MILLHOG®

Precision Pipe and Tube Beveling, Cutting and Fabricating Tools

Made in the USA

Manufacturer and Market Leader

We Deliver Cutting Edge Innovation

esco tool®

ESCO Tool

The World Leader in Boiler Maintenance Tools

For over 60 years, ESCO Tool has worked closely with end-users on the toughest tube and pipe cutting and end prep applications in the power generation and metalworking industries. Our knowledge and experience has allowed us to invent and manufacture high quality tools that work efficiently and require no special operator training.

This catalog describes our rugged MILLHOG® tools, High-Speed Bevelers and accessories. These tools are built tough and precision machined from the finest materials to make sure that you get your job done properly, on time, and under budget.

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The ESCO Quality Commitment. . .

ESCO MILLHOG® End Prep Tools are built tough and precision machined from the finest materials.

- Sturdy Gear Drive — We select the best components available today. For example, the "Wart" MILLHOG® features dual opposed tapered roller bearings, two ball bearings that support the link between the drive shaft and right angle gear assembly and a bearing supported cutterhead, providing optimum rigidity and stability.
- Rigid I.D. Clamping — All MILLHOG® tools provide torque-free operation and incorporate self-centering draw rod assemblies that rigidly mount to the tube or pipe I.D.
- EscoLock Blade Lock System — This wedge lock design creates a superior blade holding force which minimizes vibration, a primary cause of premature blade failure.
- Superior Bevel Blade Design — Providing more end preps per bevel blade, ESCO's unique chip breaker helps produce a continuous chip which minimizes heat build up on the blade. All MILLHOG® blades are made of T-15 tool steel which is TiN (titanium nitride) coated. They work on all boiler tube materials, including stainless steel, and are designed to run cooler and produce 2 to 5 times more bevels per blade than competitive blades, without cutting fluids.

ESCO MILLHOG® Universal Air-Powered Saws provide accurate cuts with no "HAZ" (Heat Affected Zone).

- Boilermaker Tough and Field Proven — The MILLHOG® saw glides along the EscoTrack System and produces a straight, clean horizontal cut that requires no further rework for boiler tube panel removal.
- Pipe Cutting Made Easy — The EscoWrap Track System is ideal for cutting pipe from 6" to 60" O.D. by 4" wall thickness. This innovative universal pipe trolley and clamp assembly mounts to the pipe and lets the saw glide around the circumference making a perfectly square cut with no heat affected zone.
- ESCO Tool, The World Leader In Boiler Maintenance Tools — For over 60 years we have worked closely with end-users to solve the toughest maintenance and construction problems in the power generation and metalworking industries.
- No Special Training Required — All ESCO tools are rugged, reliable, versatile, and easy to operate so you can get your job done properly, on-time, and under budget.

We pledge to provide you with the finest and most innovative tools and accessories available today and to support them with fair, prompt, and courteous service.

Matthew Brennan

Matthew Brennan, President

How to Order

You may contact your local Esco representative or contact Esco Tool directly by telephone at

508.429.4441 (worldwide)
800.343.6926 (U.S. & Canada)

FAX: 508.429.2811 • e—mail: millhog@escotool.com • www.escotool.com

Typical Applications

- Beveling super duplex pipe
- Beveling high chrome tubes
- Membrane and overlay removal from tube O.D.
- Flat facing tube and pipe
- 37-1/2° bevel tube and pipe
- 30° bevel tube and pipe
- Peel back stainless on clad tubes
- Tube sheet seal weld removal
- Tube sheet strength weld removal
- Tube stub removal
- Tube seal weld removal
- Facing fin fan tubes
- Compound bevel for heavy
- Wall pipe
- Composite tube step bevel
- Removing injection molded poly-propylene (IMPP) insulation from pipe
- Counter boring
- "J" preps for orbital welding
- Sawing of waterwall panels
- Notching of membrane
- Slotting of membrane
- Sawing pendant tubes
- Sawing single tubes
- Sawing pipe from 6" to 60" dia.
- Sawing concrete lined pipe
- Sawing tanks of any diameter
- Flex track for sawing curved surfaces
- Cut-off of pipe ends
- Flange facing
- Grooving of pipe O.D.
- Hand hole cap removal
- Beveling for window welds
- Dutchman boiler tube repair
- Boiler tube expanding
- Alignment of boiler tubes for welding, including waterwalls

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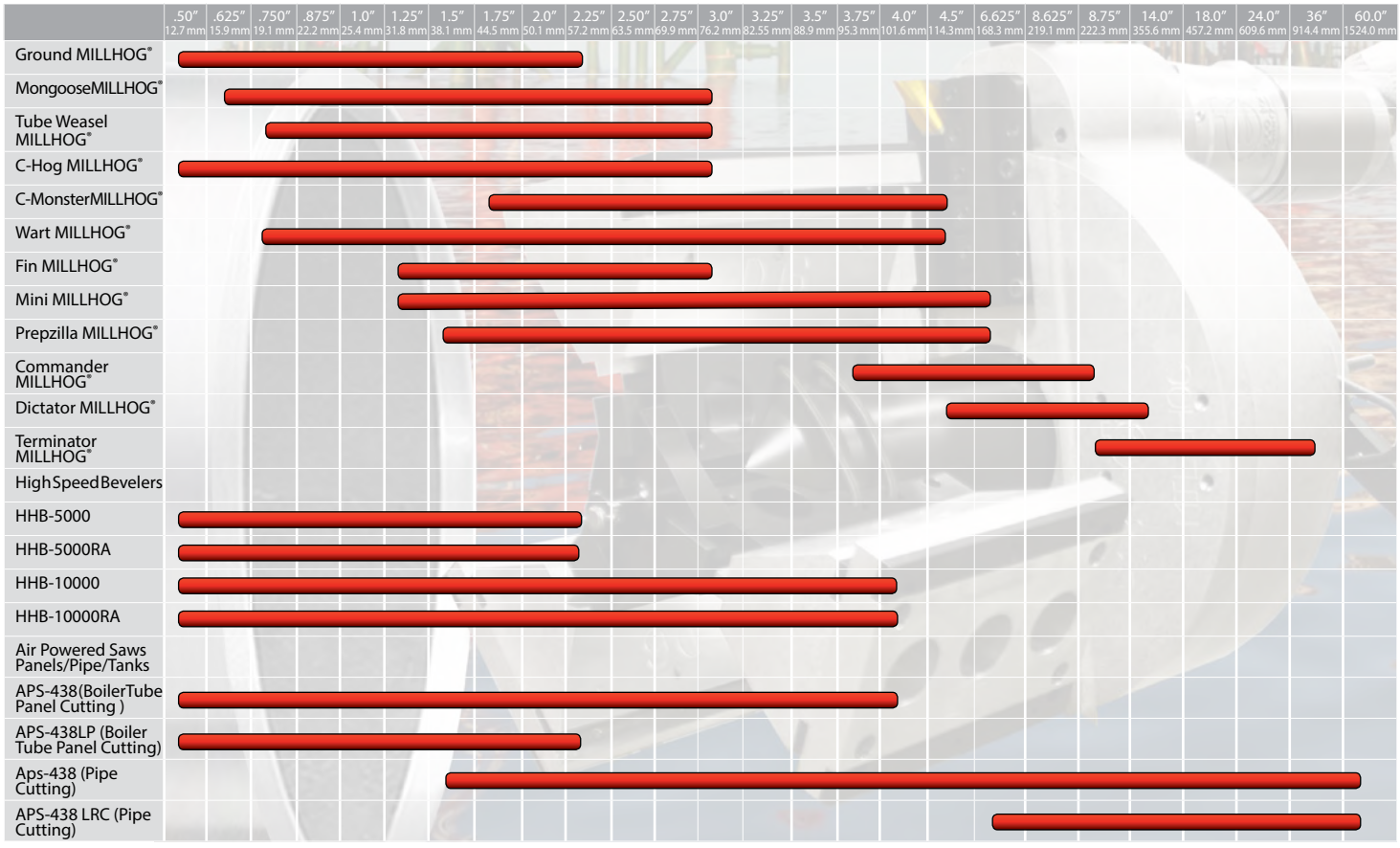
Capabilities Chart



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Ground MILLHOG®

Right Angle I.D. Clamping
Tube and Pipe Beveling Tool
0.5" I.D. to 2.25" O.D.
12.7 mm I.D. to 57.15 mm O.D.

Key Features

- Narrow body 1.5in (38.1 mm) wide for beveling a single tube in a waterwall
- Three interchangeable motor choices, pneumatic, electric and battery
- Rugged steel housing for lasting durability
- Patented clamping system permits the clamps to release as easily as they tighten, no hammer needed!
- Permanently attached wrenches keep the operating essentials at the operator's finger tips
- Dual opposed ball bearing supported gear drive design
- Proprietary EscoLock blade holding system minimizes vibration and maximizes tube and pipe bevels per blade

Popular tube and pipe beveling applications

- Bevel, face and bore
- "J" prep for orbital welding
- Tube to tube sheet weld removal and tube sheet weld preparation
- Boiler tube membrane removal
- Boiler tube overlay and cladding removal
- Boiler tube waterwall single tube replacement
- Reface fin fan tube seat surfaces

Designed for limited access boiler tube beveling

The ESCO Ground MILLHOG® is a right angle I.D. clamping tube beveling tool that is only 1.5in (38.1mm) wide and fits between boiler waterwall tubes for beveling a single tube and other boiler tube applications with restricted access. The tool is made of heat treated steel for durability and proprietary bearings support heavy duty gears for smooth operation and long durability on the toughest boiler applications.

The patented pull-push clamp and release system with permanently attached wrenches and clamps eliminate the possibility of loose parts falling down the tubes. This high performance tool utilizes the EscoLock wedge style blade lock system and TiN coated blades for chatter-free beveling.

Power choices include pneumatic, electric and battery. All motors are easy to switch and deliver optimum torque and speed that reduces bevel time by pulling a thick chip on the toughest boiler tube alloys, without cutting fluids.

Pneumatic Standard

Works well on all tube and pipe alloys including stainless steel.

Pneumatic Air Clamp

Quickly clamps and releases, reduces cycle between bevels.

Electric

Reliable plug in power, high torque and low rpm. Superior performance on all alloys including membrane and overlay removal.

Battery

Excellent for beveling all alloys including overlay and membrane removal. Best of all it's hose and cord free.

Only 1.5" wide for single boiler tube beveling

The air clamp increases production and minimizes operator fatigue

Remove membrane from between tubes

Remove membrane and overlay/ cladding from between tubes

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Ground MILLHOG®

Right Angle I.D. Clamping
Tube and Pipe Beveling Tool
0.5" I.D. to 2.25" O.D.
12.7 mm I.D. to 57.15 mm O.D.

Ground Clamp Rib Selector and corresponding spares Mandrel, Draw Rod, Actuator, Retention Bands and Springs

Clamp Rib Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size (in)	Draw Rod	Actuator	Roll Pin	Retention Band	Retention Spring
G-01A	.500	.655	12.7	16.6	G-204	.500	G-18A	G-17A	G-15A	G-14E	
G-02A	.625	.780	15.9	19.8	G-204	.500	G-18A	G-16A	G-15A	G-14F	
G-02A	.625	.780	15.9	19.8	G-20	.625	G-18	G-16	G-15	G-14F	
G-03A	.750	.905	19.1	22.9	G-20	.625	G-18	G-17	G-15	G-14F	
G-04	.875	1.030	22.3	26.1	G-20	.625	G-18	G-17	G-15		G-14
G-05	1.00	1.155	25.4	29.3	G-20	.625	G-18	G-17	G-15		G-14
G-06	1.125	1.280	28.6	32.5	G-20	.625	G-18	G-17	G-15		G-14
G-07	1.250	1.405	31.8	35.6	G-20	.625	G-18	G-17	G-15		G-14
G-08	1.395	1.530	35.0	38.8	G-20	.625	G-18	G-17	G-15		G-14
G-09	1.500	1.655	38.1	42.0	G-20	.625	G-18	G-17	G-15		G-14
G-10	1.625	1.780	41.3	45.2	G-20	.625	G-18	G-17	G-15		G-14
G-11	1.750	1.905	44.5	48.3	G-20	.625	G-18	G-17	G-15		G-14
G-12	1.875	2.030	47.7	51.5	G-20	.625	G-18	G-17	G-15		G-14
G-13	2.000	2.155	51.0	54.7	G-20	.625	G-18	G-17	G-15		G-14

Roll Pin & Actuator
G-15A, G-I7A & G-I6A

0.500" Mandrel & Draw Rod
G-204 & G-18A (Used with G-01A & G-02A Clamp Rib Set)

Roll Pin & Actuator
G-15, G-16 & G-17

0.625" Mandrel & Draw Rod
G-20 & G-18 (Used with G-02A - G-13 Clamp Rib Set)

Ground Cutterhead Blade Lock and Screw

Cutterhead Part #	Cutterhead Size	Mandrel Part #	Mandrel Size	Blade Lock Part #	Blade Lock Per Head	Lock Screw Part #	Lock Screw Per Lock
G-206	1.500	G-204	.500"	G-22	2	G-21	1
G-23	1.500	G-20	.625"	G-22	2	G-21	1
G-24	2.000	G-20	.625"	G-22A	2	G-21	1
G-25	2.250	G-20	.625"	G-22	4	G-21	1

Cutterheads feature the EscoLock Blade Lock System that hold the Cutter Blade rigidly, reduce vibration and heat resulting in superior Cutter Blade life without cutting oils.

