Operating Instructions
Millhog Series - “Wart” Millhog

CE

ESCO TOOL – HOLLISTON, MA – USA
MILLHOG SERIES: WART MILLHOG
90 PSI (6.2 BAR) INLET PRESSURE
DISCONNECT AIR SUPPLY BEFORE SERVICING

Understand all instructions before using

esco tool®

Factory:
ESCO Tool Company, a Unit of ESCO Technologies, Inc.
75 October Hill Road, Holliston, MA 01746
Tel 508-429-4441, Fax 508-429-2811
e-mail: millhog@escotool.com Web site www.escotool.com

Agent:

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ESCO Tool Guarantee

Guarantee: The manufacturer guarantees its products to be free from defects in material or workmanship for a period of one year from date of shipment from its factory. Said guarantee will not apply if equipment is used in conditions of service for which it is not recommended. The manufacturer is not responsible for damage to its products through improper use, physical damage, poor operating practice, or normal wear.

If any device is found unsatisfactory under the guarantee, the buyer must notify ESCO Tool in writing and after receipt of shipping instructions, buyer must return it directly to ESCO Tool, 75 October Hill Rd. Holliston, MA 01746 , USA, shipping charges prepaid. Such equipment will be replaced or put in satisfactory operating condition, free of all charges except transportation. The correction of any factory defect by repair or replacement by the manufacturer shall constitute fulfillment of all obligations to the purchaser. Manufacturer's guarantee is void if unauthorized repairs are made to its products.

Manufacturer shall not be liable for consequential damage in case of failure to meet the conditions of any Guarantee or Shipping Schedule, nor will claims for labor, loss of profit, repairs, or other expenses incidental to replacement be allowed.

No other representations, guarantees or warranties, expressed or implied, are made by the manufacturer in connection with the manufacture and sale of its equipment.

Hold Harmless Agreement

Customer agrees to defend, indemnify and hold ESCO Tool, its owners, agents, officers, and/or employees free and harmless from and against any and all claims, liabilities, losses, costs and out of pocket expenses (including attorneys fees) arising out of, or in connection with the ESCO Tool equipment, its use or transportation, or out of operations conducted by customer, its agents, employees, contractors, representatives, guests or invitees, including, but not limited to, active and/or passive negligence.

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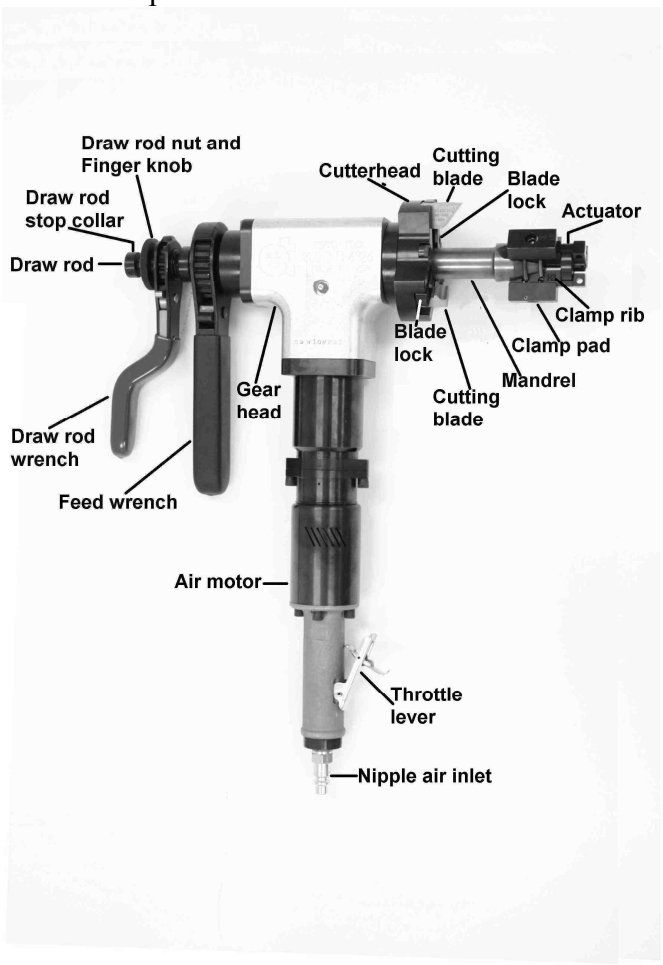
1. Instruction for putting into use.
    a. Unpacking.
        1. Use caution when handling the tool, cutting blades are sharp. Typically they are protected, however, exposed blades can cause injury.
        2. Clean any excess oil, grease or rust preventive from the surface of the tool.
    b. Air supply.
        1. Recommended air pressure, 90 psi (6.2 bar).
        2. Recommended air volume, 40 cfm (1133 lt/min.).
        3. Clean, moisture free air is essential for trouble free operation.
        4. Oil laden operating air should be used. Use a light weight air tool motor oil (s.a.e.10).
        5. A hose whip with filter and lubricator is provided with each tool. Be sure air filter is clean and lubricator is full before use. For lubricator adjustment instructions see 4a.
    c. Illustrated description of function.



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1. Instruction for putting into use, continued.
    d. Limitation on ambient conditions.
        1. In damp, moist or humid air, extra precaution must be taken in order to provide the tool with moisture free, oil laden air.
        2. In temperatures below 32 degrees Fahrenheit (0 Celsius) a lubricant with antifreeze, such as Marvel Air-Tool Oil , must be used.
    e. List of contents.
        1. Kit contains:
            Motor and gear drive
            Feed mechanism
            Draw rod and wrench assembly
            One or more clamp rib sets
            One or more clamp pad set
            One or more cutterheads
            Hose, 1/2" with filter, lubricator and quick connect couplers
            Allen wrench set
            Carrying case

2. Safety precautions.
    a. Precautions and use of personal protective equipment, eye protection.
        1. Power tools are not insulated for coming into contact with electric power sources.
        2. Tool must not be used in an explosive atmosphere.
        3. Do not use tool in a manner other than stated. Use other than stated in the instructions is forbidden.
        4. Use valved, quick connect couplers to avoid whipping compressed air hose.
        5. Use care regarding the drawing in or trapping long hair, loose clothing, etc.
        6. Cover all exposed skin before operating. Cutting blades are sharp and produce hot chips. Both can cause injury.
        7. Do not connect air until tool is securely fastened to the inside diameter of a pipe or tube.
        8. Use caution when handling, disconnect air before removing from work, changing blades, performing maintenance or breaking down.
        9. Personal protective garments should include but not be limited to.
            Safety glasses
            Work gloves
            Work boots, or shoes
            Protective clothing
            Ear protection when operator is exposed to long periods of use.

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2. Safety precautions, continued.

a. Precautions and use of personal protective equipment, eye protection.

10. Have all nearby persons wear safety glasses with side shields.

b. Special safety precautions, pinch points, cont.

1. Chips can be hot and sharp. Be careful when clearing from tool.

2. Moving and stationary parts can pinch or cause serious injury. Pay extra attention to rotating cutting blades as they can not be adequately guarded.

3. During use, machinery may separate, lurch or fall.

c. Explanation of symbols.

Caution (refer to accompanying documents).

Safety glasses must be worn.

Protective gloves, cutting blades and chips can be hot and sharp.

Work boots, or shoes.

Protective clothing.

Ear protection.

Pinch points.

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2. Safety precautions, continued.
    d. Disclaimer.
        1. If the equipment is used in a manner not specified by ESCO Tool, the protection provided by the equipment may be impaired.
    e. Operating ergonomics.
        1. Tool must be mounted at a reasonable working height.
        2. Tool may be used in any orientation.
        3. Operator must be in a position not to be injured as the machinery may separate, lurch or fall. Operator must have both feet on a stable platform. Reaching or leaning is not acceptable operating ergonomics.

3. Operating instructions.
    a. Identification of operating controls and their use.
        1. Feed wrench.
            a. Axially moves gear head on mandrel.
        2. Draw rod nut.
            a. Activates draw rod and actuator.
        3. Draw rod.
            a. Connects the actuator and draw rod nut.
            b. Turning draw rod nut clockwise pulls actuator towards mandrel and expands clamp ribs and pads.
            c. Turning draw rod nut counter-clockwise pushes actuator away from mandrel and relaxes clamp ribs and pads.
        4. Draw rod stop collar.
            a. Prevents draw rod, actuator and clamp rib and pads from becoming separated from mandrel.
        5. Draw rod nut and finger knob.
            a. In tight areas turning when the draw rod wrench doesn't actuate the draw rod the nut and finger knob when turned clockwise pulls the actuator towards mandrel and expands clamp ribs and pads.
    6. Cutterhead.
            a. Rotates and holds the tool post.
        7. Tool post.
            a. Locates cutting blade.
        8. Cutting blade.
            a. Purpose: to machine end preparations on tube or pipe.
            b. Consumable item, available in many sizes and configurations.
        9. Blade lock.
            a. Secures the cutting blade to tool post.
        10. Actuator.
            a. Holds and aligns the clamp ribs and pads with mandrel.

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3. Operating instructions.
    a. Identification of operating controls and their use.
        11. Clamp ribs / pads.
            a. Secures tool to tube or pipe inside diameter.
            b. Come in sets of three.
            c. Available in many sizes, see accompanying clamp rib chart.
        12. Mandrel.
            a. Provides torque acceptance for entire tool.
            b. Allows axial movement of tool.
            c. Provides point of rotation for cutterhead.
        13. Throttle lever.
            a. Activates the cutterhead.
            b. Requires deliberate action by the operator.
            to Activate the cutterhead.
            c. Actuating lever starts tool.
            d. Release of lever stops tool.
        14. Nipple air inlet.
            a. Accepts valved quick connect coupler for connecting air supply.
            b. Always disconnect air supply before installing, changing or securing blades, adjusting, moving, or breaking down.
        15. Air motor.
            a. Provides power to gear head.
        16. Gear head.
            a. Rotates cutterhead.
            b. Axially moves on mandrel.
    b. Selection of proper tooling.
        1. Clamp rib selection.
            a. Measure inside diameter of tube or pipe. Or using the outside diameter and minimum wall thickness, calculate the inside diameter.
            b. Using the inside diameter and the accompanying clamp rib chart select the proper clamp rib / pad set(s).
            c. Please note clamp pads attach to clamp ribs. Clamp ribs can be used without clamp pads.
        2. Cuttterhead selection.
            a. Measure the outside diameter of the tube or pipe.
            b. Select a cutterhead that either matches the outside diameter or is at least one size larger than the outside diameter.
            c. Sizes are: 2-5/8", 3", 3-1/2", 4", 4-1/2".
            d. Larger cutterheads may be used, subject to mechanical restrictions.

