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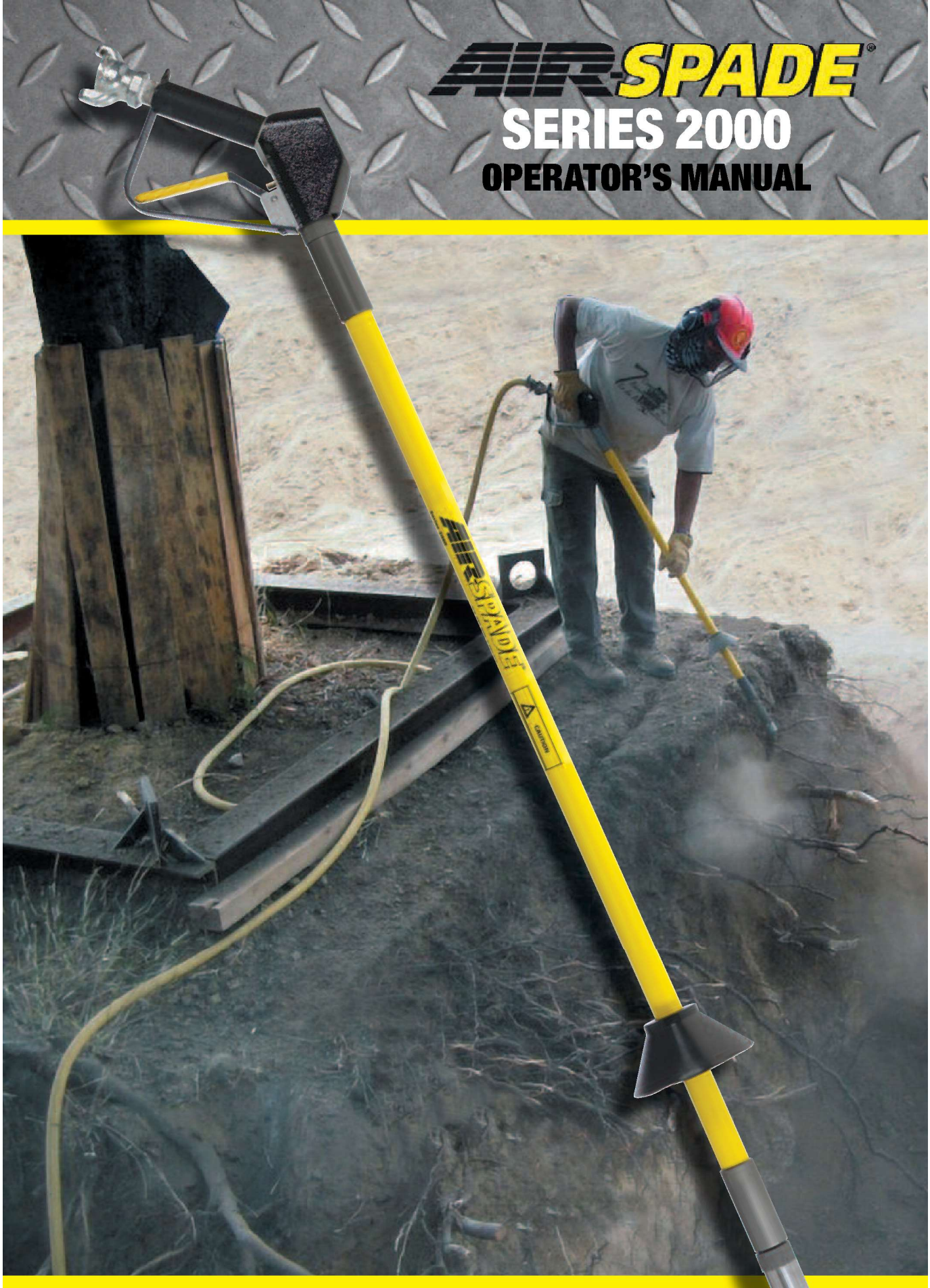
AIR-SPADE®
SERIES 2000
OPERATOR'S MANUAL



A DIVISION OF
GUARDAIR® CORPORATION

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Always wear eye and ear protection when operating air tools and related equipment.