Blade Locks and Screw
G-22, G-22A & G-21

Ground Membrane Removal Heads

Membrane Head Size	Membrane Head Part #	Base Head Part#	Inserts Part #	Inserts Qty
.875	MO-100	GB-100	MRB-8	3
1.000	MO-101	GB-101	MRB-8	4
1.125	MO-102	GB-102	MRB-8	4
1.187	MO-103	GB-103	MRB-8	4
1.250	MO-104	GB-102	MRB-8	4

Ground Overlay Removal Heads

Overlay Head Size	Overlay Head Part #	Base Head Part#	Inserts Part #	Inserts Qty
.875	MO-200	GB-100	MRB-8	3
1.000	MO-201	GB-101	MRB-8	4
1.125	MO-202	GB-102	MRB-8	4
1.187	MO-203	GB-103	MRB-8	4
1.250	MO-204	GB-102	MRB-8	4

Membrane removal heads fit over the tube O.D. and remove the membrane from between boiler waterwall tubes while not derogating the tube O.D.

The ESCO patented Membrane and Overlay Removal Heads use round inserts with a tapered shank that install with a tap from a hammer. They easily remove and rotate for extended use.

Both Membrane and Membrane/Overlay heads are mounted to a Base Head that can also hold a bevel blade.

Membrane/Overlay Heads remove membrane from between tubes and also weld overlay from the tube O.D.

Specifications: Ground MILLHOG®

Working Range	.5in (12.7 mm) I.D. to 2.25in (57.15 mm) O.D.			
Motor	Pneumatic	Air Clamp	Electric	Battery / *Charger
	1.07 hp (800 W)	1.07 hp (800 W)	120 V 8.5 A 50/60 Hz 950 W, or	18V Li-Ion - up to 5.2 Ah
	90 psi (6.2 bar)	90 psi 6.2 bar	220 - 240 V 4.4 A 50/60 Hz 950 W	*115V / 60 Hz, or
	35 cfm (990 lt/min)	35 cfm 990 lt/min		*220 - 240 V 50-60 Hz
Speed	125 rpm	125 rpm	12 rpm - 63 rpm	49 rpm
Minimum Width Clearance				
With 1.5in Cutterhead	1.5in (38.1 mm)	3.625in (92.1 mm)	1.5in (38.1 mm)	1.5in (38.1 mm)
Membrane and Overlay heads	1.875in (47.6 mm)	3.625in (92.1 mm)	1.875in (47.6 mm)	1.875in (47.6 mm)
Head Length	14in (355.6 mm)	16in (406.4 mm)	14in (355.6 mm)	14in (355.6 mm)
Working Weight	12.7 lbs (5.8 kg)	15.05 lbs (6.8 kg)	14.1 lbs (6.4 kg)	14.6 lbs (6.6 kg)
Shipping Weight	40 lbs (18.1 kg)	45 lbs (20.1 kg)	42 lbs (19.1 kg)	42 lbs (19.1 kg)
Shipping Dimensions	20in x 18in x 5 in	24in x 20in x 7in	24in x 20in x 6in	24in x 20in x 6in
	508 mm x 457 mm x 127 mm	610 mm x 508 mm x 178 mm	610 mm x 508 mm x 152 mm	610 mm x 508 mm x 152 mm

Formed Cutter Blades are made from T-15 Tool steel and are available in many sizes and for all pipe and tube bevel angles.

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Mongoose MILLHOG®

I.D. Clamping
Tube and Pipe Beveling Tool
0.625" I.D. to 3.0" O.D.
15.9 mm I.D. to 76.2 mm O.D.

Key Features

- Narrow Body 2.25" (27.15 mm)
- Light weight and torque free
- Interchangeable Pneumatic, Electric or Battery drives are easily switched
- Patented clamp system, allows the clamps to release from a tube as easily as they tighten without a hammer
- Permanently attached wrenches
- Bevel, face and bore simultaneously
- Rugged dual opposed tapered roller bearings support the gear drive for nonstop operation
- EscoLock cutter blade holding system reduces vibration and maximizes the number of preps per blade

Boilermaker Tested and Field Proven

This rugged, agile machine bevels tube and pipe quickly for accurate fit-up which helps ensure high quality welds. The Mongoose MILLHOG® is boilermaker tested and field proven.

Rugged, fast, reliable

The Mongoose MILLHOG® is a torque free beveling tool for tubes from .625" (15.9 mm) I.D. to 3" (76.2 mm) O.D. and is only 2.25" (57.15 mm) wide which makes it ideal for power station boiler tube work and constrained situations with limited access.

Featuring a patented push-pull clamp and release mechanism, it allows the clamps to release from a tube as easily as they tighten. Ideal for beveling, facing and boring on a wide range of tube and pipe alloys, the Mongoose has dual opposed tapered roller bearings and employ the rigid EscoLock blade locking system; which provides chatter-free performance and produces a thick chip without cutting fluids.

Powered by a choice of pneumatic, electric or battery motors and available with a large selection of clamping options, every Mongoose includes attached heavy duty wrenches for centering and securing the tool to the tube I.D.

Pneumatic Standard

Most popular – works well on all tube and pipe alloys including stainless steel.

Pneumatic Air Clamp

High production, quickly clamps and release from I.D., reduces cycle time between bevels.

Pneumatic High Torque Slow Speed

Best for boiler tubes with overlay, also removes membrane between tubes.

Battery

Low rpm and high torque, excellent for beveling all tube alloys including overlay and membrane removal. The battery lasts 15-30 minutes and takes 120 minutes to charge. Best of all it's hose and cord free.

Electric

Convenient plug in power and proprietary gear reduction technology produce high torque and low rpm for superior tube beveling performance on all tube alloys including boiler tube waterwall membrane and overlay removal.

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Mongoose MILLHOG®

I.D. Clamping
Tube and Pipe Beveling Tool
0.625" I.D. to 3.0" O.D.
15.9 mm I.D. to 76.2 mm O.D.

Two Mandrels are offered. The .0750" is standard and is for G-03A — G-13 Clamp Ribs and the H series wedge attaches to it for using H series clamps. The 0.625" Mandrel is for G-02A Clamp Ribs.

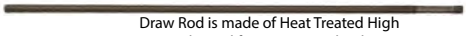
The G Series Clamps are used on the 0.625" Mandrel and the .0750" Mandrel.

The H Series Wedge fits the 0.750" Mandrel and is used for H-01, H-02, H-03, H-04 and H-05 Clamp Rib Sets.

Mongoose Clamp Rib Selector and corresponding spares
Mandrel, Draw Rod, Actuator, Retention Bands and Springs

Clamp Rib Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Size	Draw Rod	Actuator	Roll Pin	Retention Band	Retention Spring
G-02A	.625	.780	15.9	19.8	MG-38A	.625	MG-16	MG-01A	MG-14	G-14F	
G-03A	.750	.905	19.1	22.9	MG-38	.750	MG-16	MG-01	MG-14	G-14F	
G-04	.875	1.030	22.3	26.1	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-05	1.000	1.155	25.4	29.3	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-06	1.125	1.280	28.6	32.5	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-07	1.250	1.405	31.8	35.6	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-08	1.375	1.530	35.0	38.8	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-09	1.500	1.655	38.1	42.0	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-10	1.625	1.780	41.3	45.2	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-11	1.750	1.905	44.5	48.3	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-12	1.875	2.030	47.7	51.5	MG-38	.750	MG-16	MG-01	MG-14		G-14
G-13	2.000	2.155	51.0	54.7	MG-38	.750	MG-16	MG-01	MG-14		G-14
H-02	1.525	1.925	28.8	48.9	MG-38 & MG-59	.750	MG-16	MG-57	MG-58		H-14B
H-03	1.850	2.250	47.0	57.2	MG-38 & MG-59	.750	MG-16	MG-57	MG-58		H-14B
H-04	2.175	2.575	55.3	65.4	MG-38 & MG-59	.750	MG-16	MG-57	MG-58		H-14B
H-05	2.500	2.900	63.5	73.7	Attaches to H-02						

0.625" Mandrel, Actuator and Roll Pin
MG-38A, MG-01A and MG-14.



Draw Rod is made of Heat Treated High Strength Steel for maximum durability, MG-16.

0.750" Mandrel, Actuator and Roll Pin
MG-38, MG-01 and MG-57.

Wedge
MG-59.

Retention Band and Springs
G-14F, G-14 and H-14B.

Mongoose Cutterheads can hold 3 Cutter Blades.

2.250" for use with MG-38A.
2.250" for use with MG-38.
2.50" for use with MG-38.
3.0" for use with MG-38.

Blade Locks and Blade Lock Screw for MG-25, MG-25A and MG-8.

Mongoose Cutterhead Blade Lock and Screws

Cutterhead Part #	Size	Mandrel Part #	Size	Blade Lock Part #	Per Head	Lock Screw Part #	Per Lock
MG-28C	2.250	MG-38A	.625	MG-25	3	MG-24	1
MG-28	2.250	MG-38	.750	MG-25	3	MG-24	1
MG-28A	2.500	MG-38	.750	MG-25A	6	MG-24	1
MG-28B	3.000	MG-38	.750	MG-25B	6	MG-24	1

Blade Locks and double threaded screws to reduce Cutter Blade vibration and control heat for long life.

Boiler tube membrane removal and bevel.

The ESCO patented membrane and overlay removal heads use round tapered inserts that can be rotated when worn and install and removed with a tap from a hammer.

Boiler tube membrane overlay removal and bevel.

Standard membrane/ overlay heads cut to a depth of 0.75" before the bevel blade begins to prep the tube. Pictured is a custom head that removes 4.0".

Base Head with O.D. bevel Cutter Blade.

Membrane and Overlay Heads look similar. Overlay Heads have a slightly smaller circumference.

Membrane and Overlay Heads attach to the Base Head.

Mongoose Membrane Removal Heads

Membrane Head Size	Part #	Base Head Part#	Inserts Part #	Qty
1.187	MO-103	MGB-103	MRB-8	4
1.250	MO-104	MGB-104	MRB-8	4
1.375	MO-105	MGB-106	MRB-8	4
1.500	MO-106	MGB-106	MRB-8	5
1.625	MO-107	MGB-106	MRB-8	5
1.750	MO-108	MGB-106	MRB-8	5
2.000	MO-109	MGB-106	MRB-8	6

Mongoose Overlay Removal Heads

Overlay Head Size	Part #	Base Head Part#	Inserts Part #	Qty
1.187	MO-203	MGB-103	MRB-8	4
1.250	MO-204	MGB-104	MRB-8	4
1.375	MO-205	MGB-106	MRB-8	4
1.500	MO-206	MGB-106	MRB-8	5
1.625	MO-207	MGB-106	MRB-8	5
1.750	MO-208	MGB-106	MRB-8	5
2.000	MO-209	MGB-106	MRB-8	6

Specifications: Mongoose MILLHOG®

Working Range	.625in (15.9 mm) I.D. to 3in (76.2 mm) O.D.				
Motor	Pneumatic	Pneumatic Air Clamp	High Torque Slow Speed	Electric	Battery / *Charger
	1.07 hp (800 W)	1.07 hp (800 W)	1.25 hp (932 W)	120 V 8.5 A 50/60 Hz 950 W, or	18V Li-Ion - up to 5.2 Ah
	90 psi (6.2 bar)	90 psi 6.2 bar	90 psi 6.2 bar	220 - 240 V 4.4 A 50/60 Hz 950 W	*115V / 60 Hz, or
	35 cfm (990 lt/min)	35 cfm 990 lt/min	40 cfm (990 lt/min)		*220 - 240 V 50-60 Hz
Speed	108 rpm	108 rpm	100 rpm	14 rpm - 58 rpm	43 rpm
Minimum Width Clearance	2.25in (57.2 mm)	3.625in (92.1 mm)	2.25in (57.2 mm)	2.25in (57.2 mm)	2.25in (57.2 mm)
Head Length	15.25in (387.4 mm)	18.5in (470 mm)	15.25in (387.4 mm)	15.25in (387.4 mm)	15.25in (387.4 mm)
Working Weight	14.8 lbs (6.7 kg)	17.1 lbs (7.75 kg)	15.6 lbs(7.1 kg)	15.9 lbs (7.21 kg)	16.4 lbs (7.44kg)
Shipping Weight	32.05 lbs (14.53 kg)	41.95 lbs (19.02 kg)	32.85 lbs (14.9 kg)	40 lbs (18.14 kg)	40.6 lbs (18.41 kg)
Shipping Dimensions	20in x 18in x 5in	24in x 20in x 7in	20in x 18in x 5in	24in x 20in x 6in	24in x 20in x 6in
	508 mm x 457 mm x 127 mm	610 mm x 51 mm x 178 mm	508 mm x 457 mm x 127 mm	610 mm x 508 mm x 152 mm	610 mm x 50 8 mm x 152 mm

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Tube Weasel MILLHOG®

Right Angle I.D. Clamping Beveling Tool
0.750" I.D. to 3.0" O.D.
19.1 mm I.D. to 76.2 mm O.D.