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3. Operating instructions continued.
    b. Selection of proper tooling.
        3. Cutting blade selection.
            a. Measure the wall thickness of the tube or pipe.
            b. Select a blade that is wider than the wall thickness.
            c. Standard sizes are: 1/2", 3/4" and 1". Consult factory for other widths.
            d. Cutting blade configuration should be matched to your welding specification.
            e. Consult factory for special applications such as: counter boring, seal weld removal , "J" preps, etc.
    c. Installation of proper tooling.
        1. Clamp rib installation.
            a. Remove stop collar (H-56A), draw rod wrench (H-54) and pull draw rod assembly from mandrel (H-21).
            b. Slide clamp ribs over the draw rod (H-51) with the slotted end of the clamp rib towards the actuator.
            c. Insert the clamp rib slots into the slots on the actuator.
            d. Inspect springs, replace if stretched or damaged.
            e. There are two sets of clamp springs per set of clamp ribs.
            f. Reassemble, insert draw rod assembly into mandrel and install the draw rod wrench and stop collar.
        2. Cutterhead removal and installation.
            a. Remove stop collar (H-56A), draw rod wrench (H-54) and feed stop (H-57A). Pull draw rod assembly from mandrel (H-21).
            b. Using feed wrench, feed mandrel out of tool.
            c. Remove (3) cutterhead mounting screws (H-16).
            d. Using a soft hammer, tap cutterhead to remove from bearing (H-18).
            e. Select the cutterhead you want to install and align cutterhead mounting screw holes up with the drive shaft (H-19).
            f. Using the cutterhead mounting screws, evenly tighten. Be sure that the cutterhead seats evenly on the bearing.
            g. Reinstall the mandrel, align key way with key (H-25) in the torque acceptor (H-38).
            h. Insert draw rod assembly into mandrel and install the feed stop, draw rod wrench and stop collar.
        3. Cutting blade removal and installation.
            a. Loosen blade lock screw(s) (H-22), do not remove. If more than one blade lock screw has to loosened they should be loosened evenly.

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3. Operating instructions continued.
    c. Installation of proper tooling.
        3. Cutting blade removal and installation.
            b. Cutting blade must be slid to the outside of the cutterhead for removal.
            c. Insert new cutting blade from the outside of the cutterhead and align so that the blade fully covers the tube or pipe wall.
            d. Be sure to tighten *all* blade lock screws.
    d. Mounting the tool to the work
        1. Using the feed wrench extend the mandrel all the way forward (this moves clamp ribs away from cutterhead.
        2. Retract the the mandrel two turns of the feed wrench.
        3. Insert the clamp rib portion of the tool into the end of tube or pipe.
        4. While positioning the cutting blade away, at least 1/4" from the work, tighten the draw rod nut.
        5. Be sure cutterhead can rotate freely, without coming into contact with the tube or pipe, when first starting tool.
    e. Air connection.
        1. Use the hose supplied with the tool.
        2. This hose has a valved quick connect coupler which will hold back all air that is in the supply hose.
            a. This feature allows the air supply to be safely removed from the tool at any time.
        3. Connect the air supply.
    f. Operation of tool.
        1. Engage the throttle lever, this will activate the tool.
        2. Using the feed wrench advance the cutting blade towards the work.
        3. Use a steady constant feed creating a continuous chip.
            a. Using a constant feed allows the heat generated by the cutting action to be removed by the chip. Heat build up is a primary failure mode for cutting tools.
            b. Engaging a rotating cutting blade with the work surface without feed (rubbing), creates excessive heat build up.
        4. When the desired end prep is accomplished, quickly reverse the feed wrench by reversing the directional pawl, and retract the cutting blade from the work.
        5. Release the throttle lever, this will stop the tool.
        6. Disconnect the air supply.
        7. Release the clamp wrench and remove the tool from the work.

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3. Operating instructions continued.
    g. Tool limits.
        1. Size limits.
            a. Minimum inside diameter is 1-1/4" with standard mandrel.
                1. Minimum inside diameter is 3/4" with optional mandrel.
            b. Maximum outside diameter is 4-1/2".
            c. Maximum wall thickness, 1" with standard tooling.
            d. Extremely thin walls may require special tooling to prevent. deformation of diameter.
        2. Material limits.
            a. Difficult materials may require the following to maximize blade life.
                1. Lubrication such cutting oils, soluble oils, soapy water, plain water, etc.
                2. Slow the speed of air motor, using a valve on the air supply.
                3. Multiple cutting blades to balance the tool.
                4. Vary feed rate, often times difficult materials respond to a heavy feed.

4. Maintenance and servicing
    a. Regular cleaning and lubrication
        1. Hose whip, filter and lubricator
            a. Inspect filter element by removing nut from end of filter assembly.
            b. If the filter is dirty or plugged replace it using filter repair kit
            c. Remove filler plug from lubricator and be sure the adjusting screw is set half way between open and closed.
            d. Fill lubricator, use a light weight air tool motor oil (s.a.e. 10).
        2. Gear housing grease.
            a. There is no grease fitting on rental tools. This is because of the tendency to over grease. Excess grease can back up into the air motor and cause failure.
            b. A single pump from a grease gun after every two hundred hours of use is sufficient for all tools equipped with a grease fitting.
            c. Use grease NLGI # 2.
        3. Lubrication for storage
            a. Before putting the tool away, fill air inlet with a liberal amount of air tool oil and actuate motor momentarily. This will distribute oil to internal motor parts, preventing rust build up.
            b. Wipe tool down using soft cloth removing all dirt, grease, oil and chips.
            c. Lightly coat tool with rust preventive.

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4. Maintenance and servicing, continued.
    b. User service.
        1. A qualified air tool technician can provide all service for this machine
            a. Factory service or assistance is available, contact us at the numbers below.
            b. Complete drawings and parts lists are provided in section six.
                1. No special tools are required to perform complete service.
    c. Servicing by manufacturer or agent.
        1. Factory service, return the tool to the factory address listed below.
        2. Agent service, if applicable return tool to the agent listed below.
            a. If unsure of agent contact the factory.
5. Clamp rib and pad selector chart.

"WART" MILLHOG
CLAMP RIB AND PAD SELECTOR CHART

MANDREL SIZE	I.D. RANGE (in.)	I.D. RANGE (mm)	I.D. CLAMP RIB SET
OPTIONAL 3/4" (19.1mm)	.750 - .905	19.1 - 22.9	G-03
	.875 - 1.030	22.2 - 26.1	G-04
	1.00 - 1.155	25.4 - 29.3	G-05
	1.125 - 1.280	28.6 - 32.5	G-06
OPTIONAL 1" (25.5mm)	1.00 - 1.300	25.4 - 33.0	H-0
1 1/4" (31.8mm)	1.250 - 1.600	31.8 - 40.6	H-01
	1.525 - 1.925	38.8 - 48.9	H-02
	1.850 - 2.250	47.0- 57.1	H-03
	2.175 - 2.575	55.3 - 65.4	H-04
			I.D. CLAMP PADS
	2.500 - 2.900	63.5 - 73.6	H-02 & H-05
	2.825 - 3.225	71.8 - 81.9	H-03 & H-05
	3.150 - 3.550	80.0 - 90.1	H-04 & H-05
	3.475 - 3.875	88.3 - 98.4	H-02 & H-08
	3.800 - 4.200	96.6 - 106.6	H-03 & H-08
	4.125 - 4.525	104.78 - 114.94	H-04 & H-08

Note: As of 2/97, H-02, H-03, and H-04 are all tapped to receive any clamp pad. This allows a greater range from fewer clamp pads. Prior to 2/97 only the H-02 clamp rib was tapped to receive the clamp pads.

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6. Parts list and drawings
    a. Gear assembly.

"WART" MILLHOG GEAR HEAD ASSEMBLY

PART #	DESCRIPTION
H-01	CLAMP RIBS (1.250" - 1.600")
H-02	CLAMP RIBS (1.525" - 1.925")
H-03	CLAMP RIBS (1.850" - 2.250")
H-04	CLAMP RIBS (2.175" - 2.575")
H-05	CLAMP PADS (2.500" - 2.900")
H-06	CLAMP PADS (2.825" - 3.225")
H-07	CLAMP PADS (3.150" - 3.550")
H-08	CLAMP PADS (3.475" - 3.875")
H-09	CLAMP PADS (3.800" - 4.200")
H-10	CLAMP RIB SCREW
H-11	ACTUATOR ROLL PIN
H-12	ACTUATOR
H-13	ROLL PIN
H-14A	CLAMP RIB SPRING H0
H-14B	CLAMP RIB SPRING H1-H4
H-15	CUTTERHEAD SEAL
H-16	CUTTERHEAD MOUNTING SCREW
H-18	CUTTERHEAD BEARING
H-19	DRIVE SHAFT
H-20	DRIVE GEAR KEY
H-21	1.250" MANDREL
H-22A	9/16" BLADE LOCK
H-22B	5/8" BLADE LOCK
H-22C	3/4" BLADE LOCK
H-23	COMBINATION SCREW
H-24	TORQUE ACCEPTER KEY SCREW
H-25	TORQUE ACCEPTER KEY
H-26	TORQUE ACCEPTER SCREWS
H-27	"O" RING
H-28	FEED KNOB
H-29	DRIVE SHAFT "O" RING
H-30	FRONT TAPERED ROLLER BEARING
H-31	FRONT BEARING RACE
H-32	DRIVEN GEAR
H-33	HOUSING

PART #	DESCRIPTION
H-34	REAR BEARING RACE
H-35	REAR TAPERED ROLLER
H-36	LOCK WASHER
H-37	LOCK NUT
H-38	TORQUE ACCEPTER
H-39	FEED WRENCH
H-40	FEED WRENCH SCREWS
H-41	DRIVE GEAR
H-42	DRIVE GEAR BEARING
H-43	BEARING SPACER
H-44	DRIVE GEAR BEARING
H-45	DRIVE GEAR SNAP RING
H-46	HOUSING SNAP RING
H-47	DRIVE KEY
H-48	SHEAR COUPLER
H-49	FEED KNOB BALLS (20 REQ'D)
H-50	BALL RETAINER SCREW
H-51	DRAW ROD
H-52	DRAW ROD NUT SNAP RING
H-53A	DRAW ROD NUT & FINGER KNOB
H-54A	WRENCH HD DRAW ROD
H-55	DRAW ROD NUT SNAP RING
H-56A	DRAW ROD STOP COLLAR
H-56B	SOCKET HEAD SCREW
H-57A	FEED STOP COLLAR
H-57B	SET SCREW
H-58	MOTOR ADAPTER PLATE
H-59	MOTOR ADAPTER SCREWS
CH-20	2-5/8" CUTTERHEAD
CH-21	3" CUTTERHEAD
CH-22	3-1/2" CUTTERHEAD
CH-23	4" CUTTERHEAD
CH-24	4-1/2" CUTTERHEAD
H-70	AIR MOTOR COMPLETE