AIR-SPADE SERIES 2000

Overall Length	60.5 inches (154 cm)
Weight	7.1 pounds (3.2 kg)
Nozzle	Extra-hardened stainless steel
Nozzle Flow Rates	25 scfm (0.7m³/min) 60 scfm (1.7m³/min) 105 scfm (3.0m³/min) 150 scfm (4.2m³/min)* 225 scfm (6.4m³/min)
Operating Presure	90 psi (6.2 bar)
Barrel	Insulated fiberglass
Inlet	3/4" FNPT
Inlet Connector	3/4" Chicago style

***Standard Model**

AIR-SPADE is covered by U.S. Patents 5,782,414, D408,830, and D435,207.

GENERAL INFORMATION

GUARDAIR CORPORATION'S AIR-SPADE Series 2000 is a compressed air-powered tool used for excavation of a wide variety of soils. AIR-SPADE Series 2000 consists of an ergonomic pistol grip style handle, an insulated fiberglass barrel, and a patented supersonic nozzle. Typically powered by a portable tow-behind air compressor, the AIR-SPADE Series 2000 provides a safe, powerful and efficient method of uncovering underground electric lines, pipes, and tree roots without harm. Capable of excavation where a shovel or backhoe cannot be used, AIR-SPADE can be equipped with multiple nozzle sizes and a variety of extension lengths for optimum job performance.

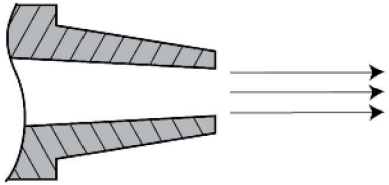
The heart of the AIR-SPADE is the patented supersonic nozzle which produces a focused "laser-like" jet of air moving at approximately 1,200 mph (1,900 km/hr), or nearly twice the speed of sound. This supersonic air-jet penetrates voids in the soil and expands rapidly, therefore fracturing the soil. Unlike the hard cutting edges of shovels, picks, blades, or buckets, the air-jet is harmless to non-porous items such as tree roots, buried pipes, or cables. Excavating with AIR-SPADE is much easier and many times faster than hand excavation.

The AIR-SPADE supersonic air-jet outperforms "homemade tools" featuring a pipe nipple or a crimped orifice. Air flow from these tools expands to atmosphere in an unfocused, complex manner while the supersonic air jet delivers significantly more kinetic energy and more focused momentum. In practical terms the AIR-SPADE does more work by moving more material, and harder material, in a shorter period of time.

AIR-SPADE PATENTED SUPERSONIC NOZZLE

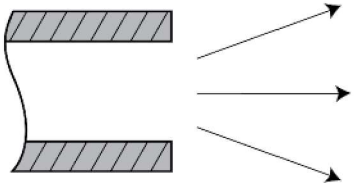
AIR-SPADE's patented supersonic nozzle turns compressed air into a high speed, laser-like jet moving at twice the speed of sound – 1,200 mph. All of the energy and momentum of air moving at approximately Mach 2 is focused into the soil, dislodging it in a fraction of a second. **(Fig.A)** The result is faster, safer, and more efficient soil excavation.

(Fig.A)



FOCUSED AIR FLOW FROM
AIR-SPADE SUPERSONIC NOZZLE

(Fig.B)



UNFOCUSED AIR FLOW FROM
IMPROPERLY DESIGNED NOZZLE

Air exiting from an improperly designed nozzle diffuses outward 3 to 4 times wider than the air-jet from the patented AIR-SPADE supersonic nozzle. **(Fig.B)**

Arboriculture / Horticulture

Utility / Construction

Trench Rescue

Environmental Remediation

ALWAYS

...**Wear** appropriate protective work clothing and equipment. Cut and puncture resistant gloves, approved safety glasses with side shields and/or face protection, and approved hearing protective earplugs or earmuffs should be worn while operating the AIR-SPADE. Eye protection should comply with ANSI Z87.1-1989. Ear protection should provide a NRR of at least 20 dB.