Agile, fits between waterwall boiler tubes and ruggedly built

Key Features

- Fits 2.75" (69.85mm) wide opening for boiler tube Dutchman repair
- Self centering clamping system rigidly mounts tool to tube I.D. and is easy to use
- Pneumatic, electric or battery motors available and are easily interchanged.
- Bevel, face and bore simultaneously
- Sealed construction allow use in any orientation
- EscoLock blade lock system securely holds cutter blades
- Torque-free operation
- Chatter-free tube and pipe bevels enhance quality welds
- Field proven by boilermakers from around the world

Performs precision bevels on all tube and pipe alloy

The boilermaker proven Tube Weasel MILLHOG® performs precision bevels for accurate weld fit-up and fits a 2.75" wide opening. Extremely durable, it features a right angle gear drive system which incorporates dual opposed tapered roller bearings. This compact tube beveling tool can be powered by pneumatic, electric or battery motors that are easily interchanged and equally powerful.

The Tube Weasel MILLHOG® uses the EscoLock cutter blade locking system that securely holds the cutter blade in the cutterhead. Cutter blades have a radical chip breaker that directs the chip away from the tubes surface and minimizes heat build-up.

These innovative design feature are why MILLHOG® Cutter Blades produce precision bevels on tube and pipe without cutting fluids.

Pneumatic

Pneumatic Air Clamp

Electric

Battery

The Tube Weasel is 2.75" wide and can bevel a single tube in a boiler tube waterwall for Dutchman repair.

The Air Clamp instantly clamps and releases the tool to the tube and pipe I.D. which saves a time by reducing the cycle time between tube bevels.

Like all MILLHOG® tools, the Tube Weasel Gear Head is built with the finest materials that are precision machined and heat treated for long reliable service. Operational wrenches are attached for fast set-up and the clamping components are designed to not separate and fall into the tube.

The three available motors are interchangeable and can be conveniently switched for working in a variety of venues.

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Tube Weasel MILLHOG®

Right Angle I.D. Clamping Beveling Tool
0.750" I.D. to 3.0" O.D.
19.1 mm I.D. to 76.2 mm O.D.

G-03A - G-13 Clamp Rib Sets for use with 0.75" Mandrel

H-01 Clamp Rib Set for use with 1.0" Mandrel

H-01 - H-04 Clamp Rib Sets & H-05 Clamp Pad Set for use with 1.25" Mandrel

The 1.25" is the standard mandrel, The 1.0" and 0.75" mandrels can be substituted or ordered as optional equipment. The 0.75" mandrel uses the TW-242 cutterhead.

Tube Weasel Clamp Rib Selector and corresponding spares Mandrel, Draw Rod, Actuator, Roll Pin, Retention Band and Springs

Clamp Rib Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size	Draw Rod	Actuator	Roll Pin	Retention Band	Retention Spring
G-03A	.750	.905	19.1	22.9	H-241	.750	H-247	G-17	G-15	G-14F	
G-04	.875	1.030	22.3	26.1	H-241	.750	H-247	G-17	G-15		G-14
G-05	1.000	1.155	25.4	29.3	H-241	.750	H-247	G-17	G-15		G-14
G-06	1.125	1.280	28.6	32.5	H-241	.750	H-247	G-17	G-15		G-14
G-07	1.250	1.405	31.8	35.6	H-241	.750	H-247	G-17	G-15		G-14
G-08	1.375	1.530	35.0	38.8	H-241	.750	H-247	G-17	G-15		G-14
G-09	1.500	1.655	38.1	42.0	H-241	.750	H-247	G-17	G-15		G-14
G-10	1.625	1.780	41.3	45.2	H-241	.750	H-247	G-17	G-15		G-14
G-11	1.750	1.905	44.5	48.3	H-241	.750	H-247	G-17	G-15		G-14
G-12	1.875	2.030	47.7	51.5	H-241	.750	H-247	G-17	G-15		G-14
G-13	2.000	2.155	51.0	54.7	H-241	.750	H-247	G-17	G-15		G-14
H-00	1.000	1.300	25.4	33.0	H-220	1.00	H-51	H-12A	H-11		H-14A
H-01	1.250	1.600	31.8	40.6	H-21	1.25	H-51	H-12	H-11		H-14B
H-02	1.525	1.925	28.8	48.9	H-21	1.25	H-51	H-12	H-11		H-14B
H-03	1.850	2.250	47.0	57.2	H-21	1.25	H-51	H-12	H-11		H-14B
H-04	2.175	2.575	55.3	65.4	H-21	1.25	H-51	H-12	H-11		H-14B
H-05	2.500	2.900	63.5	73.7	Attaches to H-02						

0.750" Mandrel, Draw Rod, Actuator and roll pin TW-241, H-247, G-17, G-15.

1.0" Mandrel, 1.25" Mandrel, Draw Rod, Actuators and Roll Pin H-220, H-21, H-51, H12A, H-12, H-11.

Retention Band and Springs G-14F, G-14, G-14A and G14B.

Cutterheads hold 3 Cutter Blades for bevel, face and bore simultaneously

2.75" for use with 0.75" Mandrel

2.75" for use with 1.25" Mandrel

3.0" for use with 1.25" Mandrel

Tube Weasel Cutterhead Blade Lock and Screws

Cutterhead Part #	Cutterhead Size	Mandrel Part #	Mandrel Size	Blade Lock Part #	Blade Lock Per Head	Lock Screw Part #	Lock Screw Per Lock
TW-242	2.750	H-241	.750	TW-22B	6	TW-23	1
TW-24	2.750	H-220 & H-21	1.00 & 1.25	TW-22A	6	TW-23	1
TW-21	3.000	H-220 & H-21	1.00 & 1.25	TW-22B	6	TW-23	1

Blade Locks and Lock Screw TW-22A, TW-22B and TW-23

All MILLHOG® Cutter Blades are made of T-15 High Speed Tool Steel, the most shock and heat resistant Tool Steel available and produce a Thick Chip without cutting fluids on high alloy pipe and tube.

Thick Chip Technology Promotes Long Cutter Blade life

MILLHOG® Cutter Blades have a radical chip breaker that directs the chip away from the tube or pipe surface and minimizes heat build-up on the cutting edge. Cutter Blades are offered with two coating choices for ultimate performance.

- Titanium Nitride Coated (TiN) adds lubricity and helps the Cutter Blades prep cooler.
- Hard Lube Coating offers additional heat resistance which extends Cutter Blade life on Super Duplex

Specifications: Tube Weasel MILLHOG®

Working Range	.750 in (19.1 mm) i.d. to 3 in (76.2 mm) o.d.			
Motor	Pneumatic	Electric	Battery / *Charger	Air Clamp
	1.07 hp (800 W)	120 V 8.5 A 50/60 Hz 950 W, or	18V Li-Ion - up to 5.2 Ah	1.07 hp (800k W)
	90 psi (6.2 bar)	220 - 240 V 4.4 A 50/60 Hz 950 W	*115V / 60 Hz, or	90 psi 6.2 bar
	35 cfm (990 lt/min)		*220 - 240 V 50-60 Hz	35 cfm 990 lt/min
Speed	117 rpm	14 rpm - 62 rpm	45 rpm	117 rpm
Minimum Clearance				
With 3 in (76.2 mm) Cutterhead	3 in (76.2 mm)	3 in (76.2 mm)	3 in (76.2 mm)	4.5 in (114.3 mm)
With 2.75 in (69.85 mm) Cutterhead	2.75 in (69.85 mm)	2.75 in (69.85 mm)	2.75 in (69.85 mm)	4.5 in (114.3 mm)
Head Length	15.25 in (387.4 mm)	15.25 in (387.4 mm)	15.25 in (387.4 mm)	17.5 in (470 mm)
Working Weight	14.8 lbs (6.7 kg)	15.9 lbs (7.21 kg)	16.4 lbs (7.44kg)	17.1 lbs (7.75 kg)
Shipping Weight	32.05 lbs (14.53 kg)	40 lbs (18.14 kg)	40.6 lbs (18.41 kg)	41.95 lbs (19.02 kg)
Shipping Dimensions	20 in x 18 in x 5 in	24 in x 20 in x 6 in	24 in x 20 in x 6 in	24 in x 20 in x 7 in
	508 mm x 457 mm x 127 mm	(610 mm x 508 mm x 152 mm)	(610 mm x 50 8 mm x 152 mm)	(610 mm x 50 8mm x 178 mm)

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C-HOG MILLHOG®

O.D. Clamping
Tube and Pipe Beveling Tool
0.50" I.D. to 3.0" O.D.
12.7 mm I.D. to 76.2 mm O.D.

Built for beveling small bore heavy wall tube and pipe

Key Features

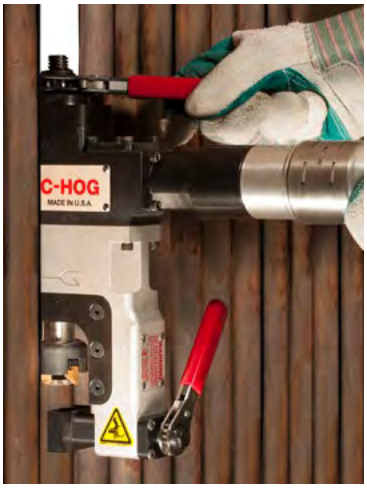
- Narrow body only 1.75" (44.45 mm) wide
- Large clamping surface rigidly holds tool for chatter-free bevels
- Powerful pneumatic, electric and battery motor choices
- No I.D. mandrel makes this tool perfect for boring
- Robust ratchet wrenches are securely attached
- Changing clamps and other tooling is easy
- Low maintenance
- Compact, light weight and rugged

Secures to the tube O.D. and is easy to use

TheC-HOGbevelingtoolsecurelyattachestothetubeO.D.withahuge clampthatminimizeschatterandvibrationandiswellsuitedforsmall boretubesbecausethereisnoI.D.clampormandreltointerfere.The I.D.clearancegainedalsoallowsforlarge,toughI.D.boringbladesthat increase Cutter Blade endurance.

Designedformaximumoperatorcomfort,efficiencyandeaseofuse,the C-HOG'sattachedfeedwrenchletstheoperatorcomfortablyfeedthetool asitbevelsthetubewithminimalfatigue.Constructedtodeliverreliable performanceonthetoughestapplications,theC-HOGisaruggedtool thatislightinweightandcompact.Highlyengineered,itincorporates state of the art materials and heat treated components.

The C-HOG is ideally suited for beveling small bore heavy wall tubes with a high percentage of chrome, stainless steel and other hard alloys.



This rugged tool has a narrow profile and can fit between 1.25" O.D. membrane water wall boiler tubes to bevel a single tube for a Dutchmen tube repair.

The optional Right Angle Drive allows the air motor to be mounted in four different positions for use in limited access areas.

Cutterheads hold Cutter Blades and are easily switched.

Blade Locks, Blade Lock Screw and Cutterhead Screw CF-39A, CF 39B, CF-39, CF-36 and CF-40.

Pneumatic

Electric

Battery

C-HOG Cutterheads, Blade Locks and Screws

Cutterhead		Blade Lock		Lock Screw		Cutterhead Screw	
Part #	Size	Part #	Per Head	Part #	Per Lock	Part #	Per Head
CF-35	1.750	CF-39B	3	CF-36	1	CF-40	1
CF-35A	2.000	CF-39	3	CF-36	1	CF-40	1
CF-35B	2.250	CF-39A	6	CF-36	1	CF-40	1
CF-35C	2.500	CF-39B & CF-39A	3 of each	CF-36	1	CF-40	1
CF-35D	3.000	CF-39	6	CF-36	1	CF-40	1

Specifications: C-HOG MILLHOG®

Working Range	.5in (12.7 mm) O.D. to 3in 76.2mm) O.D.		
Motor	Pneumatic	Electric	Battery / *Charger
	1.07 hp / 800 W	120V 8.5 A 50/60 Hz 950 W, or	18V Li-Ion - up to 5.2 Ah
	90 psi 6.2 bar	220 - 240 V 4.4 A 50/60 Hz 950 W	*115 V / 60 Hz, or
	35 cfm		*220 - 24 0V 50-60 Hz
Speed	125 rpm	12 rpm - 63 rpm	49 rpm
Minimum Clearance	`		
With 1.75in (44.5 mm) Cutterhead	1.75in (44.5 mm)	1.75in (44.5 mm)	1.75in (44.5 mm)
Head Length	9.7in (4.4 mm)	9.7in 246.4mm)	9.7in (246.4 mm)
Working Weight	20 lbs (9 kg)	23 lbs (10.5 kg)	23lbs (10.5 kg)
Shipping Weight	40 lbs (18.1 kg)	46 lbs (19.1 kg)	42lbs (19.1 kg)
Shipping Dimensions	21in x 18in x 7in	17in x 31in x 8in	17in x 31in x 8in
	533 mm x 457 mm x 178 mm	432 mm x 787 mm x 203 mm	432 mm x 787 mm x 203 mm

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C-Monster MILLHOG®

O.D. Clamping
Tube and Pipe Beveling Tool
1.75" I.D. to 4.5" O.D.
44.45 mm I.D. to 114.3 mm O.D.

