be used where required and will be a consideration in every safety analysis. Personal protective clothing will be selected to minimize the potential for ignition, burning, trapping hot sparks, chemical or radiation exposure, and electric shock.

5.15.1 Protective Headwear

Protective headwear will be worn when:

- A. There is a danger of bumping one's head.
- B. There is a danger of falling objects.
- C. There is a possibility of contacting an electrical source with the head. Nonconducting headwear (hard-hats) will be worn in this

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situation. Class G hardhats are proof tested at 2200 volts. Class E hardhats are proof tested at 20,000 volts. Class C hardhats provide no electrical insulation; therefore, they will not be worn in situations where the possibility of exposure to voltage is present.

NOTE: Protective headwear requires special attention. Hard hats or helmets must be properly selected for the type of environment it will be used in, maintained, sanitized, stored properly, and inspected regularly. For specific information on selection and maintenance of protective headwear, see ANSI Z89.1, American National Standard for Industrial Head Protection.

5.15.2 Eye Protection

- A. Contact lenses will not be worn in shop environments where debris such as dust, chips, particles, chemicals, toxic fumes, or vapors could be trapped behind the lens or be absorbed by soft lenses. In these environments, prescription safety glasses that meet OSHA specifications will be worn in place of contact lenses. Full-face shields are recommended when there is a possibility of flying particles; however, approved eye protection will be used in every case. DFRC requires all safety glasses to have wraparound lenses or side shields. See 29 CFR 1910.133, Eye and Face Protection, and ANSI Z87.1, Occupational and Educational Personal Eye and Face Protection Devices.
- B. "Eye Protection Required" warning signs will be posted in conspicuous locations to warn personnel of potential eye hazards where such hazards exist. Supervisors of eye-protection-required areas will ensure that all exposed personnel, including visitors, comply with eye protection requirements.

5.15.3 Hearing Protection

It is NASA's policy to engineer out excessive work place noise where possible. To "engineer out" means equipment that produces problem noise will be located away from work areas, isolated with noise abatement material, or engineered in other ways to reduce noise output where possible. If excessive noise cannot be engineered out, other protective methods must be used. Employees who believe they are exposed to levels greater than those requiring hearing protection as established by NASA should contact the Industrial Hygienist at the Safety, Health, and Environmental Office for a noise survey and evaluation. See the DFRC on hearing conservation and NPR 1800.1, NASA

Occupational Health Program Procedures, Chapter 4.8, Hearing Conservation.

5.15.4 Respiratory Protection

- A. Person(s) who need respiratory protection equipment must first make an appointment at the DFRC Health Unit for a medical evaluation, then schedule a training class and fit test with the DFRC Industrial Hygienist. Employers are responsible for ensuring that the employee receives training prior to using respirators. See the DFRC procedure on respiratory safety for details.
- B. Contact lenses will not be worn under a full-face respirator.

5.15.5 Safety Footwear

Appropriate safety footwear for the task and work area will be worn. Example: steel-toed shoes are a requirement at DFRC in shops and hangars. Other footwear needs may include protection from hot, corrosive, wet, or toxic substances as well as for protection from falling objects. Damaged footwear that could cause trips, slips, falls, or foot injuries will not be worn. See ASTM F2412-05 Standard Test Methods for Foot Protection and ASTM F2413-05 Standard Specification for Performance Requirements for Foot Protection for specific footwear requirements.

6.0 TRAINING & CERTIFICATION

6.1 Training Requirements

The employer is responsible for the training of its employees. Shop supervisors will identify and ensure that employees receive required training before operating shop equipment. Training may be required by OSHA, NASA, and manufacture's requirements or recommendations, or as a result of findings from shop safety analysis. Depending on the particular shop, safety training may include, but not be limited to:

- bloodborne pathogens
- cryogenics
- ergonomics
- fire protection
- hearing conservation
- hydraulics
- laboratory safety (chemical)
- lockout/tagout
- confined space
- electrical safety
- explosive safety
- hazard communication
- high pressure air
- ionizing radiation safety
- lifting device
- machine guarding

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- manufacture's equipment
- personal protective equipment
- respiratory protection
- Spill Prevention Control and Countermeasures Plan (SPCC) Training
- non-ionizing radiation safety
- pressure systems
- vehicle safety

6.2 Certification

Shop safety training will be certified by the instructor for that discipline. A copy of training certificates will be maintained by the trainee's supervisors or placed in a central location that is available to the employee and authorized inspectors.