...**Wear** approved respiratory protection when working in extremely dusty conditions.

...**Wear** approved, electrically insulated footwear and gloves if working near underground electrical lines.

...**Ensure** that all personnel near the area being excavated are aware that AIR-SPADE is being used and that they wear appropriate personal protection as indicated.

...**Protect** surfaces that could be chipped, or damaged by dislodged soil or rock particles adjacent to the excavation work area by using suitable drop cloths, screens, or other means.

...**Check** the AIR-SPADE for loose or damaged parts prior to use. Tighten, repair, and/or replace as necessary.

...**Inspect** hoses for leakage, kinking, abrasion, corrosion, or any other signs of wear or damage. Worn or damaged hose assemblies should be replaced immediately.

...**Check** that the air compressor is delivering the specified pressure to operate the AIR-SPADE.

...**Anticipate** that the AIR-SPADE tool will push upwards when using the 45 degree adapter. Brace against the upwards force by holding the tool in accordance with the operating instructions.

...**Operate** the AIR-SPADE until the operating and safety instructions are read and fully understood.

...**Make** any modifications to the AIR-SPADE.

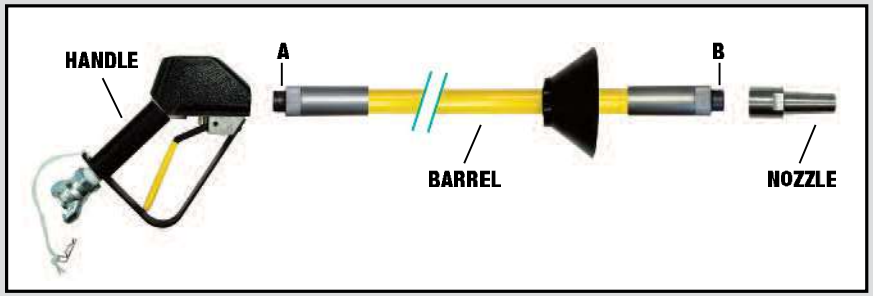
...**Tie,** tape, or otherwise lock or fasten the trigger in the "ON" position.

...**Point,** or aim the AIR-SPADE at any person during operation.

...**Allow** hands, feet, or any body parts near the AIR-SPADE nozzle tip during operation.

...**Use** the AIR-SPADE as a pry bar.

- Read and follow the directions below to properly assembly the AIR-SPADE.
- Apply a small amount of commercial grade anti-seize compound on the barrel threads (A & B) to prevent galling. Screw the nozzle into the barrel by turning clockwise. **Hand-tighten only.**
- Screw the barrel into the handle by turning clockwise. **Hand-tighten only.**



WARNING

CAUTION

User assumes full responsibility to read and understand these instructions prior to operation. Failure to adhere to these instructions can result in personal injury. User should also have operating knowledge of the air-compressor to which the tool is attached.

BEFORE OPERATION

- Match the air compressor size to the AIR-SPADE nozzle on the tool. To properly size the air compressor, make sure the air compressor flow rate is equal to, or greater than, the nozzle flow rate.
- Check the air compressor for sufficient fuel and oil levels.
- Make sure the air compressor is secure from accidental motion.
- Close the air supply valve on the air compressor.
- Make sure all air supply hose connections are securely made and safety clips are installed.
- Use air supply hose with a pressure rating equal to, or greater than, 150 psig.
- Use air supply hose of an appropriate diameter and length. ***(See Table)***

Maximum Recommended Air Supply Hose Length (Feet)

Nozzle Flow (scfm)	3/4" ID	1" ID	1 1/4" ID
25	4,750	≤5,000	≤5,000
60	900	3,460	≤5,000
105	240	1,110	3,350
150	110	520	1,730
225	40	220	880

STARTING

- Start the air compressor according to the manufacturer's instructions.
- The air compressor should build pressure until 100 – 120 psig is shown on the air compressor pressure gauge.
- Make sure that AIR-SPADE is turned off. Point the nozzle away from all personnel or loose objects that could become airborne. Open the air supply valve on the air compressor.
- Securely hold the AIR-SPADE. Point the nozzle up and away from all personnel and any loose objects, and depress the trigger. Read the air compressor pressure gauge and the pressure gauge on the tool. During operation the air pressure gauge on the tool should read between 80 and 100 psig (5.5 and 6.9 bar). If not, adjust the output pressure of the air compressor.