Bevels small heavy wall tube and pipe, plus pulls a thick chip without cutting oils.

Key Features

- Rigidly clamps and produces perfect bevels
- Ideal for boring; there is no mandrel to obstruct the I.D.
- Available bench mount bracket
- 3 Blade holders for simultaneous bevel, face and bore
- Powerful pneumatic and electric motor choices
- Changing clamps and other tooling is easy
- Rugged construction
- Low maintenance

The C-Monster MILLHOG® O.D. clamping pipe and tube beveling tool has the power to bevel face and counterbore heavy wall pipe and tube plus the agility to flat face thin wall stainless for orbital welding.

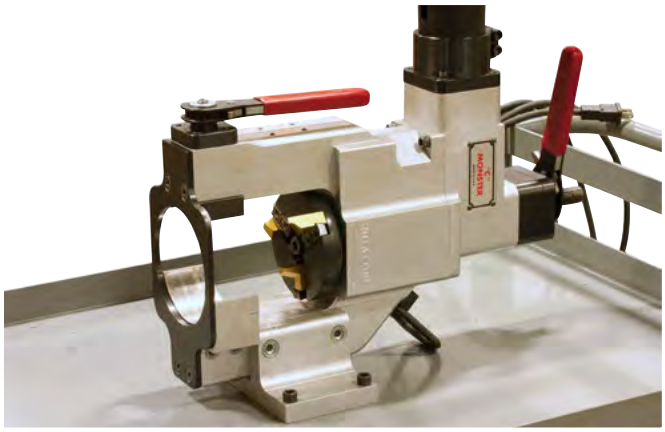
The C-Monster has a range of 1.75" I.D. (44.45mm) O.D. to 4.5" (114.3mm) O.D. and uses a clamp with a large contact area that rigidly holds the pipe or tube and reduces chatter to produce bevels with smooth, mirror finishes at any angle. Most steel alloys can be beveled dry.

An available bench mount bracket allows the C-Monster to be mounted on a bench or a cart for greater mobility and is ideal for welding schools for machining test coupons or anyone making tube or pipe assemblies.

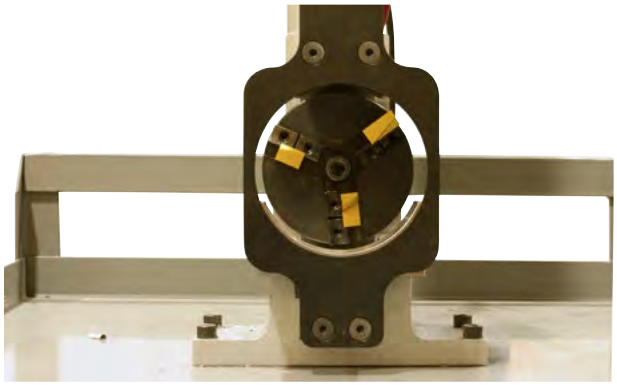
Pneumatic
2hp motor

Electric
1800 watt motor

Available cart mount bracket allows complete mobility.



Rugged construction, low maintenance and easy to change tooling.



Bevel Face and Bore, holds up to 3 cutter blades for simultaneous compound pipe and tube bevels.

Specifications: C-Monster MILLHOG®

Working Range	1.75in (44.45 mm) O.D. to 4.5in (114.3 mm) O.D.	
Motor	Pneumatic	Electric
	2 hp (1491 W) 90 psi (6.2 bar) 40 cfm (990 lt/min)	110 V AC 50/60 Hz 1800 W, or 230 V AC 50/60 Hz 1800 W
Speed	92 rpm	2 speed 26 and 86
Width 5.375in (136.5 mm)	5.375in (136.5 mm)	5.375in (136.5 mm)
Head Length	19in (482.6 mm)	19in (482.6 mm)
Working Weight	56 lbs (25.5 kg)	63 lbs (28.60 kg)
Shipping Weight	98 lbs (44.5 kg)	105 lbs (47.7 kg)
Shipping Dimensions	27in x 21in x 7in 686 mm x 533 mm x 178 mm	27in x 21in x 7in 686 mm x 533 mm x 178 mm

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Wart MILLHOG®

Right Angle I.D. Clamping
Tube and Pipe Beveling Tool
0.750" I.D. to 4.5" O.D.
19.1 mm I.D. to 114.3 mm O.D.

Key Features

- Only 2.625" (66.68mm) wide fits between tubes for single tube beveling
- Bevel, face and bore simultaneously
- No cutting lubricant required
- Available with pneumatic or electric drive motor that easily interchange
- Torque-free operation prevents operator fatigue
- Heavy duty ratchet wrench and knurled knob allows easy clamping and is perfect for limited access areas
- Mounts rigidly to produce a clean, continuous chip
- Lightweight and requires no special training
- Efficient chatter-free EscoLock cutter blade locking design directs heat away from tube surface and bevel blade cutting edge
- Low maintenance

Boilermaker proven, legendary reliability

The ESCO Wart MILLHOG® is a portable right angle I.D. clamping pipe and tube beveling tool that features an efficient low maintenance design. Incorporating a gear drive that is fully supported by dual opposed tapered roller bearings and three heavy duty ball bearings. This gives the Wart the backbone to satisfy a wide variety of applications and is a favorite choice among boilermakers and pipefitters.

All components are made of the finest materials and parts subject to wear are heat treated for durability and long use. Sealed construction prevents debris from getting inside the tool, allowing use in any orientation. What's more the compact design requires a minimum of 2.625" to fit between tubes in a boiler tube waterwall.

Pneumatic Wart

Electric Wart

Contour Wart

Z Wart

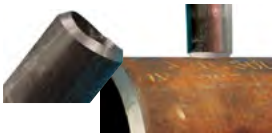
The "Z Wart" MILLHOG® incorporates a right angle drive that lowers the rpm by half and doubles the torque at the cutter blade. This makes it well suited for applications that include tube stub weld removal and weld overlay removal. Please consult factory for application specifications and ordering information.

The Wart needs a minimum of 2.625" to fit between tubes in a boiler tube waterwall.

Tube overlay is efficiently removed from the O.D. and the end is simultaneously beveled.

Trimming tubes to length.

Strength weld removal prepares the surface for welding the new tube into place using the "Z Wart".



Fish mouth contours tube to fit evenly on header radius.

Tube overlay is efficiently removed from the tube O.D. and the tube end simultaneously beveled in preparation for welding.

Bolt hole resurfacing is prepared using a standard Wart MILLHOG and cutter blades.

Specifications: Wart MILLHOG®

U.S. Patent 5,531,550 & 7,938,047

Working Range	.750in (19.1 mm) I.D. to 4.5in (114.3 mm) O.D.			
Motor	Pneumatic	Electric	Contour	"Z" wart
	1.25 hp (932 W)	120 V 8.5 A 50/60 Hz 950 W, or	1.25 hp (932 W)	1.25 hp (932 W)
	90 psi (6.2 bar)	220 - 240 V 4.4 A 50/60 Hz 950 W	90 psi (6.2 bar)	90 psi (6.2 bar)
	40 cfm (1133 lt/min)		40 cfm (990 lt/min)	40 cfm (990 lt/min)
Speed	98 rpm (49 rpm "Z" Wart)	55 rpm - 88 rpm	98 rpm	49 rpm
Minimum Clearance				
With 2.625in (66.68mm)	2.625in (66.68 mm)	2.625in (66.68 mm)	5in (127 mm)	2.625in (66.68 mm)
Head Length	15.25in (387.4 mm)	15.25in (387.4 mm)	15.25in (387.4 mm)	15.25in (387.4 mm)
Working Weight	21.5 lbs (9.75 kg)	22.6 lbs (10.25 kg)	28 lbs (12.7 kg)	60 lbs (27.2 kg)
Shipping Weight	55 lbs (25 kg)	60 lbs (27.3kg)	65 lbs (29.5kg)	70 lbs (31.2 kg)
Shipping Dimensions	(24in x 20in x 6in)	(24in x 20in x 7in)	(24 in x 20 in x 7 in)	27in x 21in x 7in
	(610 mm x 508 mm x 152 mm)	(610 mm x 508 mm x 178 mm)	(610 mm x 508 mm x 178 mm)	686 mm x 534 mm x 178 mm

Applications beyond tube end preparation

- Tube and pipe beveling
- Remove cladding, weld overlay and membrane from tube
- Face tubes to length
- Tube stub and seal weld removal
- Contour tube end preparation
- Bolt hole resurfacing

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Wart MILLHOG®

Right Angle I.D. Clamping Tube and Pipe Beveling Tool
0.750" I.D. to 4.5" O.D.
19.1 mm I.D. to 114.3 mm O.D.

Three Mandrels are offered with the 1.25" standard. The 1.0" and 0.75" Mandrels can be substituted or ordered as optional equipment.

Wart Clamp Rib Selector and corresponding spares
Mandrel, Draw Rod, Actuator, Roll Pin, Retention Band and Springs

Clamp Rib Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size	Draw Rod	Actuator	Roll Pin	Retention Band	Retention Spring
G-03A	.750	.905	19.1	22.9	H-241	.750	H-247	G-17	G-15	G-14F	
G-04	.875	1.030	22.3	26.1	H-241	.750	H-247	G-17	G-15		G-14
G-05	1.000	1.155	25.4	29.3	H-241	.750	H-247	G-17	G-15		G-14
G-06	1.125	1.280	28.6	32.5	H-241	.750	H-247	G-17	G-15		G-14
G-07	1.250	1.405	31.8	35.6	H-241	.750	H-247	G-17	G-15		G-14
G-08	1.375	1.530	35.0	38.8	H-241	.750	H-247	G-17	G-15		G-14
G-09	1.500	1.655	38.1	42.0	H-241	.750	H-247	G-17	G-15		G-14
G-10	1.625	1.780	41.3	45.2	H-241	.750	H-247	G-17	G-15		G-14
G-11	1.750	1.905	44.5	48.3	H-241	.750	H-247	G-17	G-15		G-14
G-12	1.875	2.030	47.7	51.5	H-241	.750	H-247	G-17	G-15		G-14
G-13	2.000	2.155	51.0	54.7	H-241	.750	H-247	G-17	G-15		G-14
H-00	1.000	1.300	25.4	33.0	H-220	1.00	H-51	H-12A	H-11		H-14A
H-01	1.250	1.600	31.8	40.6	H-21	1.25	H-51	H-12	H-11		H-14B
H-02	1.525	1.925	28.8	48.9	H-21	1.25	H-51	H-12	H-11		H-14B
H-03	1.850	2.250	47.0	57.2	H-21	1.25	H-51	H-12	H-11		H-14B
H-04	2.175	2.575	55.3	65.4	H-21	1.25	H-51	H-12	H-11		H-14B
H-02 & H-05	2.500	2.900	63.5	73.7	H-21	1.25	H-51	H-12	H-11		H-14B
H-03 & H-05	2.825	3.225	71.8	81.9	H-21	1.25	H-51	H-12	H-11		H-14B
H-04 & H-05	3.150	3.550	80.0	90.2	H-21	1.25	H-51	H-12	H-11		H-14B
H-02 & H-08	3.475	3.875	88.3	98.4	H-21	1.25	H-51	H-12	H-11		H-14B
H-03 & H-08	3.800	4.200	96.6	106.6	H-21	1.25	H-51	H-12	H-11		H-14B
H-04 & H-08	4.125	4.525	104.8	114.9	H-21	1.25	H-51	H-12	H-11		H-14B

G Series Clamp Ribs work on the 0.75" Mandrel

H-0 Clamp Ribs work on the 1.0" Mandrel.

H-01 thru H-04 Clamp Ribs and H-05 and H-08 work on the 1.25" Mandrel.

0.75" Mandrel, Roll Pin, Actuator and Draw Rod.
H-241, G-15, G-17 and H-247

1.0" Mandrel, Roll Pin, Actuator and Draw Rod.
H-220, H-11, H-12A and H-51

1.25" Mandrel, Roll Pin, Actuator and Draw Rod.
H-21, H-11, H-12 and H-51

Wart Cutterheads and Parts

Cutterhead Part #	Cutterhead Size	Mandrel Part #	Mandrel Size	Blade Lock Part #	Blade Lock Per Head	Blade Screw Part #	Blade Screw Per Lock
H-242	2.625	H-241	.750	H-22	3	H-23	1
CH-20	2.625	H-220 or H-21	1.00 or 1.250	H-22B	3	H-23	1
CH-21	3.00	H-21	1.250	H-22C	3	H-23	1
CH-22	3.50	H-21	1.250	H-22A	6	H-23	1
CH-23	4.00	H-21	1.250	H-22A	3	H-23	1
				H-22C	3	H-23	1
CH-24	4.50	H-21	1.250	H-22C	6	H-23	1

Cutterheads hold 3 Cutters for Bevel, Face and Bore

0.75", 1.0" and 1.25" Mandrels
H-241, H-220, H-21

Blade Locks and Blade Lock Screw
H-22A, H-22B and H-22-C

2.625" for 0.75" Mandrel

2.625" for 1.0" & 1.25" Mandrel

3.0" for 1.0" & 1.25" Mandrel

3.5" for 1.0" & 1.25" Mandrel

4.0" for 1.0" & 1.25" Mandrel

4.5" for 1.0" & 1.25" mandrel

Base Head can hold one Cutterblade

Membrane and Overlay heads look similar. Overlay heads have a slightly smaller inside diameter.