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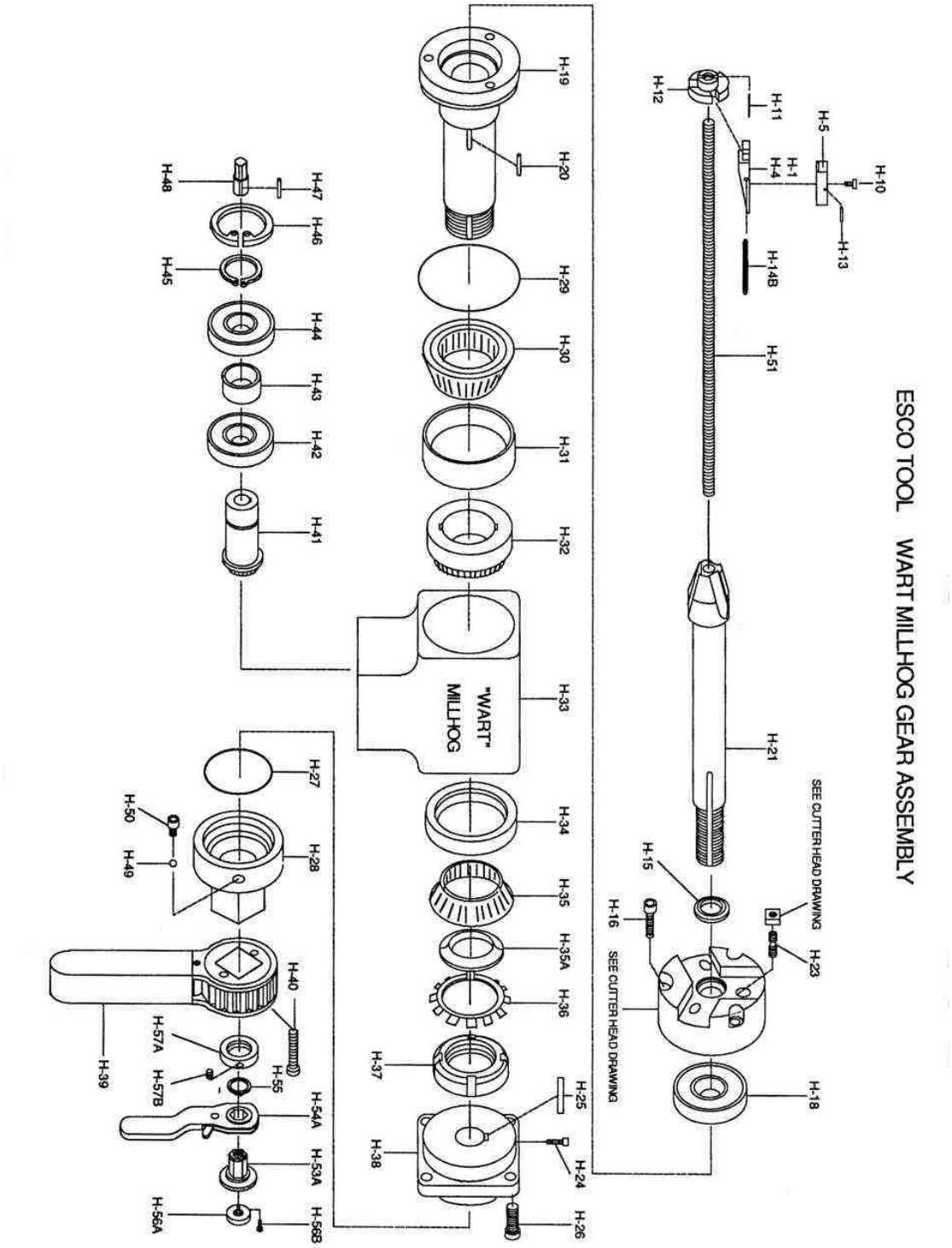
6. Parts list and drawings

a. Gear assembly.



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6. Parts list and drawings
   b. air motor.

"WART" MILLHOG
AIR MOTOR PARTS LIST

PART #	DESCRIPTION	PART #	DESCRIPTION
18-01	GREASE FITTING	18-29	EXHAUST DEFLECTOR
		18-30	GASKET (OLD STYLE)
18-02A	GEAR HOUSING	18-30A	GASKET
18-03	BEARING	18-31	"O" RING
18-04	GEAR SPIDER	18-32	REAR PLATE
18-05	PIN	18-33	CAP SCREW
18-06	BEARING	18-34	LOCK WASHER
18-07	GEAR	18-35	CAP SCREW
18-08	BEARING	18-36	LOCK WASHER
18-09	RETAINER RING	18-40	SEAL
18-10	SPACER	18-40A	WASHER
18-11	GEAR SPIDER	18-41	LOCK WASHER
18-12	BEARING	18-42	BUTTON HEAD SCREW
18-13	BEARING HOUSING	18-43	AIR VALVE
18-14	GASKET	18-44	"O" RING
18-15	BEARING	18-45	SPRING
18-16	FRONT END PLATE	18-46	LOCK WASHER
18-17	PIN	18-46A	LOCK WASHER
18-18	BEARING	18-47	CAP SCREW
18-19	GEAR	18-47A	CAP SCREW
18-20	CYLINDER	18-48	THROTTLE LEVER
18-21	ALIGNMENT PIN	18-49	COUPLER
18-22	ROTOR	18-50	SCREEN
18-23	ROTOR BLADES (5 PER SET)	18-51	ROLL PIN
18-24	REAR END PLATE	18-52	OIL PLUG
18-25	BEARING	18-52A	OIL PLUG
18-26	RETAINER RING	18-53	THROTTLE HANDLE
18-27	GASKET	18-53A	THROTTLE HANDLE COMPLETE
18-28	AIR MOTOR HOUSING	18-54	COMPLETE AIRMOTOR
		H-59	MOTOR ADAPTER SCREW

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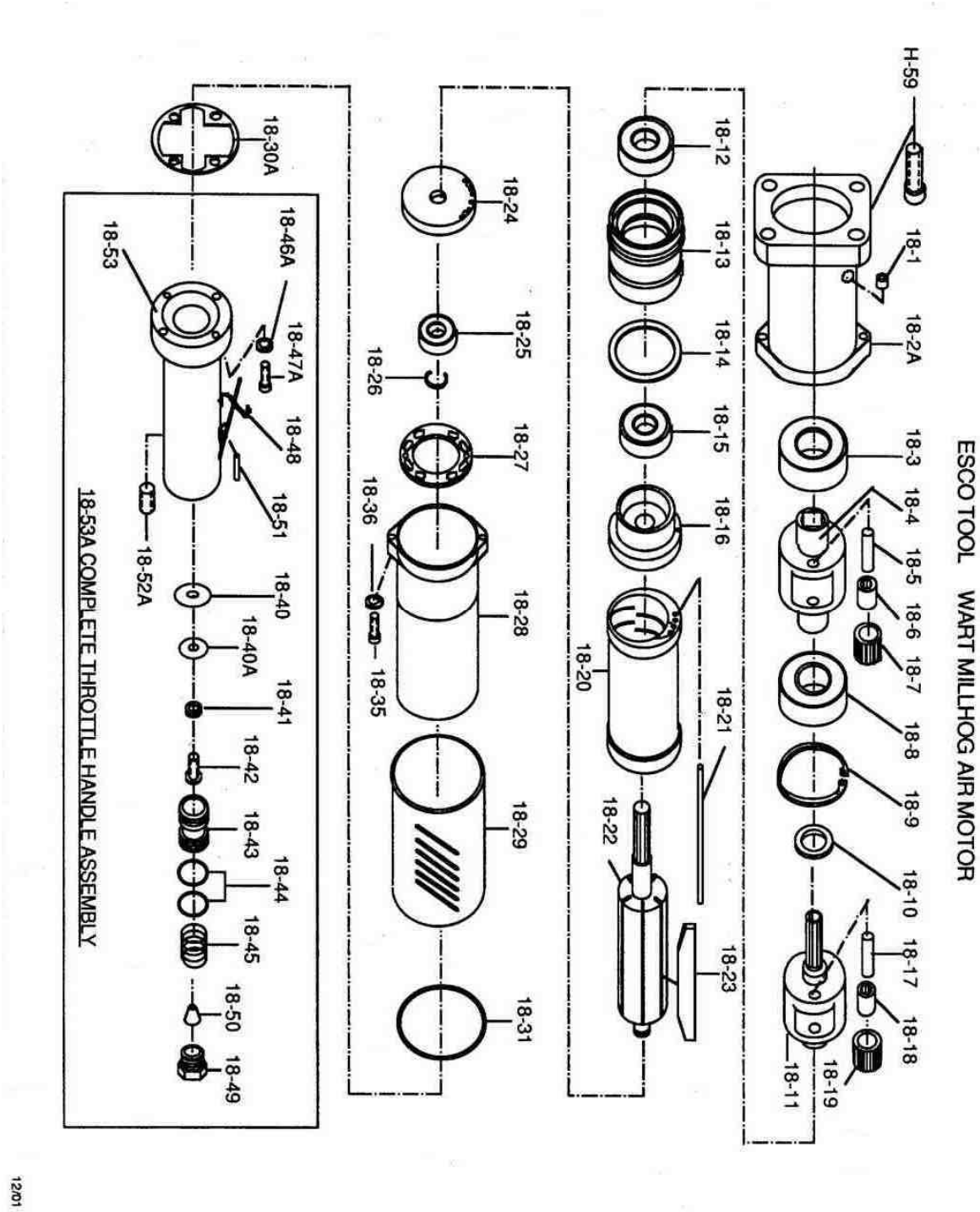
6. Parts list and drawings
    b. air motor.



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6. Parts list and drawings
    c. ¾” mandrel.