7.0 MANAGEMENT RECORDS & RECORDS RETENTION

Training records and certifications will be maintained by supervisors or in a central location where the records are accessible to the supervisor, employee, and authorized inspectors.

Records are preserved, maintained, and disposed of in accordance with NPR 1441.1, NASA Records Retention Schedules, and DFRC records management procedures. Destruction of any records, regardless of format, without an approved schedule is a violation of Federal law.

8.0 RELEVANT DOCUMENTS

8.1 Authority Documents

NPR 1800.1	NASA Occupational Health Program
NPR 8621.1	NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping
29 CFR 1910	OSHA General Industry Standards
-Subpart D	Walking-Working Surfaces
-Subpart H	Hazardous Materials
-Subpart O	Machinery and Machine Guarding
-Subpart P	Hand and Portable Powered Tools and Other Hand-Held Equipment
-Subpart Q	Welding, Cutting, and Brazing
29 CFR 1926	Safety and Health Regulations for Construction
NPR 8715.3	NASA General Safety Program Requirements

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NPR 8715.1 NASA Occupational Safety and Health Programs

8.2 Reference Documents

29 CFR 1910.120	Hazardous waste operations and emergency response
29 CFR 1910.25	Portable wood ladders
29 CFR 1910.26	Portable metal ladders
29 CFR 1910.27	Fixed ladders
ASTM F2412-05	Standard Test Methods for Foot Protection
ASTM F2413-05	Standard Specification for Performance Requirements for Foot Protection
DCP-S-062	Lockout / Tagout
DCP-S-065	Pressure Vessels and Pressurized Systems Safety
DFRC procedure	Confined Space Safety
DFRC procedure	Hazard Communication
DFRC procedure	Hearing Conservation
DFRC procedure	Lifting Operations, Devices, & Equipment
Manufacturer's instructions	
DFRC procedure	Respiratory Safety
NASA STD 8719.12	Safety Standard for Explosives, Propellants, and Pyrotechnics

8.3 Informational Documents

29 1910.1000	Air contaminants
29 CFR 1910.21	Machinery and Machine Guarding Definitions.
29 CFR 1910.213	Woodworking machinery requirements
29 CFR 1910.215	Abrasive wheel machinery
29 CFR 1910.217	Mechanical power presses
29 CFR 1910.243(d)	Guarding of Portable Power Tools
ANSI/A10.3	Explosive-Actuated Fastening Tools Equipment manufacturer's instructions and recommendations
ANSI/AIHA Z9.2	Design and Operation of Local Exhaust Ventilation Systems
ANSI/ASSE A10.3	Safety Requirements for Powder-Actuated Fastening Systems
ANSI/ISEA Z87.1	American National Standard for Occupational and

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ANSI/ISEA Z89.1 Educational Personal Eye and Face Protection
Devices
American National Standard for Industrial Head
Protection

8.4 Forms

AF Form 592 Welding, Cutting and Brazing Permit
[DFRC 117-1f](#) Request for Deviation or Waiver
[D-WK 127-8](#) Dryden Safety Report

9.0 ACRONYMS

ACGIH American Conference of Government Industrial Hygienists.
ANSI American National Standards Institute.
ASME American Society of Mechanical Engineers.
CGA Compress Gas Association.
NFC National Fire Codes
NFPA National Fire Protection Association
OSHA Occupational Safety & Health Administration
PPE Personal Protective Equipment.
SOP Standard Operating Procedures

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This page is for informational purposes and does not have to be retained with the document.

Status Change	Document Revision	Effective Date	Page	Description of Change
Baseline		11-30-10		Replaces DCP-S-009, Chapter 2.
Admin Change	Baseline-1	05-03-11		Page 21: Added to Section 5.15.2: DFRC requires all safety glasses to have wraparound lenses or side shields.

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