Membrane and Overlay heads mount to the base head.

Membrane and Overlay Heads are offered in standard sizes. Additional sizes are also available.

Two Base Heads accommodate all Membrane and Overlay Heads.

Membrane Removal Heads

Membrane Head Size	Membrane Head Part #	Base Head Part#	Inserts Part #	Inserts Qty
2	MO-110	HB-110	MRB-8	6
2.125	MO-111	HB-110	MRB-8	6
2.25	MO-112	HB-110	MRB-8	6
2.5	MO-113	HB-110 or HB-114	MRB-8	7
2.75	MO-114	HB-114	MRB-8	7
3	MO-115	HB-114	MRB-8	8

Overlay and Membrane Removal Heads

Overlay Head Size	Overlay Head Part #	Base Head Part#	Inserts Part #	Inserts Qty
2	MO-210	HB-110	MRB-8	6
2.125	MO-211	HB-110	MRB-8	6
2.25	MO-212	HB-110	MRB-8	6
2.5	MO-213	HB-110 or HB-114	MRB-8	7
2.75	MO-214	HB-114	MRB-8	7
3	MO-215	HB-114	MRB-8	8

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Mini MILLHOG®

I.D. Clamping Pipe and Tube
Portable Beveling Tool
1.25" I.D. to 6.625" O.D.
31.8 mm I.D. to 168.3 mm O.D.

Bevels heavy wall pipe or tube, is fast, chatter-free and easy to use...

Key Features

- Tool rigidly mounts to pipe or tube I.D.
- Self-Centering
- Heavy duty spur gear drive train delivers optimum rpm, torque and maximum durability
- One mandrel covers the majority of the tool's range
- Esco Lock cutter blade holding system achieve chatter-free bevels on tough tube and pipe alloys
- Removes tube stub welds and prepares the header
- Removes tube weld overlay and cladding
- Torque-free
- Choice of pneumatic or electric motors
- Produces clean continuous chip without cutting fluids
- Lightweight and simple to operate and maintain

Pneumatic

Electric

Rugged, Fast and Reliable

The Mini MILLHOG® is a ruggedly built beveling tool with a spur gear drive train and bevels all tube and pipe alloys to 6.625" O.D. It's combination of rpm and torque also make it ideal for tube stub weld removal and tube overlay and cladding removal.

All clamping components including the draw rod are heat treated and provide the strength to rigidly secure the tool on the inside diameter of the tube or pipe. The Esco Lock cutter blade holding system securely holds the cutters in the tool post and helps reduce chatter and produce a clean, continuous chip on most pipe and tube alloys without cutting fluids.

Easy to operate and maintain, this tool delivers a lot of performance in a small package and is available with either a pneumatic or electric motor.

Electric and Pneumatic motors offer plenty of power for end prepping a wide range of pipe and tube alloy.

Overlay is removed from new and existing tubes and their ends are prepared for welding to new tubes.

Portable, for on-site and tube beveling. Tube stub weld removal from header also prepares the header for new tube installation.

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Mini MILLHOG®

I.D. Clamping Pipe and Tube
Portable Beveling Tool
1.25" I.D. to 6.625" O.D.
31.8 mm I.D. to 168.3 mm O.D.

Two Mandrels are offered, with the 1.80" is standard. The 1.25" Mandrels can be substituted or ordered as optional equipment. The 1.25" Mandrel uses the H Series Clamps.

Mini Clamp Rib Selector and Corresponding Spares
Clamp Rib Sets, Mandrel, Draw Rod, Actuator, Roll Pin, Retention Band and Springs

Clamp Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size	Draw Rod	Actuator	Roll Pin	Retention Spring
H-01	1.250	1.600	31.8	40.6	M-361	1.250	M-65	H-12	H-11	H-14B
H-02	1.525	1.925	38.8	48.9	M-361	1.250	M-65	H-12	H-11	H-14B
M-01	1.800	2.270	45.8	57.6	M-36	1.800	M-53	M-46	M-47	M-52
M-02	2.240	2.695	56.9	68.4	M-36	1.800	M-53	M-46	M-47	M-52
M-03	2.665	3.120	67.7	79.2	M-36	1.800	M-53	M-46	M-47	M-52
M-04	3.050	3.500	77.4	88.9	M-36	1.800	M-53	M-46	M-47	M-52
M-02 & M-05	3.415	3.865	86.7	98.1	M-36	1.800	M-53	M-46	M-47	M-52
M-03 & M-05	3.780	4.230	96.0	107.4	M-36	1.800	M-53	M-46	M-47	M-52
M-04 & M-05	4.145	4.595	105.3	116.7	M-36	1.800	M-53	M-46	M-47	M-52
M-02 & M-08	4.510	4.960	114.5	126.0	M-36	1.800	M-53	M-46	M-47	M-52
M-03 & M-08	4.875	5.325	123.8	135.2	M-36	1.800	M-53	M-46	M-47	M-52
M-04 & M-08	5.240	5.690	133.1	144.5	M-36	1.800	M-53	M-46	M-47	M-52
M-02 & M-11	5.605	6.055	142.3	153.8	M-36	1.800	M-53	M-46	M-47	M-52
M-03 & M-11	5.970	6.420	151.6	163.0	M-36	1.800	M-53	M-46	M-47	M-52


M Series Clamp Ribs
M-01, M-02, M-03 and M-04


M Series Clamp Pads
M-05, M-08 and M-11


1.8" Mandrel
M-36


H Series Clamp Ribs
H-01 and H-02


1.2" Mandrel
M-361


Roll Pin, Actuator, Draw Rod and Retention Spring
H-11, H-12, M-53 and H-14B


Roll Pin Actuator, Draw Rod and Retention Spring
M-47, M-46, M-53 and M-52

Tool Post

Tool Post Part #	Size in	Size mm	Blade Lock Part #	Blade Lock Qty	Blade Lock Screw Part #	Blade Lock Screw Per Lock
M-68	6.625	168.3	M-48	8	M-51	1
M-68A	4.5	114.3	M-48	6	M-51	1

The Tool Post rigidly holds up to two different Cutter Blades. It can accommodate a bevel and face Cutter Blade simultaneously and a third post can be added for other bevel functions. Numerous variations of tool post options are available. Please consult the factory with your application.

The blade locks and the double threaded (right and left hand) blade lock screws produce unmatched holding force and hold the Cutter Blades rigidly in the tool post.


Tool Post
M-68


Tool Post
M-68A


Blade Lock and Blade Lock screw
M-48 and M-51


Tool Post M-68 Shown

Mini Membrane Removal Heads

Membrane Head Size	Base Head Part #	Inserts Part#	Inserts Part #	Inserts Qty
2.5	MO-113	MMB-113	MRB-8	7
2.75	MO-114	MMB-113	MRB-8	7
3	MO-115	MMB-113	MRB-8	8

Mini Overlay Removal Heads

Overlay Head Size	Base Head Part #	Inserts Part#	Inserts Part #	Inserts Qty
2.5	MO-213	MMB-113	MRB-8	7
2.75	MO-214	MMB-113	MRB-8	7
3	MO-215	MMB-113	MRB-8	8

Membrane and Overlay removal heads fit over the tube O.D. and remove the membrane from between boiler waterwall tubes. Additionally, Overlay Heads remove cladding and weld overlay from the tube O.D.

Membrane and Membrane/Overlay heads look similar but Overlay heads a have slightly smaller diameter. Both share a common base head.


Base Head
MMB-113


Base Head with bevel blade and Membrane head.


Membrane Heads
MO-113, MO-114 and MO-115


Overlay Heads
MO-213, MO-214 and MO-215

The Golf T shaped insert has a precision ground cutting edge that gets under the surface of the material being removed and transfers heat away from the milling action. This allows it to run relatively cool without cutting fluids. It features a tapered shank that slides into a corresponding hole in the Membrane or Membrane/Overlay Head and, with a tap and small hammer, it is easily secured. Just as quickly, it can be removed and rotated to take advantage the multiple cutting surfaces the round insert offers.

Specifications: Mini MILLHOG®

Working Range	1.250in (31.8 mm) I.D. to 6.625in (168.3 mm) O.D.	
Motor	Pneumatic	Electric
	1.25 hp (932 W)	120 V AC 50/60 Hz 1800 W, or
	90 psi (6.2 bar)	230 V AC 50/60 Hz 1800 W
	40 cfm (1133 lt/min)	
Speed	55 rpm	19 rpm - 66 rpm
Minimum Clearance		
With M-68 Tool Post	6.625in (168.3 mm)	6.625in (168.3 mm)
With M-68A Tool Post	5.30in (134.6 mm)	5.30in (134.60 mm)
Head Length	14.25in (362 mm)	14.25in (362 mm)
Working Weight	27.5 lbs (12.5 kg)	38.8 lbs (17.6 kg)
Shipping Weight	65 lbs (29.5 kg)	75lbs (34.5 kg)
Shipping Dimensions	(17in x 31in x 6in)	(24in x 21in x 7in)
	431.8 mm x 787.5 mm x 152 mm	610 mm x 533.48 mm x 178 mm

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High Speed MILLHOG®

Model HHB-5000
Model HHB-10000
Model HHB-5000RA
Model HHB-10000RA

Straight-Thru, Track Mountable, and Right Angle Models available

Key Features

- Bevels tubes in seconds
- Hand Held or Track Mountable with adjustable depth stop ensures uniform beveled tube ends
- Pilot automatically locates and centers tool on pipe or tube I.D.
- No clamping and no torque reaction to operator
- Cutter blades have multiple cutting edges and require no fluids
- Straight thru and right angle models
- Tooling is interchangeable with all High Speed models
- Fast, accurate and easy to use
- Field proven, tough and boilermaker approved

High Speed Bevelers bevel tubes in seconds, no clamping required, the pilot locates and centers the tool on the tube I.D.

The Track Chassis and Post Assembly's adjustable depth stop ensures all tubes are beveled to the same height.

No Clamping Required

MILLHOG® High speed tube bevelers feature a pilot locating system that automatically centers the tool on the tube. Simple to operate, just insert the pilot into the I.D., squeeze the throttle and finish your end prep completely in as fast as 3 seconds. The high speed cutting action creates no reaction torque, even if the tool is stalled.

Straight-Thru and Right Angle Models

The straight-thru models can be hand-held or used with the Track Chassis and Post Assembly. With this option bevel height is controlled with the adjustable depth stop and ensures all bevels are exactly the same height, saving valuable fit-up time. Right angle models are ideal for applications with height restrictions.

Right angle models fit limited access areas.

The boiler tube panel saw works on the same track as the straight-thru models.

Cutterheads hold the carbide cutter inserts and pilot and can be changed as needed for various tube and pipe sizes.

HHB-5000
Straight-Thru

HHB-10000
Straight-Thru

Cutterheads

Cutterhead Part #	Size in	Size mm	O.D. Dimension in	O.D. Dimension mm	Max. Tube O.D. in	Max. Tube O.D. mm	Min Tube I.D in	Min Tube I.D mm	Insert Size
1050-01	1.250	31.76	1.600	40.64	1.250	31.76	.450	11.43	.500
1050-02	1.500	38.10	1.850	47.00	1.500	38.10	.700	17.78	.500
1050-03	1.750	44.45	2.100	53.34	1.750	44.45	.700	17.78	.625
1050-04	2.000	50.80	2.350	59.69	2.000	50.80	.950	24.13	.625
1050-05	2.250	57.15	2.600	66.04	2.250	57.15	1.200	30.48	.625
1050-06	2.500	63.50	2.850	72.39	2.500	63.50	1.450	36.83	.625
1050-07	2.750	69.85	3.100	78.74	2.750	69.85	1.700	43.18	.625
1050-08	3.000	76.20	3.350	85.09	3.000	76.20	1.950	49.53	.625
1050-09	3.250	82.55	3.600	91.44	3.250	82.55	2.200	55.88	.625
1050-10	3.500	88.90	3.850	97.79	3.500	88.90	2.450	62.23	.625
1050-11	3.750	95.25	4.100	104.14	3.750	95.25	2.700	68.58	.625
1050-12	4.000	101.60	4.350	110.49	4.000	101.60	2.950	74.93	.625

HHB-5000RA
Right Angle

HHB-10000RA
Right Angle

Specifications: High Speed MILLHOG®

	HHB-5000	HHB-5000RA	HHB-10000	HHB-10000RA
Working Range	.450in (11.43 mm)	.450in (11.43 mm)	.450in (11.43 mm)	.450in (11.43 mm)
to	2.250in (57.15 mm)	2.250in (57.15 mm)	4.00in (11.43 mm)	4.00in (11.43 mm)
Motor, pneumatic	1.5 hp (1118.55 W)	1.5 hp (1118.55 W)	3 hp (2237 W)	3 hp (2237 W)
Air Pressure	91 psi (6.2 bar)	91 psi (6.2 bar)	91 psi (6.2 bar)	91 psi (6.2 bar)
Air Volume	50 cfm (1416 lt/min)	50 cfm (1416 lt/min)	80 cfm (2265 lt/min)	80 cfm (2265 lt/min)
Speed	5,000 rpm	5,000 rpm	10,000 rpm	10,000 rpm
Clearance	1.5in (38.1 mm)	1.9in (48.26 mm)	2.125in (54 mm)	2.5in (63.5 mm)
Working weight	9 lbs (4.1 kg)	8 lbs (3.63 kg)	14 lbs (6.4 kg)	13 lbs (5.9 kg)
Shipping weight	40 lbs (18.2 kg)	40 lbs (18.2 kg)	45 lbs (20.4 kg)	45 lbs (20.4 kg)
Track mountable	yes	no	yes	no
Shipping Dimensions	27in x 18in x 7in (666 mm x 457 mm x 177 mm)			

Pilots center the tool and keep it square to the tube. A properly sized pilot is .015" to .030" under the tube I.D. This tolerance ensures smooth operation, long blade life and chatter free bevels.