"WART" MILLHOG
¾” MANDREL KIT PARTS LIST

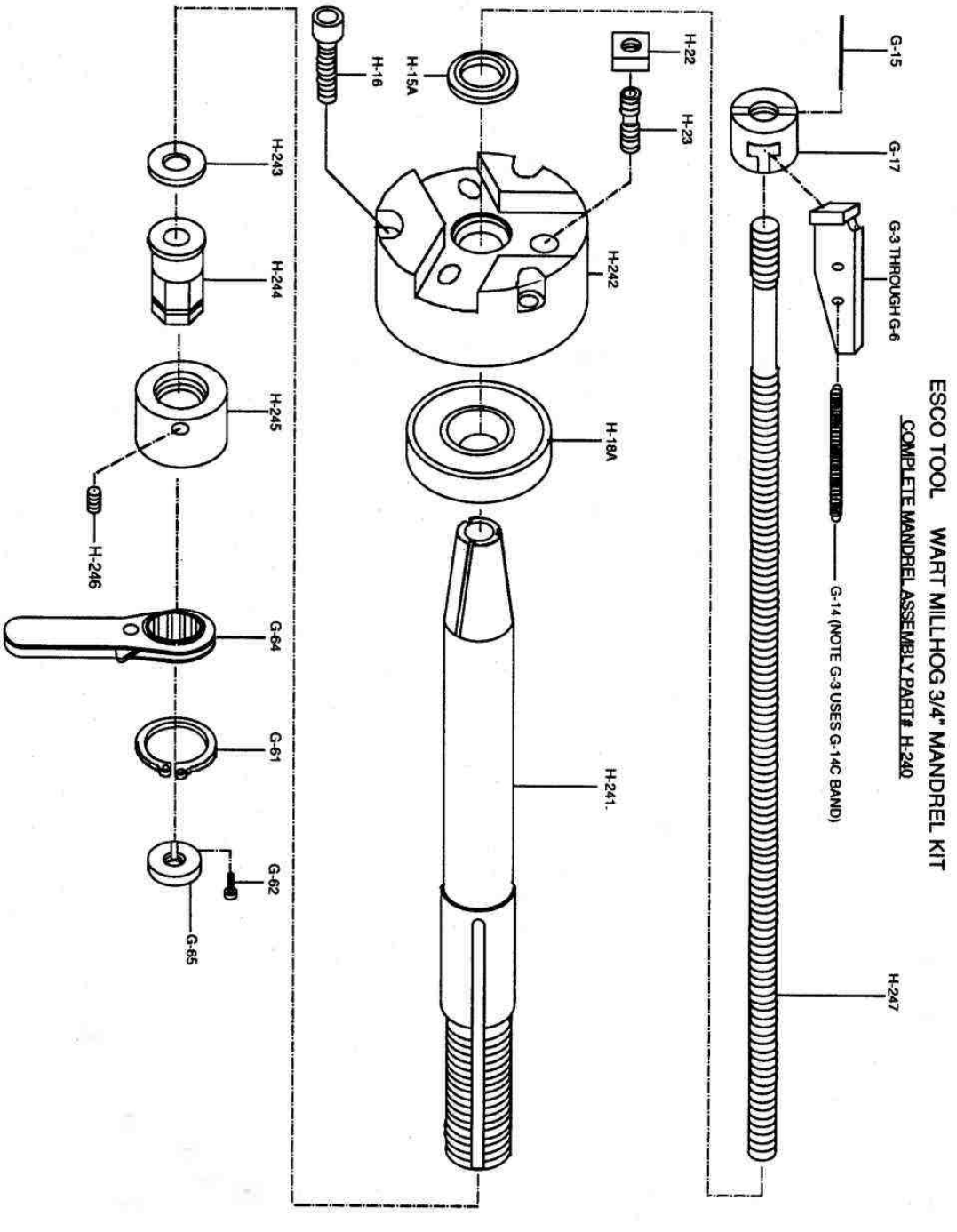
PART #	DESCRIPTION
G-03	CLAMP RIB SET (.750 - .905)
G-04	CLAMP RIB SET (.875 - 1.030)
G-05	CLAMP RIB SET (1.000 - 1.155)
G-06	CLAMP RIB SET (1.125 - 1.280)
G-14	CLAMP RIB SPRING FOR G4-G11
G-15	ACTUATOR ROLL PIN
G-17	ACTUATOR FOR .750 & UP
G-61	SNAP RING
G-62	SCREW
G-63	SET SCREW
G-64	CLAMP RELEASE WRENCH
G-65	DRAW ROD STOP COLLAR

PART #	DESCRIPTION
H-15A	CUTTERHEAD SEAL
H-16	CUTTERHEAD MOUNTING SCREW
H-18A	CUTTERHEAD BEARING FOR 3/4" MANDREL
H-22C	BLADE LOCK, 3/4"
H-23	COMBINATION SCREW
H-241	MANDREL, 3/4"
H-242	CUTTERHEAD 3/4" - 2-5/8"
H-243	WASHER
H-244	DRAW NUT
H-245	FEED STOP HOUSING
H-246	SET SCREW
H-247	DRAW ROD FOR 3/4" MANDREL
H-240	MANDREL KIT COMPLETE, 3/4"

Factory: **Agent:**
ESCO Tool Company, a Unit of ESCO Technologies, Inc.
75 October Hill Road, Holliston, MA 01746
Tel 508-429-4441, Fax 508-429-2811
e-mail: millhog@escotool.com Web site www.escotool.com

Operating Instructions
Millhog Series - “Wart” Millhog

6. Parts list and drawings
    c. ¾” mandrel.



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6. Parts list and drawings
    d. 1” mandrel.

"WART" MILLHOG
1" MANDREL KIT
PARTS LIST

PART #	DESCRIPTION	PART #	DESCRIPTION
H-00	CLAMP RIB SET (1.000" - 1.250")	H-55	DRAW ROD NUT SNAP RING
H-11	ACTUATOR ROLL PIN	H-56A	DRAW ROD STOP COLLAR
H-12A	ACTUATOR, 1"	H-56B	SOCKET HEAD SCREW
H-14A	CLAMP RIB SPRING H-00	H-57A	FEED STOP COLLAR
H-51	DRAW ROD & STOP COLLAR	H-57B	SET SCREW
H-53A	DRAW ROD NUT & FINGER KNOB	H-220	MANDREL, 1" W/ FEED STOP
H-54A	WRENCH, H.D. DRAW ROD	H-221	MANDREL KIT COMPLETE, 1"

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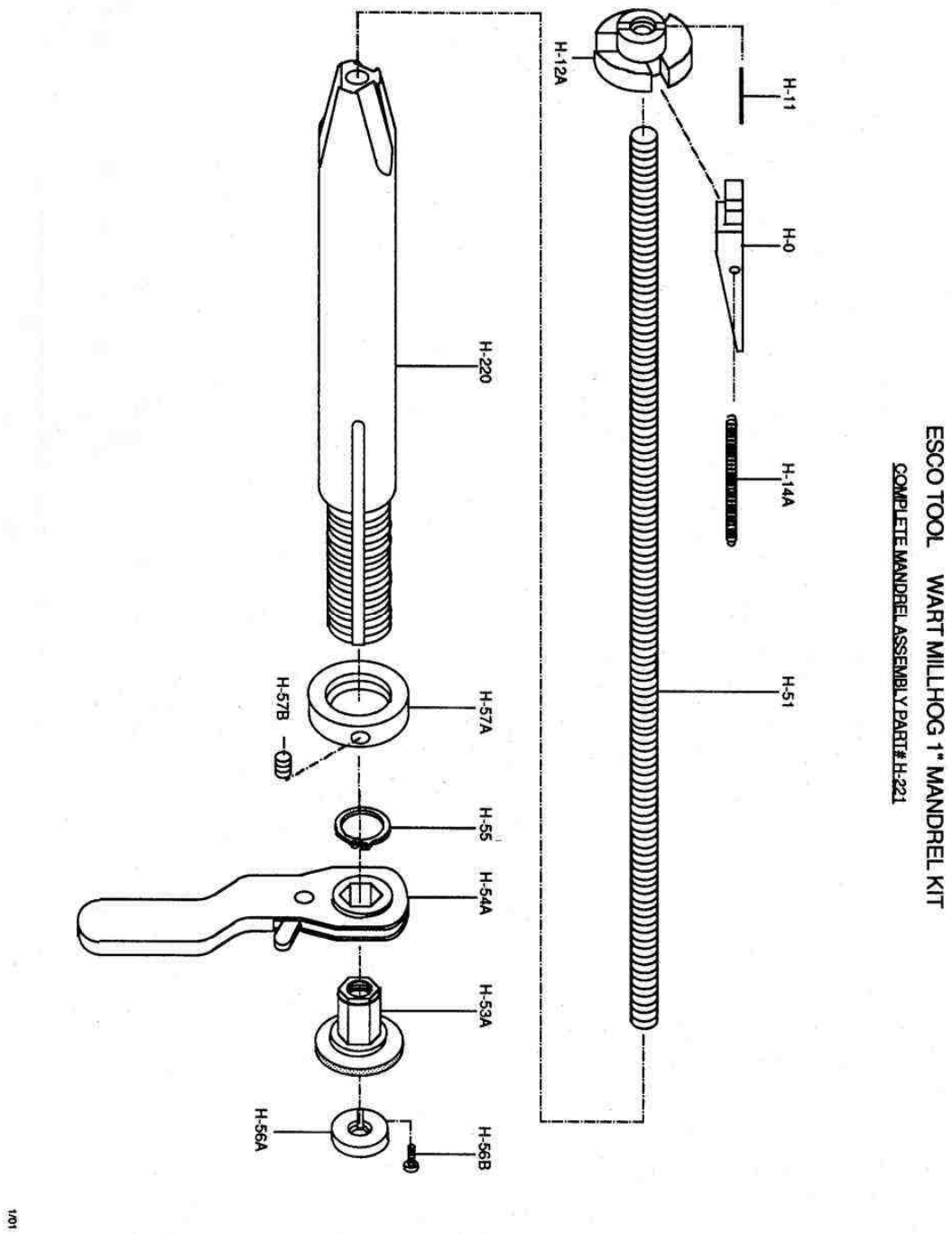
Operating Instructions
Millhog Series - “Wart” Millhog

6. Parts list and drawings
    d. 1” mandrel.



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Agent:

6. Parts list and drawings
e Cutterheads.

WART" MILLHOG
CUTTERHEAD PARTS LIST

PART #	DESCRIPTION	PART #	DESCRIPTION
CH-20	2-5/8" CUTTERHEAD	H-22A	9/16" BLADE LOCK
CH-21	3" CUTTERHEAD	H-22B	5/8" BLADE LOCK
CH-22	3-1/2" CUTTERHEAD	H-22C	3/4" BLADE LOCK
CH-23	4" CUTTERHEAD	H-23	COMBINATION SCREW
CH-24	4-1/2" CUTTERHEAD	AW-01	ALLEN WRENCH SET (NOT SHOWN)