EXCAVATION PROCEDURES

- For most excavations the best performance is achieved by holding the AIR-SPADE nozzle at approximately a 45 degree angle from horizontal and about 1 inch away from the surface to be excavated.
- Depending on the soil type, the AIR-SPADE should be directed above the surface to be excavated at a rate of approximately 1 to 2 feet per second (0.3 to 0.6 meters per second).
- Except in very hard and compacted clays, dwelling on the same spot tends to reduce the rate at which material is excavated and can increase the amount of material blown away from the excavation site.
- Watering the work area ahead of time can often be helpful. Watering reduces airborne dust if the soil is extremely dry. It also reduces the soil strength making digging easier.
- For small diameter holes, position the AIR-SPADE barrel perpendicular to the ground with the nozzle close to the surface. Depress the trigger, and slowly thrust the tool into the soil. When resistance is met, slowly withdraw the AIR-SPADE and then reinsert. This procedure allows loose soil at the bottom of the hole to exit upwards. Reinsert the nozzle and repeat the above procedure until the desired depth of hole is reached.
- When boring a small diameter hole, or when plunging the AIR-SPADE into loose soil, the tendency to expose the operator to blown back material is increased. The adjustable dirt shield should be positioned close to the ground to deflect airborne material away from the operator.
- For large diameter holes, position the AIR-SPADE at an angle between 30° and 45° from the horizontal. Depress the trigger and move the AIR-SPADE back and forth across the footprint of the excavation to loosen the soil to a depth of several inches. Each layer of loose soil should then be removed with a shovel, backhoe, or vacuum. Repeat the procedure until the desired depth is reached.
- For shallow, wide excavations, position the AIR-SPADE at an angle between 30° and 45° from the horizontal. Depress the trigger, move the nozzle from side to side the desired width, and blow the loosened soil ahead of the nozzle. Continue until the excavation is completed to the required length.

- For deeper excavations or trenches loosen the soil in layers of several inches. Remove the soil with a shovel, backhoe, or vacuum. Repeat the procedure until the desired depth is reached.
- Excavation rates will vary depending upon soil composition, soil compaction, and the air delivered from the AIR-SPADE nozzle. ***(See Table)***
- Use a portable (collapsible) barrier or fence constructed from plywood, or canvas cloth, to keep dislodged soil confined to the working area.

Soil Excavation Rates

Nozzle Flow (scfm)	Soil Excavation Rate (cubic ft / min)
25	0.4 to 0.9
60	0.7 to 1.1
105	0.9 to 1.5
150	1.2 to 1.8
225	1.7 to 2.3

SHUT DOWN

- Turn off the air compressor air supply valve.
- Shut down the air compressor.
- Securely hold the AIR-SPADE. Point the nozzle up and away from all personnel and any loose objects, and depress the trigger. Continue to depress the trigger until all compressed air from the tool and hose is fully expelled and the air pressure gauge on the AIR-SPADE reads "0".
- It is now safe to disconnect the air supply hose. Store the AIR-SPADE as desired.

MAINTENANCE

- As with any professional grade tool, the AIR-SPADE requires regular care to ensure proper operation. Prior to each use, inspect the tool for any loose or visibly damaged parts. Tighten or replace worn parts as required. Brush off dirt or other foreign material from around the trigger and valve stem areas. Periodically apply light oil or lubricant (e.g. WD40) to the exposed valve stem to ensure smooth operation.