Carbide cutter inserts are available with two or four cutting edges and in two sizes.

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FIN MILLHOG®

Right Angle I.D. Clamping
Boiler Tube Fin Removal Tool
1.25" I.D. to 2.5" 63.5 mm O.D.
31.8 mm I.D. to 63.5 mm O.D.

Eliminates chipping hammers and saves time

Key Features

- Removes 4.0" (101 mm) depth of fin from the tube O.D. in less than 2 minutes
- Standard working range of 1.25" to 2.5" O.D.
- Heavy duty rack and pinion feed mechanism assures smooth operation for greater fin removal control
- Rigidly clamps to the tube I.D.
- Works in any orientation
- Easy to operate and no reaction torque to operator
- No cutting fluid is required
- Saves a lot of time by eliminating chipping and grinding

Removes spirally wound fin from tube O.D. The patented cutter requires no cutting fluids and can be resharpened.

Patented tool removes 4.0" of fin from the tube O.D. in minutes

The FIN MILLHOG® tube fin removal tool clamps to the tube I.D. and features a patented cutter blade which separates fin from tube O.D. Forget about chipping hammers and grinders! This tool removes 4.0" (101 mm) of fin from a tube O.D. in under 2 minutes and is a real time saver.

Easy to operate, the FIN MILLHOG® is operator friendly and has its wrenches conveniently attached for maximum efficiency. Once the tool is attached to the tube I.D. and the power is activated, the operator advances the rotating cutter and engages the spirally wound fin until the desired amount of fin is removed. The quick action of the rack and pinion feed allows the operator to disengage the feed and clear the separated fin from the cutter quickly.

Compact with all wrenches attached the FIN MILLHOG® saves time and makes a tough job easier.


Left Hand Wound Fin.


4.0" (101 mm) depth of fin is removed and tube is ready for beveling.


Right Hand Wound Fin

The FIN MILLHOG® rack and pinion feed has a 4.0" of stroke that allows the operator to quickly engage and disengage the cutter for clearing separated fin from the work area.

Specifications: FIN MILLHOG®

Working Range	1.25in (31.8 mm) I.D. to 2.5in (63.5 mm) O.D.	
Motor	Pneumatic	Electric - consult factory
	1.25 hp (.932 kW) 90 psi (6.2 bar) 40 cfm (990 lt/min)	120 V 8.5 A 50/60 Hz 950 W, or 220 - 240 V 4.4 A 50/60 Hz 950 W
Speed	98 rpm	55 rpm - 88 rpm
Minimum Clearance	2.625in (66.68 mm)	2.625in (66.68 mm)
Head Length	20in (508 mm)	20in (508 mm)
Working Weight	21.5 lbs (9.75 kg)	22.6 lbs (10.25 kg)
Shipping Weight	55 lbs (25 kg)	60 lbs (27.3 kg)
Shipping Dimensions	(24in x 20in x 6in) (610 mm x 508 mm x 152 mm)	(24in x 20in x 7in) (610 mm x 508 mm x 178 mm)

U.S. patents 7,305,746 & 7,774,909

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HOG TIE®
MILLHOG®

Boiler Tube Weld
Alignment Clamp

Aligns boiler tube ends for welding

Key Features

- Aligns tube ends quickly for tube joint tack welding
- Ideal for waterwall, economizer, header, crossover, superheat, reheat, and generating tubes
- Speeds boiler tube waterwall welding process
- Reduces the risk of costly tube joint failure due to misalignment
- Made of high strength precision machined steel for long service
- For tube sizes 1.75" O.D. to 3.25" O.D.
- Threaded inserts are replacable
- Available kits come with everything needed
- Set-up is easy and fast
- Saves time and money
- For Sale and Rent

Simplifies tube alignment and improves tube joint welds

The HOG TIE® boiler tube joint alignment tool speeds the welding process for boiler tube waterwall panel replacement by quickly and accurately aligning new boiler tube ends with existing tubes in preparation for creating welded tube joints.

The HOG TIE® two piece design is simple and easy to use. One piece has two through holes and the other has two threaded replaceable inserts. Two bolts draw the assembly together. Each bolt passes through the through hole and threads into the piece with the threaded insert. With the two tube ends between the HOG TIE® assembly, the tack weld window on each HOG TIE® piece is centered. When the bolts are tightened, it draws the tube ends into alignment.

During this process, adjustments can be made to ensure a proper gap is maintained between the tube ends before tack welding them. After the HOG TIE® is removed, the tack weld holds the tube ends in alignment, allowing for full access to the tube joint in order to complete the tube joint weld.

Accurate tube end alignment helps to make a better welded tube joint and reduces the risk of tube joint failure due to inaccurate alignment which saves time and money on costly boiler shut-down and re-work.

The HOG TIE® alignment tool can also be used in other applications requiring accurate alignment of tube and pipe for welding. It is made of precision machined high strength steel for long service and is available for tube sizes from 1.75" to 3.25" O.D.

HOG TIE® tube alignment tools speed waterwall boiler tube fit-up and helps reduce tube joint failure due to misalignment.

Available impact wrench draws the HOG TIE® assembly together for fast tube end alignment.

Specifications: HOG-TIE® Boiler Tube Joint Weld Alignment Tool

	Tube Size OD		Dimensions		Weight		Gr B7 Bolt
Product #	in	mm	in	mm	lbs	kgs	Length
HT-134	1.75	44.5	6 x 4	152.4 x 101.6	7.5	3.4	3in (76.2mm)
HT-200	2	50.8	6 x 4	152.4 x 101.6	7.5	3.4	3.5in (88.9mm)
HT-214	2.25	57.2	6 x 4	152.4 x 101.6	8	3.63	3.5in (88.9mm)
HT-238	2.375	60.3	6 x 4.375	152.4 x 111.1	8	3.63	4in (101.6mm)
HT-212	2.5	63.5	6 x 4.375	152.4 x 111.1	8	3.63	4in (101.6mm)
HT-300	3	76.2	6 x 4.75	152.4 x 12.07	10	4.54	4.5in (114.3mm)
HT-325	3.25	82.6	6 x 4.75	152.4 x 12.07	10	4.54	4.5in (114.3mm)

HOG-TIE® assemblies are designed for use on boiler tube waterwall panels with 0.5" (12.7mm) wide membrane. For other pipe applications, please consult factory.

Available HOG TIE® kits include an impact wrench and socket, four B7 0.5" bolts, two spare threaded inserts and a carrying case.

HOG TIE® assemblies use replaceable threaded inserts.

HOG TIE® alignment tools also align single tubes and pipe ends for tack welding.

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For Sale and Rent

MILLHOG®

MILLHOG® Rolling Motors and Tube Expanders for fabricating and maintaining boilers, heat exchangers and condensers….

MILLHOG® Rolling Motor Features

- Quickly, automatically control tube expansion
- Precise, consistent tube wall reduction and tight tube joints
- Torque Control helps prevent over and under expansion
- Pneumatically powered
- Right angle models are available for tight, restricted areas
- Many models are available for sale and rent

MILLHOG® Tube Expander Features

- 0.625" to 4.5" (15.9mm to 114.3mm)
- Tube sheets to 5.375" (136.53MM)
- Flare and Straight rolls
- Kits available for sale and rent

Precisely Bonds Tube to Tube Sheet

Equipped with the proper MILLHOG® Tube Expander and MILLHOG® Boiler Tube Rolling Control Motor, premature tube failure and damage to the tube sheet, due to over or under expansion is prevented, assuring a tight, uniform bond between the tube and O.D. and the tube sheet.

Straight, Flare Beading, Long Reach and accompanying spares are available for rent.

Available for sale and rent, tube expanding kits are custom fitted to meet your needs.

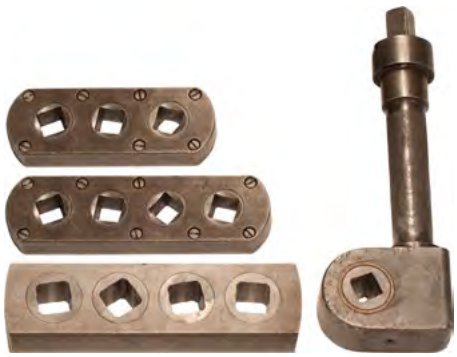
Lever and roll Throttle Torque Control Rolling Motors accurately govern tube expansion and stop automatically when the tube is joined to the boiler tube sheet.

Specifications: HOG-TIE® Boiler Tube Rolling Control Motors

		RT 90	LT 90	RT 190	LT 190	RT 280	LT 280
Free Speed	RPM	90	90	190	190	280	280
Torque Control		Yes	Yes	Yes	Yes	Yes	Yes
Maximum Torque	FT LBS	305	305	140	140	104	104
	NM	410	410	200	200	140	140
Minimum Torque	FT LBS	150	150	70	70	44	44
	NM	200	200	95	95	60	60
Weight	LBS	14.75	14.75	13	13	13	13
	KG	6.7	6.7	5.8	5.8	5.8	5.8
Overall Length	INCH	21.7	21.7	20.1	20.1	20.1	20.1
	MM	550	550	530	530	530	530
Height Without Drive	INCH	2.75	2.75	2.6	2.6	2.6	2.6
	MM	70	70	65	65	65	65
Side To Center	INCH	1.5	1.5	1.1	1.1	1.1	1.1
	MM	37	37	28	28	28	28
Square Drive	INCH	3/4	3/4	5/8 or 3/4		5/8 or 3/4	
	MM	19.1	19.1	15.9 or 19.1		15.9 or 19.1	
Throttle Type	TYPE	Roll	Lever	Roll	Lever	Roll	Lever
Tube Capacity	INCH	4	4	2.5	2.5	2.25	2.25
	MM	101.6	101.6	63.5	63.5	57.1	57.1
Chuck Size	INCH	3/4 x 3/4 or 3/4 x 1		3/4 x 3/4 or 5/8 x 3/4		3/4 x 3/4 or 5/8 x 3/4	
	MM	19.1 x 19.1 or 19.1 x 25.4		19.1 x 19.1 or 15.9 x 19.1		19.1 x 19.1 or 15.9 x 19.1	
Chuck Size Optional	INCH			1/2	1/2	1/2	1/2
	MM			12.7	12.7	12.7	12.7

Tube Rolling motors can be set-up with adapters, universals, extensions and right angle gear drives for a wide variety of applications.

Adapters and Universals



Parallel and Right Angle Gear Drives

Straight Extensions and Universal Extensions

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Air Powered Boiler Saw

MILLHOG®

Standard APS-438
Low Profile APS-438LP

ESCO APS Air Powered Boiler Saws and accessories cut boiler tube panels, boiler tube membrane and pendant tubes. They also squarely cut pipe, concrete pilings and storage tanks.

The Standard and Low Profile Boiler Tube Panel Saws

Key Features

- Provides clean, accurate, straight cuts with no "HAZ" (Heat Affect Zone) when cutting boiler tube panels
- Easy to set up and operate
- Cut tough materials with a high percentage of chrome and tubes with overlay or cladding
- Glides smoothly on easy to install EscoTrack for boiler tube panel cutting
- Rotates easily for membrane removal
- Eliminates rework and grinding before beveling
- Powerful 3 hp pneumatic motor operates on 90 psi shop air and uses only 80 cfm
- Ergonomic design provides optimum balance of speed and torque
- Ideal for many applications requiring straight and accurate cuts

Boilermaker Tough and Field Proven

The MILLHOG® Air Powered boiler tube panel saw effortlessly glides along the 5 foot steel EscoTrack System that is attaches to a boiler tube panel section using weld tabs. The saw's powerful pneumatic motor and proprietary reinforced fiberglass abrasive saw blade cut all boiler tube alloys efficiently and makes both horizontal and vertical cuts. After completing a horizontal cut, simply remove the saw, rotate it 90° and reinstall it on the track. For even faster membrane removal, use the membrane removal bracket and available 0.250" (6.35 mm) or 0.375" (9.53 mm) membrane removal blades.

Combining a MILLHOG® tube beveling tool equiped with a membrane or membrane and overlay (cladding) removal head, the tube end prep and its O.D. are quickly and economically prepared for welding.