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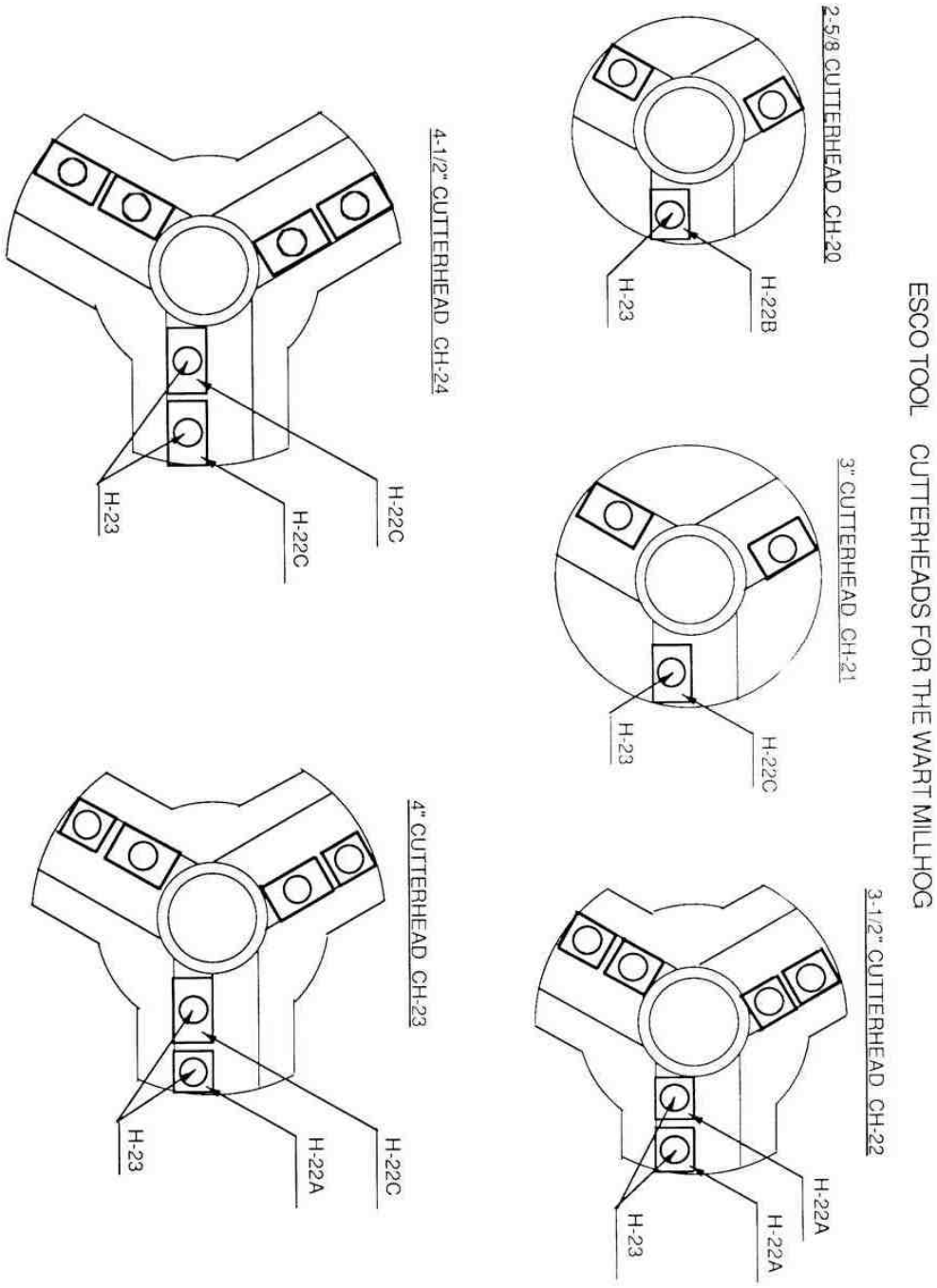
Operating Instructions
Millhog Series - “Wart” Millhog

6. Parts list and drawings
   e Cutterheads.



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Agent:

6. Parts list and drawings
    f. Blades.

MBB-1	BLADE 1/2" BEVEL TIN
MBB-2	BLADE 3/4" BEVEL TIN
MBB-3	BLADE 1" BEVEL TIN
MBBP-1	1/2" 37-1/2 DEG 1/4" PEEL BACK
MBBP-2	3/4" 37-1/2 DEG 1/4" PEEL BACK
MBBP-3	1" 37-1/2 DEG 1/4" PEEL BACK
MCB-1	BLADE,CUSTOM 1/2"CNTR BORE TiN
MCB-2	BLADE,CUSTOM 3/4"CNTR BORE TiN
MCB-3	BLADE,CUSTOM 1"CNTR BORE TiN
MCB10L-1	1/2" 10 DEG BORING >1-3/4"ID
MCB10L-2	3/4" 10 DEG BORING >1-3/4"ID
MCB10L-3	1" 10 DEG BORING > 1-3/4" ID
MCB10S-1	1/2" 10 DEG BORING <1-3/4 ID
MCB10S-2	3/4" 10 DEG BORING <1-3/4 ID
MCB10S-3	1" 10 DEG BORING < 1-3/4" ID
MCBSL-1	1/2" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MCBSL-2	3/4" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MCBSL-3	1" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MCBSS-1	1/2" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MCBSS-2	3/4" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MCBSS-3	1" WIDE 3/8"STRAIGHT BORE 18 DEG TAPER
MJB-1	1/2" "J" BEVEL 22 DEG+3/16 RADIUS
MJB-2	3/4" "J" BEVEL 22 DEG+3/16 RADIUS
MJB-3	1" "J" BEVEL 22 DEG+3/16 RADIUS
MLB-1	BLADE 1/2" LAND TIN
MLB-2	BLADE 3/4" LAND TIN
MLB-3	BLADE 1" LAND TIN
MLRB-1	1/2" FACING BLADE W/ OD RADIUS
MLRB-2	3/4" FACING BLADE W/ OD RADIUS
MLRB-3	1" FACING BLADE W/ OD RADIUS
MRBB-1	1/2"37-1/2 DEGREE BORING BLADE
MRBB-2	3/4"37-1/2 DEGREE BORING BLADE
MRBB-3	1" 37-1/2 DEGREE BORING BLADE
MTSR-1	BLADE, 1/2" TUBE STUB REMOVAL
MTSR-2	BLADE, 3/4" TUBE STUB REMOVAL
MTSR-3	BLADE, 1" TUBE STUB REMOVAL
MTSS-1	BLADE, 1/2" TUBE SEAT
MTSS-2	BLADE, 3/4" TUBE SEAT
MTSS-3	BLADE, 1" TUBE SEAT

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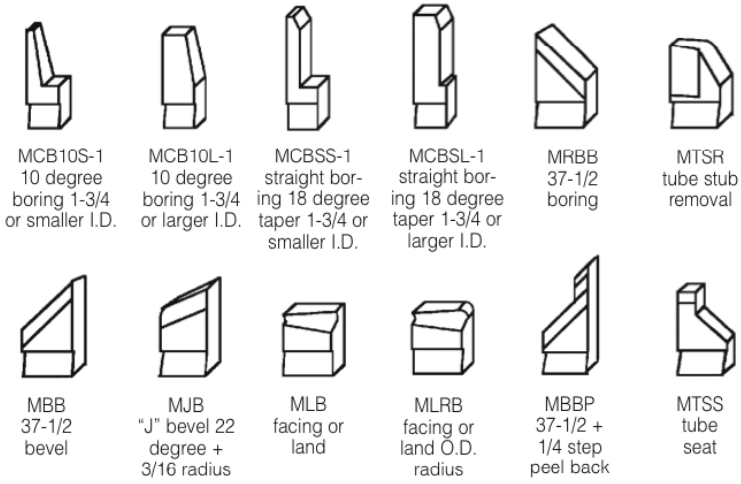
Operating Instructions
Millhog Series - “Wart” Millhog

6. Parts list and drawings
    f. Blades.

Cutter Blades for the Wart, Mini, Prepzilla, Commander, and Dictator MILLHOG®



MCB10S-1 10 degree boring 1-3/4 or smaller I.D.

MCB10L-1 10 degree boring 1-3/4 or larger I.D.

MCBSS-1 straight boring 18 degree taper 1-3/4 or smaller I.D.

MCBSL-1 straight boring 18 degree taper 1-3/4 or larger I.D.

MRBB 37-1/2 boring

MTSR tube stub removal

MBB 37-1/2 bevel

MJB “J” bevel 22 degree + 3/16 radius

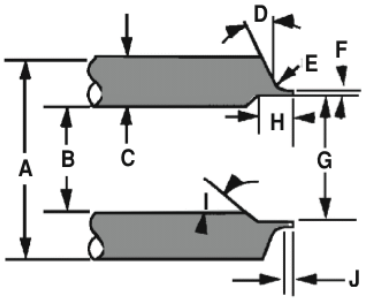
MLB facing or land

MLRB facing or land O.D. radius

MBBP 37-1/2 + 1/4 step peel back

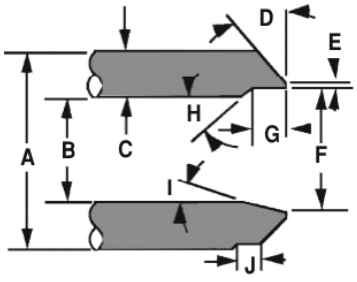
MTSS tube seat

Specifications for “J” Prep Custom Blades



		Standard	Your Spec.
A	Tube O.D.	—	
B	Tube I. D.	—	
C	Wall thickness	—	
D	Bevel Angle	22°	
E	Radius	3/16	
F	Land or Face	—	
G	Bore Dia.	—	
H	Bore Depth	3/8	
I	Bore Taper	18°	
J	Nose (Straight)	—	
K	Tapered bore angle instead of straight bore	10°	

Specifications for “V” Prep Custom Blades



		Standard	Your Spec.
A	Tube O.D.	—	
B	Tube I. D.	—	
C	Wall thickness	—	
D	Bevel Angle	37-1/2°	
E	Land or Face	—	
F	Bore Dia.	—	
G	Depth of Bore	3/8	
H	Taper Angle	18°	
I	Bore Angle	10°	
J	Peel Back	1/4”	

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Agent:

6. Parts list and drawings
    g. Air hose.

HOSE ASSEMBLY
PARTS LIST

PART #	DESCRIPTION
AHW-300	NIPPLE, 3/8" x 3/8"
AHW-301	COUPLER
AHW-302	HOSE BARB, 1/2" x 3/8"
AHW-303	HOSE, 6'
AHW-304	SEAL
AHW-305	CHICAGO FITTING, 1/2"
AHW-306	SAFETY PIN
AHW-307A	COMPLETE FILTER & LUBRICATOR ASSY.
AHG-308	FILLER PLUG
AHG-309	FILLER PLUG "O" RING
AHG-310	OIL ADJUSTMENT VALVE ASSEMBLY
AHG-311	VALVE GASKET
AHG-312	SIGHT DISK AND SEAL
AHG-313	SIGHT DISK LOCK NUT
AHW-308A	FILTER REPAIR KIT
AHW-309	HOSE BARB, 1/2" x 1/2"
AH-201	COMP. HOSE ASSEMBLY

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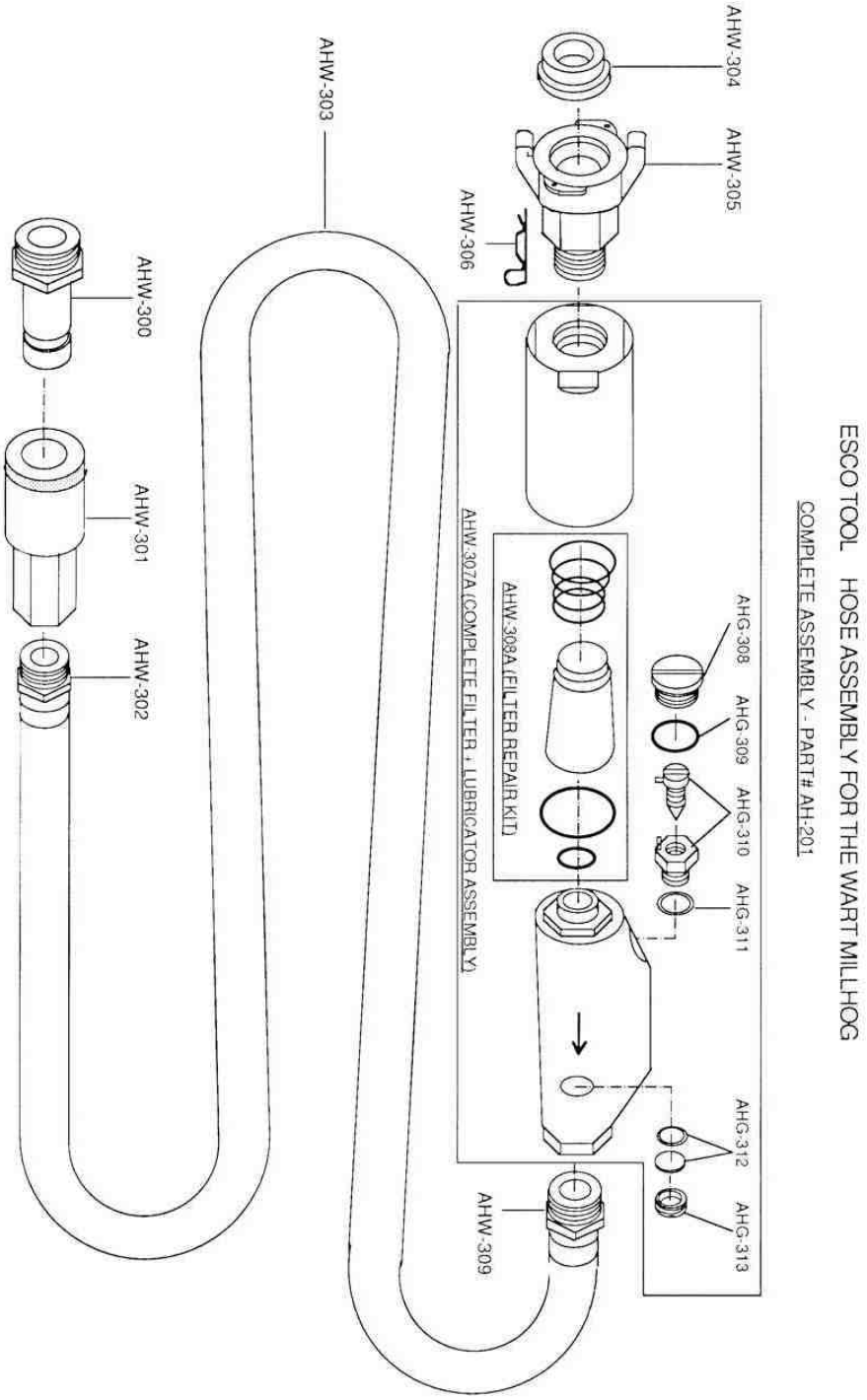
Operating Instructions
Millhog Series - “Wart” Millhog

6. Parts list and drawings
    g. Air hose.



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7. MSDS.
    a. Marvel Air Tool Oil.
        1. PRODUCT AND COMPANY IDENTICATION.
            a. PRODUCT NAME Marvel Air Tool Oil.
            b. PRODUCT CODE MM080, MM085, MM086, MM088R, MM089 MM.
            c. CHEMICAL FAMILY Petroleum Distillates.
            d. CHEMICAL NAME Complex Mixture of Hydrocarbons.
            e. FORMULA Mixture.
        2. MANUFACTURER EMERGENCY TELEPHONE NUMBERS.
            a.Marvel Oil Company, Inc Transportation:
            5655 W. 73rd Street CHEMTREC: 800-424-9300
            Chicago, IL 60638 Medical:
            Phone: 708-563-3766 ROCKY MTN POISON CTR: 800-332-3073 Fax: 708-563-3715.
        3. POSITION/INFORMATION ON INGREDIENTS.
            a. COMPONENT CAS NUMBER CONCENTRATION (wt %).
            b. Naphthenic Hydrocarbons 64742-52-5 70 – 80.
            c. Mineral Spirits 08052-41-3 20 – 30.
            d. Chlorinated Hydrocarbons 00095-50-1 0 – 1.
        4. EXPOSURE LIMITS 8 hrs. TWA(ppm).
            a. OSHA PEL ACGIH TLV.
            b. Naphthenic Hydrocarbons 5 as oil mist 5 as oil mist.
            c. Mineral Spirits 100 100.
            d. Chlorinated Hydrocarbons 25 25.
        5. HAZARDS IDENTIFICATION, POTENTIAL HEALTH EFFECTS.
            a. INHALATION: Can cause nasal and respiratory irritation, dizziness, weakness, fatigue, nausea, headache, possible unconsciousness and even asphyxiation.
            b. INGESTION**:** Can cause gastrointestinal irritation, nausea, vomiting and diarrhea. Aspiration into lungs can cause pneumonitis which can be fatal.
            c. SKIN CONTACT: Prolonged or repeated contact can cause moderated irritation, defatting or dermatitis.
            d. EYE CONTACT: Can cause severe irritation, redness, tearing or blurred vision.
        6. FIRST AID MEASURES
            a. EYE: Flush with large amounts of water, lifting upper and lower eyelids occasionally. Get medical attention.
            b. SKIN: Thoroughly was exposed area with soap and water. Remove contaminated clothing. Launder before re-use.
            c. INHALATION: Remove person to fresh air. If breathing difficult, administer oxygen. If breathing has stopped, give artificial respiration. Keep person warm and quiet. Call a physician.
            d. INGESTION: Do not induce vomiting. Keep person quiet and warm. Get medical attention. Aspiration of material into lungs can cause chemical pneumonitis which can be fatal.
        7. FIRE FIGHTING MEASURES.
            a. FLASH POINT: 128 ° F (53 ° C) TCC.
            b. EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, foam.
            c. SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus with full facepiece operated with positive pressure-demand when fighting large fires.
        8. ACCIDENTIAL RELEASE MEASURES SPILL OR LEAK PROCEDURES:
            a.Ventilate area. Remove sources of ignition.
            b.Prevent entry into sewers and waterways.

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7. MSDS, continued.
    a. Marvel Air Tool Oil.
        8. ACCIDENTIAL RELEASE MEASURES SPILL OR LEAK PROCEDURES:
            c. Pick up free liquid for recycle and/or disposal.
            d. Absorb small amounts on inertmaterial for disposal.
        9. HANDLING AND STORAGE.
            a. STORAGE TEMPERATURE (MIN./MAX.): -40 º F (-40 º C)/ 120 º F (49 C).
            b. SHELF LIFE: 3 years minimum when the original container is kept tightly closed and properly stored.
            c. SPECIAL SENSITIVITY: None.
            d. HANDLING AND STORAGE PRECAUTIONS: Empty containers may be dangerous since fumes may still exist. Observe precautions given for this product as stated in this document.
        10. EXPOSURE CONTROLS/PERSONAL PROTECTION.
            a. EYE PROTECTION REQUIREMENTS: Splash goggles.
            b. SKIN PROTECTION REQUIREMENTS: Wear chemically resistant gloves.
            c. RESPIRATOR/VENTILATION REQUIREMENTS: Provide sufficient ventilation to avoid exposure levels above the established TLV's.
            d. EXPOSURE LIMITS: Not established for product as whole.
            e. Mineral Spirits NIOSH 100 ppm TWA.
            f. Oil Mist OSHA 5 mg/m3.
        11. PHYSICAL AND CHEMICAL PROPERTIES.
            a. PHYSICAL FORM: Thin liquid.
            b. COLOR: Red.
            c. ODOR: Wintergreen.
            d. BOILING POINT: Not determined.
            e. MELT / FREEZE POINT - 60 º F (- 51 º C).
            f. PH: Not applicable.
            g. SOLUBILITY IN WATER: Insoluble.
            h. SPECIFIC GRAVITY: 0.876 @ 60 º F (15.6 º C).
            i. % VOLATILE BY WEIGHT: 25 %.
            j. VAPOR PRESSURE: Not determined.
            k. VAPOR DENSITY: Not determined.
        l2. REACTIVITY.
            a. STABILITY: Stable.
            b. HAZARDOUS POLYMERIZATION: Will not occur.
            c. INCOMPATIBILITIES: Strong oxidizing agents.
            d. DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide and hydrocarbons.
        13. TOXICOLOGICAL INFORMATION.
            a. ACUTE INHALATION: Aspiration into lungs can cause pneumonitis which can be fatal.
            b. CHRONIC INHALATION: Not determined.
            c. ACUTE SKIN CONTACT: Prolonged or repeated contact can cause moderate irritation, defatting or dermatitis.
            d. CHRONIC SKIN CONTACT: Not determined.
            e. ACUTE EYE CONTACT: Can cause severe irritation, redness, tearing or blurred vision.