APS-438 Standard Boiler Tube Panel Saw

APS-438LP Low Profile Boiler Tube Panel Saw

Designed for cutting pendant tube panels in tight spaces using the EscoTrack System, this model requires a 7.5" (191 mm) clearance.

The Standard APS can also achieve perfect cuts on contoured and cylindrical structures, steel plate and pipe from 6.0" to 60.0" with available accessories.

Specifications: Air Powered Boiler Saw

Model	APS-438 Standard	APS-438LP Low Profile
Motor	3 hp (2237 W)	3 hp 2237 W)
Air Pressure	90 psi (6.2 bar)	90 psi (6.2 bar)
Air Volume	80 cfm (2265 lt/min)	80 cfm (2265 lt/min)
Speed	5050 rpm	5050 rpm
Radial Clearance	13.5in (343 mm) with 12in blade fully plunged into tube	7.5in (19 1 mm) with 10in blade fully plunged into tube
Cut Depth	4.375in (111.13 mm)	3.375in (85.7 mm)
Working Weight	28 lbs (12.7 kg)	28.5 lbs ((13 kg)
Shipping Weight	65 lbs ((29.5 kg)	65 lbs (29.5 kg)
Track 5 ft (1,524 mm)	19 lbs (9 kg) 19in (483 mm)	19 lbs (9 kg) 19in (483 mm)
Shipping Dimensions	27in x 15in x 11in 686 mm x 381 mm x 254 mm)	27in x 15in x 11in 686 mm x 381 mm x 254 mm)
Track	66in x 3in (1676 mm x 77 mm)	66in x 3in (1676 mm x 77 mm)

The HHB series of boiler tube bevelers can use the same track set-up as the APS panel cutting saws.

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Air Powered Boiler Saw

MILLHOG®

Standard APS-438
Low Profile APS-438LP
Membrane Bracket, Quick Clamp
Chain Mount Tabs, Track Connector
Vertical Track Attachment, Blades, Accessories

Membrane Bracket

The Membrane Bracket slides onto the standard track and the APS-438 Standard or APS-438LRC is mounted for quickly removing membrane from between tubes. The Membrane Bracket Track can be set up in two different positions.

Quick Clamp

The Quick Clamp attaches to the standard track and securely grips the boiler tube panel for making perfectly square cuts.

The Quick Clamp attaches the standard track to the panel without tack welding and is a popular option for working on boiler tube panels before installation.

Chain Mount Tab

Track Connector

Straight track can be mounted in numerous cutting positions and sections can be joined using the Track Connector. The flex track works on warped boiler tube panels and is useful for many other applications that include contour and serpentine surfaces.

Vertical Track Alignment

The APS-438 Saw moves up and down on the Vertical Track Attachment for cutting membrane from between boiler tubes and the attachment can be slid horizontal on the standard track for precise alignment. Two brakes, one on the APS-438 Saw and one on the Vertical Track Attachment enable secure and stable cutting.

Cut-Off Blades and Membrane Removal Blades

Saw blades are available in a variety of widths and diameters and made to cut a wide range of material from super duplex to concrete lined ductile iron pipe to boiler tubes with inconel overlay.

Air Powered Saws Depth of Cut for Boiler Tube Panels

Boiler Tube Panel	
4.375in (111.1 mm) Max cut depth	APS-438 w/5' Track and 12in Cut-Off Blade
2.375in (60.33 mm) Max cut depth	APS-438LP Low Profile w/5' Track and 10in Cut-Off Blade
Flex Track	
Tanks, serpentine surfaces	
4.0in (101.6 mm) Max cut Depth	APS-438 w/6 (ft) Flex track and 12in Cut-Off Blade

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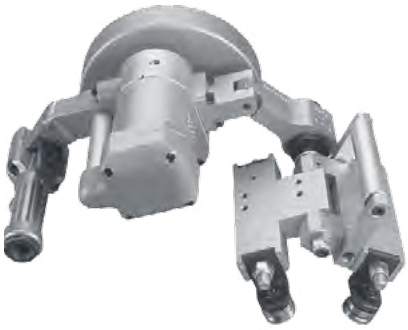
Air Powered Pipe, Piling & Storage Tank Cutting Saw

MILLHOG®

Standard APS-438
Low Radial Clearance APS-438LRC

Cut all alloys of steel pipe without "HAZ"

ESCO APS-438 and APS-438LRC Low Radial Clearance Air Powered Saws cut all alloys of steel pipe including ductile iron concrete lined pipe, concrete pilings and storage tanks perfectly square and without a "HAZ" (Heat Affect Zone).



Key Features

- Perfectly square cuts with no "HAZ" on pipe from 6.0" – 60.0" using EscoWrap Tracks
- Low Clearance, only 6.25" (158.75 mm) with the APS-438LRC
- Using the Universal Pipe Trolley the Standard APS-438 boiler saw can be used on the EscoWrap Track
- Scores concrete pilings for trimming to length
- Cuts concrete lined steel and ductile iron pipe cleanly
- Powerful 3 hp pneumatic motor
- The Flex Track attaches by tack welds to the side of any straight, contoured or cylindrical structure with a radius of 2.5 ft. or larger

The APS-LRC requires 6.0" (152.4 mm) clearance with Cut-Off blade plunged into pipe and has a cutting depth of 2.0" (50.8 mm).

Easily configured for a wide variety of applications

The MILLHOG® Air Powered APS-438LRC Low Radial Clearance and Standard APS-438 are operator friendly and effectively cut pipe and other metal structures perfectly straight with no "HAZ".

EscoWrap Tracks securely clamp to the pipe O.D. and the trolley is attaches to it for mounting the saw. This ultra-stable platform permits the operator to easily move the saw around the circumference to produce a clean, perfectly square cut. The Standard APS-438 with a pipe trolley and APS-438LRC are recommended for use with EscoWrap Tracks.

Flex Tracks are attached to straight, contoured, cylindrical and serpentine surfaces by tack welding. The saw then slides onto it and the operator can easily and safely control the powerful cutting action for precise cuts.

APS-438 cuts 8.0" pipe cleanly and square with no "HAZ" and has a cutting depth of 4.0" (101.6 mm) using a 12.0" Cut-Off Blade.

The Flex Track attaches to straight, contoured, cylindrical and serpentine surfaces for making accurate square cuts with no "HAZ".

Scoring concrete pilings for height trimming. Concrete Cut-Off Blades are available in Diameters of up to 14".

Air Powered Saws Depth of Cut for Boiler Tube Panels

Model	APS-438 Standard	APS-438LRC Low Radial Clearance
Motor	3 hp (2237 W)	3 hp (2237 W)
Air Pressure	90 psi (6.2 bar)	90 psi (6.2 bar)
Air Volume	80 cfm (2265 lt/min)	80 cfm (2265 lt/min)
Speed	5050 rpm	5050 rpm
Radial Clearance	13.5in (343 mm) with 8in blade fully plunged into pipe	6in (152.4 mm) with 8in blade fully plunged into pipe
Cut Depth	4.375in (111.13 mm)	2.375in (60.3 mm)
Working Weight	28 lbs (12.7 kg)	30 lbs (13.6 kg)
Shipping Weight	65 lbs ((29.5 kg)	68 lbs (30.85 lg)
Track 5 ft (1,524 mm)	19 lbs (9 kg)	
	19in (483 mm)	N/A
Shipping Dimensions	27in x 15in x 11in	27in x 15in x 11in
	686 mm x 381 mm x 254 mm)	686 mm x 381 mm x 254 mm)
Track	66in x 3in (1676 mm x 77 mm	66in x 3in (1676 mm x 77 mm

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ESCO Wrap Track, Trolley and Standard APS-438 system is simple to use.

Wrap Tracks are available in standard pipe sizes for pipe from 6.0" to 60.0".

Mount the Wrap Track to the pipe

Clamp into position

Mount Trolley

Adjust and Secure

Mount saw to trolley

Trolley is adjustable to fit all Esco Wrap Tracks

The Esco Wrap Track provides a stable platform for mounting the 3hp air driven saw and produce a clean perfectly square cut.

Set up and make a perfectly square cut on 10" sch. 160 pipe in under 10 minutes.

The Single-Cut Bracket turns the panel saw into a portable chop saw for quickly and accurately cutting pipe, tube or solid stock up to 4.0" O.D.

Concrete lined pipe can be cut cleanly. See the Video on our website showing this APS-438LRC with a 12" cut-off blade cutting this 8" concrete lined ductile iron pipe.

Flex Tracks attach to warped boiler tube panels and storage tanks and can be used for many applications requiring straight cuts. 6 ft lengths are standard.

Wrap Tracks are made of stainless steel for standard pipe sizes. Special sizes can be made to specification.

WrapTrackSelections

Part No.	EscoWrap Tracks
EW-06	EscoWrap Tracks, 6in
EW-08	EscoWrap Tracks, 8in
EW-10	EscoWrap Tracks, 10in
EW-12	EscoWrap Tracks, 12in
EW-14	EscoWrap Tracks, 14in
EW-16	EscoWrap Tracks, 16in
EW-18	EscoWrap Tracks, 18in
EW-20	EscoWrap Tracks, 20in
EW-22	EscoWrap Tracks, 22in
EW-24	EscoWrap Tracks, 24in
EW-26	EscoWrap Tracks, 26in
EW-28	EscoWrap Tracks, 28in
EW-30	EscoWrap Tracks, 30in
EW-32	EscoWrap Tracks, 32in
EW-34	EscoWrap Tracks, 34in
EW-36	EscoWrap Tracks, 36in
EW-38	EscoWrap Tracks, 38in
EW-40	EscoWrap Tracks, 40in
EW-42	EscoWrap Tracks, 42in
EW-44	EscoWrap Tracks, 44in
EW-46	EscoWrap Tracks, 46in
EW-48	EscoWrap Tracks, 48in
EW-50	EscoWrap Tracks, 50in
EW-52	EscoWrap Tracks, 52in
EW-54	EscoWrap Tracks, 54in
EW-56	EscoWrap Tracks, 56in
EW-58	EscoWrap Tracks, 58in
EW-60	EscoWrap Tracks, 60in
EW-60	EscoWrap Tracks, 60in

AirPoweredSawsDepthofCutforPipes

Pipe Cutting - 6 - 60 (in) 4.0 (101.6 mm) Max cut depth 2.0 (50.8 mm) Max cut depth	APS-438 w/ independent Pipe Trolley and 12in Cut-Off Blade APS-438LRC Low Radial Clearance w/ built in Pipe Trolley and 8in Cut-Off Blade
Flex Track Tanks, serpentine surfaces 4.0in (101.6 mm)	APS-438 w/6 (ft) Flex track and 12in Cut-Off Blade

Prepzilla MILLHOG®

I.D. Clamping Beveling Tool
1.575" I.D. to 8.625" O.D.
40 mm I.D. to 219.1 mm O.D.

Ruggedly built and bevels highly alloyed pipe for fast fit-up and precision welds

Key Features

- Only 1 mandrel and 8 sets of clamps to cover entire range
- Third Cutter Blade Tool Post expands pipe beveling capacity for beveling, facing and boring simultaneously
- Optional flange facing attachment (consult factory)
- Low rpm and tremendous torque
- Produces thick chips on all highly alloyed tube and pipe without cutting fluids
- Pneumatic, electric and hydraulic motor choices are easily interchanged
- Dual opposed tapered roller bearing construction delivers rock solid performance
- Heavy duty clamping system will not break

High Performance, Low Maintenance

The Prepzilla MILLHOG® is smooth, quiet and powerful. It is highly desired for its ability to bevel difficult pipe alloys like super duplex and P-91 quickly and efficiently.

Ruggedly designed for years of trouble free service, the Prepzilla is built with dual opposed tapered roller bearings, heat treated and hardened clamping, cutting and operational components.

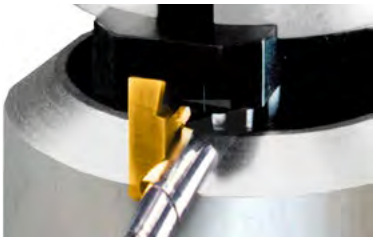
It can bevel pipe at any angle without cutting fluid for fast fit-up and enables precise pipe joint welds. Additionally, it only requires oil and grease for routine maintenance.

The Prepzilla MILLHOG® pipe beveling tool is used daily on hundreds of job sites around the world. Portable and accurate, it enables fast fit-up and precision welds.

Pneumatic

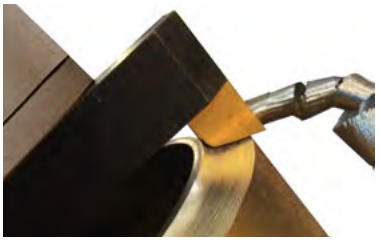
Electric

Hydraulic



37.5° bevel x 0.125" land 6" schedule 160

30° bevel .0625" land and 10° bore 8" schedule xx.



J bevel with 22° radius and .0938in land 8" schedule 120.

The Prepzilla MILLHOG® is capable of performing any degree of bevel on all alloys of pipe up to 8.0". These bevel examples are typical of the Prepzlla's capabilities.