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7. MSDS, continued.
    a. Marvel Air Tool Oil.
        14. ECOLOGICAL INFORMATION.
            a. No data available.
            b. DISPOSAL CONSIDERATIONS.
            c. Ignitable hazardous waste, EPA Hazardous Waste Number D001
        15. WASTE DISPOSAL METHOD:
            a. Dispose of product in accordance with all local, state and federal laws and regulations.
        16. TRANSPORT INFORMATION.
            a. DOT INFORMATION:
                1. PROPER SHIPPING NAME: Non Bulk Not regulated.
                2. Bulk Petroleum distillates, n.o.s.
                3. TECHNICAL SHIPPING NAME: Fuel and oil additive.
                4. HAZARD CLASS: Non Bulk ORM-D.
                5. Bulk Class 3.
                6. UN NUMBER: UN 1268.
                7. PRODUCT RQ (lbs): None.
                8. LABEL: Non Bulk ORM-D.
                9. Bulk Flammable Liquid.
                10. PLACARD: Non Bulk None.
                11. Bulk Flammable Liquid.
                12. FREIGHT CLASS BULK: PG III.
                13. FREIGHT CLASS PACKAGE: None.
                14. PRODUCT LABEL None.
                15. REGULATORY INFORMATION.
                16. TSCA STATUS: All ingredients listed.
                17. CERCLA REPORTABLE QUANTITY: None.
                18. SARA TITLE III:
                19. SECTION 302 EXTREMELY.
                20. HAZARDOUS SUBSTANCES None.
                21. SECTION 311/312.
                22. HAZARD CATEGORIES.
                23. Acute Health Yes.
                24. Chronic Health Yes.
                24. Fire Yes.
                26. Reactive No.
                27. Sudden Release of Pressure No.
        17. SECTION 313.
            a. CHEMICAL NAME / CAS NUMBER CONCENTRATION.
                1.Ortho-dichlorobenzene 00095-50-1 0 – 0.25 %.
        18. RCRA STATUS: If discarded in its purchased form, this product would be an ignitable waste with an EPA Hazardous Waste Number of D001. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product should be classified as a hazardous waste. (40CFR261.20-24).
        19. CANADIAN STATUS:
            a. All materials contained in this product are listed on the Canadian Domestic Substances List.
        20. EUROPEAN UNION:
            a. All materials contained in this product are listed on EINECS.

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7. MSDS, continued.
    a. Marvel Air Tool Oil.
        21. STATE REGULATORY INFORMATION:
            a.The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.
        22. COMPONENT/ CAS NUMBER CONCENTRATION STATE CODE.
            a. p-dichlorobenzene less than 150 ppm CA 00106-46-7 CA = Material known to the state of California to cause cancer and/or birth defects. (California Proposition 65).
        23. OTHER INFORMATION.
            a. HMIS CLASSIFICATION Health 2.
            b. Flammability 2.
            c. Reactivity 0.
            d. PPI B.
            e. NFPA RATING Health 2.
            f. Fire 2.
            g. Reactivity 0.
            h. Special None.
            i. REASON FOR ISSUE Update to ANSI format.
            j. PREPARED BY Richard P. Kelly.
            k. TITLE Technical Manager.
            l. APPROVAL DATE June 21, 2002.
            m. SUPERCEDES DATE November 7, 2000.
            n. REVISION NUMBER #04.

This information is to the best of Marvel Oil Company's knowledge and belief, accurate and reliable. However, no representation, warranty, or guarantee is made to its accuracy, reliability or completeness. It is the users responsibility to satisfy himself as to the suitableness and completeness of such information for his own particular use.

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7. MSDS, continued.

b. Tool steel cutting blades.

Crucible Service Centers

Material Safety Data Sheet

1. PRODUCT IDENTIFICATION

This MSDS applies to all established steel grades distributed by Crucible Service Centers. Specified percent components for each element can be obtained from the certificate of test.

Supersedes: March 2002 (Revised November 2002)

Reissued: July, 2005

Prepared by: Crucible Service Centers Division
575 State Fair Blvd
Syracuse, NY 13201

Telephone for Information: (315)-470-9048 Contact Quality Assurance-Distribution.
Emergency Telephone: 1-800-365-1180

HMIS Rating: Health=1; Flammability=0; Reactivity=0.
WHMIS Rating (Canada): Class D – Division – 2 -Sub Division A
Untested mixture containing a toxic material

2. HAZARDOUS INGREDIENTS

% Weight

Alloy Element	CAS NO.	High Speed	Tool Steel	300 Stainless	400 Stainless	Valve Steel	Alloy Steel
Aluminum*+	7429-90-5	<0.1	<3.0	<1.0	<0.5	<0.5	<1.0
Carbon	7440-44-0	<4.0	<4.0	<0.5	<4.0	<1.0	<0.70
Chromium*	7440-47-3	<5.0	<13.0	<26.0	<27.0	<23.0	<2.0
Cobalt*	7440-48-4	<15.0	<11.0	<0.5	<0.5	<0.5	<0.50
Columbium	7440-03-1	<0.1	<0.1	<2.0	<2.5	<2.5	<0.10
Copper*	7440-50-8	<0.5	<1.5	<4.0	<5.0	<0.5	<0.50
Iron	1309-37-1	<75.0	<90.0	<90.0	<60.0	<60.0	<99.0
Lead*	7439-92-1	<0.1	<0.1	<0.10	<0.1	<0.10	<0.35
Manganese*	7439-96-5	<1.0	<3.0	<6.0	<3.0	<13.0	<2.0
Molybdenum	7439-98-7	<11.0	<10.0	<4.0	<3.5	<1.0	<1.0
Nickel*	7440-02-0	<1.0	<18.0	<37.0	<5.0	<15.0	<4.0
Selenium*	7782-49-2	<0.1	<2.0	<0.5	<0.5	<1.0	<0.10
Silicon	7440-21-3	<1.0	<5.0	<2.0	<2.0	<4.0	<0.40
Titanium	7440-32-6	<0.1	<0.1	<1.0	<0.5	<0.5	<0.10
Tungsten	7440-33-7	<19.0	<11.0	<0.5	<4.0	<3.0	<0.10
Vanadium	7440-62-2	<10.0	<18.0	<0.5	<10.0	<0.5	<0.30

* Sara Title III, Section 313, Toxic Chemical. These chemicals are subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to Know Act of 1986 and 40 CFR 372. Please note if you repackage or otherwise redistribute this product to industrial customers, a notice similar to this one must be sent to those customers.
+ Regulated, under Section 313, as fume or dust.

Factory: **Agent:**
ESCO Tool Company, a Unit of ESCO Technologies, Inc.
75 October Hill Road, Holliston, MA 01746
Tel 508-429-4441, Fax 508-429-2811
e-mail: millhog@escotool.com Web site www.escotool.com

7. MSDS.
   b. Tool steel cutting blades.

3. PHYSICAL DATA

Boiling Point: NA
Melting Point: 2600°F to 2800°F
Vapor Pressure (mmHg): NA
Vapor Density (Air=1) NA
Specific Gravity (H_2O=1): 7.4-8.7g/cm^3
Evaporation Rate (Butyl Acetate+1): NA
Solubility in Water: Insoluble
Appearance & Odor: Powder, odorless metal.

4. FIRE AND EXPLOSION DATA

Flash Point: NA
Flammable Limits: NA
Unusual Fire Hazard: NA
Special Fire Fighting Procedures: NA
LEL/UEL: NA
Extinguishing Media: NA

5. REACTIVITY DATA

Stability: Chemically stable

Conditions to Avoid: Avoid exposure to generated dust or fume.
Incompatibility (Material to Avoid): Reacts with strong acids and oxidizers.
Hazardous Decomposition or Byproducts: None
Hazardous Polymerization: None

6. HEALTH HAZARD DATA

Primary Route of Exposure: Inhalation of dust and fumes
Routes Of Entry: Inhalation: YES Skin: NO Ingestion: NO Eyes: YES

Health Hazards (Acute and Chronic):

Note: Steel products in their usual physical form do not pose any health hazard. However, when subjected to welding, burning, sawing, brazing, grinding, etc. potential hazardous fumes or dust may be generated. The above operations should be performed in well ventilated areas. The primary rout of exposure is from inhalation of fume and dust.

The effects of overexposure to the various metal fumes and dust, which may be generated from this product, and the associated health effects from overexposure are as follows:

Acute: Excessive inhalation of metallic fumes and dusts may be irritating to respiratory passages. Excessive inhalation of fumes from many metals can produce an acute reaction known as "metal fume fever". Symptoms consist of chills and fever (very similar and easily confused with flu symptoms), a metallic taste in the mouth, and dryness and irritation of the throat. The symptoms come on a few hours after excessive exposures and usually last from 12 to 48 hours. Long-term effects from metal fume fever have not been noted. Iron oxide, copper and manganese have been associated with causing metal fume fever.

High concentrations of metallic fumes and dusts can result in irritation of the eyes, skin, mucous membranes, and other forms of physical irritation.

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7. MSDS, continued.
   b. Tool steel cutting blades.

Alloy Element	CAS No.	OSHA PEL	ACGIH TLV
ALUMINUM	7429-90-5	15 mg/m^3 (total dust) 5mg.m^3 (respirable dust)	10mg/m^3 (metal dust) 5mg/m^3 (welding fume)
CARBON	7440-44-0	3.5 mg/m^3 (as carbon black)	3.5mg/ m^3 (as carbon black)
CHROMIUM	7440-47-3	1 mg/ m^3	0.5 mg/ m^3
COBALT	7440-48-4	0.1 mg/ m^3	0.02 mg/ m^3
COLUMBIUM	7440-03-1	15 mg/m^3 (total dust) 5 mg/m^3 (respirable dust)	10 mg/ m^3 (total dust) 3 mg/m^3 (respirable dust)
COPPER	7440-50-8	0.1 mg/ m^3 (fume) 1 mg/m^3 (dust)	0.2 mg/m^3 (fume) 1 mg/m^3 (dust)
IRON	1309-37-1	10 mg/m^3 (as iron oxide)	5 mg/m^3 (as iron oxide)
MANGANESE	7439-96-5	5 mg/m^3 (dust)(ceiling limit) 1 mg/m^3 (fume) 3 mg/m^3 (fume) (STEL)	0.2 mg/m^3 (dust) 1 mg/m^3 (fume) 3 mg/m^3 (fume) (STEL)
MOLYBDENUM	7439-98-7	10 mg/m^3 (as MO & insoluble compounds)	10 mg/m^3 (as MO & insoluble compounds)
NICKEL	7440-02-0	1 mg/m^3 (metal and insoluble compounds)	1 mg/m^3 (metal and insoluble compounds)
SELENIUM	7782-49-2	0.2 mg/m^3	0.2 mg/m^3
SILICON	7440-21-3	15 mg/m3 (total dust)	10 mg/m3 (total dust)
TITANIUM	7440-32-6	15 mg/m^3 (total dust as TiO_2)	10 mg/m^3 (total dust as TiO_2)
TUNGSTEN	7440-33-7	15 mg/m^3 (total dust) 5 mg/m^3 (respirable dust) (Insoluble compounds)	5 mg/m^3 10 mg/m^3 (STEL) (Insoluble compounds)
VANADIUM	7440-62-2	0.5 mg/m^3 (respirable dust as V_2O_5) 0.1 mg/m^3 (fume as V_2O_5)	0.5 mg/m^3 (respirable fraction as V_2O_5)

NTP = NATIONAL TOXICOLOGY PROGRAM

1: Known to be carcinogenic; sufficient evidence from human studies
2: Reasonably anticipated to be a carcinogen; limited evidence from studies in humans or sufficient evidence from studies in experimental animals

IARC = INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

1: Carcinogenic to humans; sufficient evidence of carcinogenic
2A: Probably carcinogenic to humans; limited human evidence, sufficient evidence in experimental animals
2B: Possibly carcinogenic to humans; limited evidence in human in the absence of sufficient evidence in experimental animals
3: Not classified as to carcinogenic to humans
4: Probably not carcinogenic to humans

= =

CHRONIC: Chronic inhalation of high concentrations of metallic fumes and dusts are associated with the following conditions:

ALUMINUM: Excessive exposures to aluminum metal fumes and dust have been associated with scarring of the lung tissue and respiratory irritation, but this effect may be due to simultaneous silica exposure.
CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

CARBON: Elemental carbon, as it exists in this product, is of very low toxicity. Health hazard data presented here is based on exposures to carbon black, not carbon as it is found in this product. Chronic inhalation exposure to carbon black may result in temporary or permanent damage to lungs and heart. Pneumoconiosis has been found in workers engaged in the production of carbon black. Skin conditions such as inflammation of the hair follicles, and oral mucosal lesions have also been reported from skin exposure.
CARCINOGENICITY: NA NTP: NO IARC: 3* OSHA REGULATED: NO
*** (for carbon black)**

7. MSDS, continued.
   b. Tool steel cutting blades.

CHROMIUM: The health hazards associated with exposure to chromium are dependent on its oxidation state. The metal form (chromium as it exists in this product) is of very low toxicity. The water-soluble hexavalent chromium form is considerably more toxic. Adverse effects of the hexavalent form on the skin may include ulcerations, dermatitis, and allergic skin reactions. Inhalation of hexavalent chromium compounds can result in ulceration and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasm and edema. Respiratory symptoms may include coughing and wheezing, shortness of breath, and nasal itch. Eye irritation or inflammation may also result. The NTP lists hexavalent chromium as a known human carcinogen. Chromium metal is listed as not classifiable as to carcinogenic to humans.

CARCINOGENICITY: YES NTP: NO* IARC: 3* OSHA REGULATED: NO
*** (Hexavalent Chromium NTP: 1, IARC: 1)**

COBALT: Inhalation of cobalt metal fumes and dust causes irritation of the nose and throat. Cobalt dust may cause an asthma-like disease with symptoms ranging from cough, chronic bronchitis, shortness of breath and labored breathing, to decreased pulmonary function, nodular scarring of the lung tissue, permanent disability, and death. Exposure to cobalt may cause weight loss, dermatitis (inflammation of the skin) and respiratory hypersensitivity. Although cobalt is not listed by NTP or OSHA as a carcinogen, some data suggests that cobalt is an experimental carcinogen in laboratory animals. The author finds that the current OSHA limit of 0.1 mg/m^3 is not protective of worker health.

CARCINOGENICITY: NA NTP: NO IARC: 2B OSHA REGULATED: NO

COLUMBIUM (NIOBIUM): Columbium, when inhaled, is retained mainly in the lungs, and secondarily in bones. It interferes with calcium as an activator of enzyme systems. In laboratory animals, inhalation of niobium nitride and/or pentoxide leads to scarring of the lungs at exposure levels of 40 mg/m^3. Columbium is a moderate eye irritant and a powerful skin irritant in laboratory animals.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

COPPER: Industrial exposure to copper fumes, dusts and/or mists results in metal fume fever, nausea, irritation of upper respiratory tract, and irritation of nasal mucous membranes. Chronic poisoning could aggravate individuals who suffer from Wilson's disease, a genetic condition characterized by liver cirrhosis, brain damage, nerve damage, kidney disease, and copper deposition in the cornea (eye).

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

IRON: Chronic inhalation of excessive concentrations of iron oxide fumes and dusts may result in development of a benign pneumoconiosis called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of iron oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Acute exposure to the eyes may result in mild conjunctivitis.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

MANGANESE: Chronic exposure to high concentrations of manganese fumes and dusts may increase the incidence of pneumonia and lung damage and may adversely affect the central nervous system with symptoms including sleepiness, weakness, emotional disturbances, spastic walk, mask-like facial expression, and paralysis.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

MOLYBDENUM: Dust of metallic molybdenum has caused difficulty breathing, general weakness, dizziness, chest pain, expectoration, fatigue, headache, anorexia, and joint and muscle pain. Molybdenum has caused anemia and poor growth in experimental animals. Molybdenum may also cause pneumoconiosis and irritation to the lungs and eyes. In rats, dusts of metallic molybdenum

7. MSDS, continued.
   b. Tool steel cutting blades.

have caused growth, depression and thickening of intra-alveolar septa, which contained connective tissue fibers.
CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

NICKEL: Nickel fumes are respiratory irritants and have been a known cause of asthma, pneumonia, pulmonary edema and pulmonary fibrosis in welders using nickel alloys. Airborne nickel-contaminated dusts are regarded as capable of producing lung cancer. The risk is higher for workers at primary nickel smelters and refineries than for workers exposed to nickel alloys. Skin contact may cause an allergic rash. Nickel itch is the dermatitis resulting from sensitization to nickel. Itching can occur up to seven days before skin eruption occurs. The primary skin eruption is reddening or infection of the hair follicles, which may be followed by skin ulceration. Nickel sensitivity, once acquired, is apparently not lost.
CARCINOGENICITY: YES NTP: 2 IARC: 2B OSHA REGULATED: NO

SELENIUM: Overexposure of selenium fumes may produce accumulation of fluid in the lungs, garlic breath, bronchitis, pneumonitis, bronchial asthma, nausea, chills, fever, headache, sore throat, shortness of breath, conjunctivitis, vomiting, abdominal pain, diarrhea, and enlarged liver. Selenium is an eye and upper respiratory irritant and a sensitizer. Overexposure may result in red staining of the nails, teeth, and hair. Selenium dioxide reacts with moisture to form selenious acid, which is corrosive to the skin and eyes.
CARCINOGENICITY: NA NTP: NO IARC: 3 OSHA REGULATED: NO

SILICON: Elementary silicon is an inert material. Slight pulmonary lesions have been reported in laboratory animals from injections of silicon dust within the trachea. Silicon dust has little adverse effect on lungs and does not appear to produce significant organic disease or toxic effects when exposures are kept under the TLV. Silicon may cause chronic respiratory effects if repeated overexposure occurs.
CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

TITANIUM: Elemental titanium is an inert material. Titanium dioxide may be generated in welding fumes from this product. At extremely high concentrations, titanium dioxide has induced lung cancer in rats. Titanium dioxide dust is a mild pulmonary, eye and skin irritant: Rats exposed to titanium dioxide developed small focal areas of emphysema which were attributable to large deposits of dust. Excessive exposure in humans may result in slight changes in the lungs. The dusts of titanium dioxide can be placed in the nuisance category.
CARCINOGENICITY: NA NTP: NO IARC: 3* OSHA REGULATED: NO * (for Titanium Dioxide)

TUNGSTEN: Chronic exposure to tungsten dust has been reported to cause pulmonary fibrosis characterized by cough, labored breathing and wheezing. Dermatitis (inflammation of the skin), primarily on the sides of the neck, inner forearm, and the backs of the hands, was also reported. Dusts of tungsten pose a hazard considered to be somewhat greater than that of nuisance dust.
CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

VANADIUM: The health hazards associated with exposure to vanadium are dependent on its oxidation state. This product contains elemental vanadium. Elemental vanadium could be oxidized to vanadium pentoxide during welding. The pentoxide form is more toxic than the elemental form. Chronic exposure to vanadium pentoxide dust and fumes may cause severe irritation of the eyes, skin, upper respiratory tract, persistent inflammation of the trachea and bronchi, pulmonary edema, and systemic poisoning. Signs and symptoms of overexposure include: conjunctivitis, nasopharyngitis, cough, labored breathing, rapid heartbeat, lung changes, chronic bronchitis, skin pal, greenish-black tongue, and an allergic skin rash.
CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

7. MSDS, continued.

b. Tool steel cutting blades.

This product, as a mixture, has not been determined to be carcinogenic. However, individual components - nickel, certain chromium and cobalt compounds, and titanium dioxide - have been associated with carcinogenicity.

7. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken when material is spilled or released: N/A

Waste Disposal Methods: In accordance with Local, State and Federal Authorities.

Precautions to be taken in Handling and Storage: If user operations generate dust, fume or mist, use proper ventilation to keep exposure to airborne metal blow the PEL. If ventilation alone cannot control exposure, use of a NIOSH approved respirator selected according to OSHA 29CFR 1910.134 is a must. Consult a professional Industrial Hygienist.

Other precautions: Do not eat, drink or smoke in areas where dust/fume is generated, handled, processed or stored openly.

8. CONTROL MEASURES AND USE – Always consult a Professional Hygienist

Respiratory Protection: If fumes, misting or dust conditions occur, consult a professional Industrial Hygienist. Provide NIOSH-approved respirators.

Ventilation: Use general or local exhaust ventilation to keep airborne concentration of dust and fumes below the TLV. Consult a professional Industrial Hygienist.

Eye Protection: Safety Goggles should be worn.

Protective Gloves: Non-Cloth gloves and barrier creams may be necessary to prevent skin sensitization and dermatitis (inflammation of the skin).

9. ADDITIONAL INFORMATION

CONTACT: Quality Assurance-Distribution
Crucible Specialty Metals
PO Box 977
Syracuse, New York 13201

TELEPHONE: 315-470-9048

As defined by OSHA, a STEL (Short Term Exposure Limit) is the employee's 15 minute time weighted average exposure, which must not be exceeded at any time during a workday. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than 4 times per day, with an hour between successive exposures.

Coatings may be applied to the product for protective purposes. The possible presence of coatings should be recognized and considered when evaluating potential employee hazards and exposures during dust/fume generating activities. Applicable coating MSDS's are available upon request.