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Prepzilla

MILLHOG®

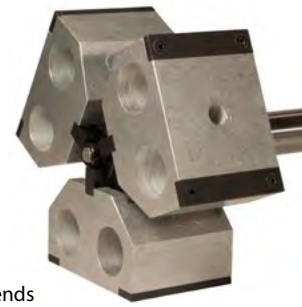
I.D. Clamping Beveling Tool
1.575" I.D. to 8.625" O.D.
40 mm I.D. to 219.1 mm O.D.

Prepzilla Clamp Rib Selector and corresponding spares
Mandrel, Draw Rod, Actuator, Roll Pin, Retention Bands and Springs

Clamp Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size	Draw Rod	Actuator Part #	Actuator Roll Pin	Retention Spring
P-01	1.575	2.050	40.0	52.1	P-30	1.575	P-11	P-14	P-10	H-14 B
P-02	2.025	2.505	51.4	63.6	P-30	1.575	P-11	P-14	P-10	P-10A
P-03	2.475	2.955	62.9	75.1	P-30	1.575	P-11	P-14	P-10	P-10A
P-04	2.925	3.405	74.3	86.5	P-30	1.575	P-11	P-14	P-10	P-10A
P-02 & P-05	3.375	3.855	85.7	97.9	P-30	1.575	P-11	P-14	P-10	P-10A
P-03 & P-05	3.825	4.305	97.2	109.3	P-30	1.575	P-11	P-14	P-10	P-10A
P-04 & P-05	4.275	4.755	108.6	120.8	P-30	1.575	P-11	P-14	P-10	P-10A
P-02 & P-06	4.725	5.205	120.0	132.2	P-30	1.575	P-11	P-14	P-10	P-10A
P-03 & P-06	5.175	5.655	131.4	143.6	P-30	1.575	P-11	P-14	P-10	P-10A
P-04 & P-06	5.625	6.105	142.9	155.1	P-30	1.575	P-11	P-14	P-10	P-10A
P-02 & P-07	6.075	6.555	154.3	166.5	P-30	1.575	P-11	P-14	P-10	P-10A
P-03 & P-07	6.525	6.980	165.7	177.3	P-30	1.575	P-11	P-14	P-10	P-10A
P-04 & P-07	6.950	7.430	176.5	188.7	P-30	1.575	P-11	P-14	P-10	P-10A
P-02 & P-08	7.400	7.880	188.0	200.2	P-30	1.575	P-11	P-14	P-10	P-10A
P-03 & P-08	7.850	8.330	199.4	211.6	P-30	1.575	P-11	P-14	P-10	P-10A
P-04 & P-08	8.300	8.780	210.8	223.0	P-30	1.575	P-11	P-14	P-10	P-10A

Clamp ribs and clamp pad are precision machined, heat treated and securely fasten the Prepzilla to the tube or pipe I.D. for torque free beveling.

One Mandrel, 4 Clamp Ribs and 4 Clamp Pads sets achieve the standard range of 1.575" I.D. to 8.625" O.D.



Optional Clamp Pad set extends I.D. range. Consult factory.

1.5in Mandrel, Draw Rod, Actuators and Roll Pin
P-30, P-11, P-14A, P-14 and P-10A

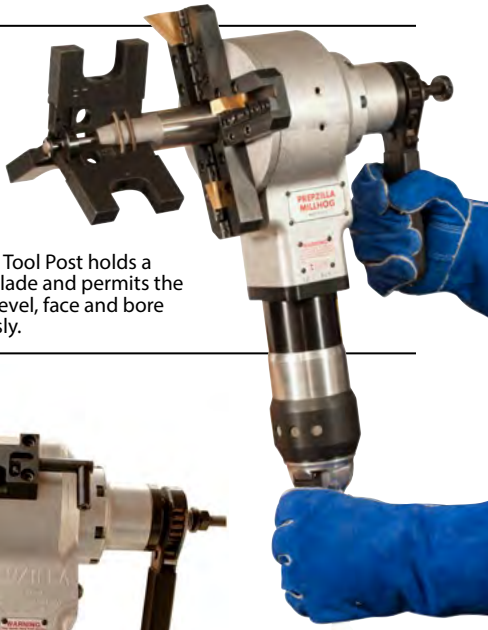
PrepzillaToolPosts,BladeLocksandScrews

Tool Post Part #	Tool Post Size	Blade Lock Part #	Blade Lock Per Post	Lock Screw Part #	Lock Screw Per Lock
P-20-875	8.75in	P-17	10	P-18	1
* P-20-375	3.5in	P-17	5	P-18	1
* P-20-1075	10.75in	P-17	12	P-18	1

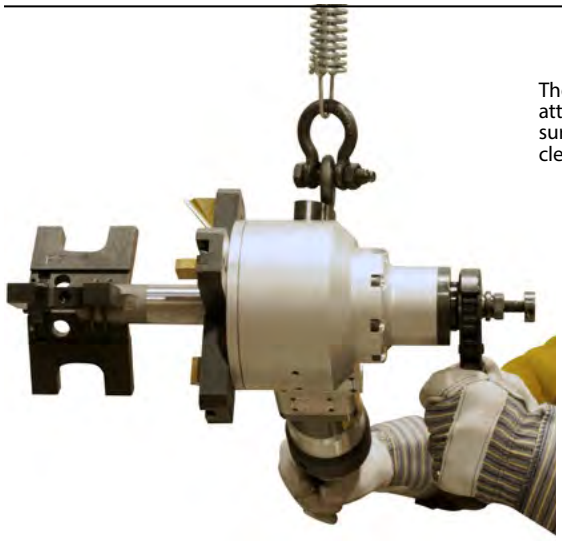
* Optional

Tool Posts 8.75", 3.5", 10.75"
P-20-875, P-20-375, P-20-1075

Blade Lock and
Blade Lock Screw
P-17 and P-18.



The P-20-375 Tool Post holds a third cutter blade and permits the Prepzilla to bevel, face and bore simultaneously.



Hanging the Prepzilla with the available D-Ring and Spring Hanger allows one operator to align the tool with ease when clamping to the pipe I.D.

The optional Flange Facer attachment faces flange surfaces and produces a clean finish.

Specifications: Prepzill

Working Range`	1.575in (40 mm) I.D. to 8.625in (219.1 mm) O.D.		
Motor	Pneumatic	Electric	Hydraulic
	2 hp (1491 W)	120 V AC 50/60 Hz 1800 W, or	Pump requirements
	90 psi (6.2 bar)	230 V AC 50/60 Hz 1800 W	5 - 10 gpm @ 1500 psi
	40 cfm (990 lt/min)		20 gallon reservoir
Speed	34 rpm	9 rpm - 31 rpm	1 rpm -16 rpm
Minimum Clearance			
With 8.750 in (222.2 mm) Tool Post	8.750in (222.3 mm)	8.75in (222.3 mm)	8.75in (222.3 mm)
Head Length	19.75in (501.7 mm)	19.75in (501.7 mm)	26in (660.4 mm)
Working Weight	44 lbs (20 kg)	54 lbs (24.5 kg)	56 lbs (55.4 kg)
Shipping Weight	110 lbs (50 kg)	120lbs (54.5 kg)	122 lbs (25 kg)
Shipping Dimensions	27in x 21in x 7in	27in x 21in x 7in	27in x 21in x 7in
	686 mm x 534 mm x 178 mm	686 mm x 534 mm x 178 mm	686 mm x 534 mm x 178 mm

Commander MILLHOG®

Model C-134
I.D. Clamping Pipe Beveling Tool
3.75" I.D. to 14" O.D.
95.25 mm I.D. to 355.6 mm O.D.

Bevels heavy wall pipe and pulls a thick chip without cutting fluids

Key Features

- One mandrel and seven sets of clamps cover entire tool range
- Wide clamps spread the contact force for superior clamping
- Three powerful motor choices that are easily switched and interchangeable with the Dictator
  - Pneumatic
  - Electric
  - Hydraulic
- Dual opposed tapered roller bearing design provide years of trouble free service
- Available off-set gear drive lowers rpm, doubles the torque and enables the cutter blade to pull a thick chip for fast pipe beveling and increased Cutter Blade life.
- Available spring hanger ensures accurate alignment when clamping
- Engineered for high performance and low maintenance
- Fully portable for on-site use

The clamping system of the Commander MILLHOG® Model C-314 pipe beveling machine has six contact points that minimize vibration for chatter free bevels on both thin and heavy wall pipe.

Precision pipe beveler makes chatter-free bevels for precision welds

Designed to bevel all schedules of pipe from 3.75" I.D. to 14" O.D., the Commander MILLHOG® Model C-314 features a clamping system that spreads the contact points of the clamps radially inside the pipe. This minimizes vibration for chatter-free end preps on both thin and heavy wall pipe. To assure stable, smooth rotation of the cutterhead, this rugged tool employs dual opposed tapered roller bearings that are easy to adjust and never wear out.

Powerful and versatile, torque at the cutter blade for the Model C-314 is achieved with the choice of three motor options suited to fit your application.

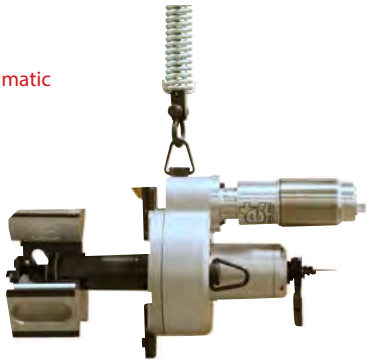
Like all MILLHOG® tools, the Commander MILLHOG® Model C-314 is simple to operate and rugedly designed for years of trouble free service.

Applications

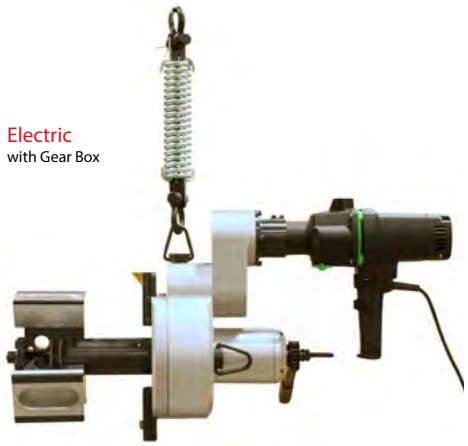
- Super alloy pipe beveling
- On and off-shore pipeline construction
- Petrochemical
- Power generation
- Systems fabrication
- Structural construction

Super Duplex and other high alloy pipe materials can be difficult to bevel at speeds that work well on Carbon Steel and other alloys. The need to reduce the rpm and increase the torque is required for these applications and the Gear Box does just that. It easily and quickly mounts to the Commander and reduces the rpm by half and doubles the torque at the cutter blade.

Pneumatic



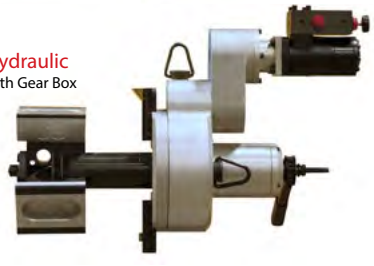
Electric
with Gear Box



Hydraulic

Pneumatic
with Gear Box

Hydraulic
with Gear Box



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Commander MILLHOG®

Model C-314
I.D. Clamping Pipe Beveling Tool
3.75" I.D. to 14" O.D.
95.25 mm I.D. to 355.6 mm O.D.

Clamp System Features

- Only 7 sets of clamps for entire range
- All clamps work on one Mandrel
- Clamp Pads have replaceable corners
- All key clamping components, including Draw Rod are heat treated.

Clamps spread force for rock solid stability

The Commander MILLHOG® Clamp Ribs combined with Clamp Pads achieve a huge I.D. range of 3.75" to 14" with only 7 sets of clamps that all work on the same Mandrel. The Clamp Pads are V shaped to spread the clamping force radially inside the pipe for rock solid stability and have heat treated and hardened replaceable steel corners that are easy and economical to change when worn.

Commander Clamp Rib Selector and corresponding spares
Mandrel, Draw Rod, Actuator, Roll Pin, Retention Springs and Clamp Pad Corners

Clamp Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size (in)	Draw Rod	Actuator Part #	Actuator Roll Pin	Retention Spring	Clamp Pad Corner Part #	Clamp Pad Corner Per Pad Set	Clamp Pad Screw Part #	Clamp Pad Screw Per Pad Set
C-01	3.750	4.500	95.250	114.300	C-37	3	C-14	C-11	C-12	C-13				
C-02	4.375	5.250	111.130	133.350	C-37	3	C-14	C-11	C-12	C-13				
C-03	5.125	6.000	130.180	152.400	C-37	3	C-14	C-11	C-12	C-13				
C-04	5.875	6.800	149.230	172.720	C-37	3	C-14	C-11	C-12	C-13				
C-01 & C-05	6.750	7.562	171.450	192.080	C-37	3	C-14	C-11	C-12	C-13	C-10	6	C-08	18
C-02 & C-05	7.437	8.250	188.900	209.550	C-37	3	C-14	C-11	C-12	C-13				
C-03 & C-05	8.125	8.938	206.380	227.030	C-37	3	C-14	C-11	C-12	C-13				
C-04 & C-05	8.875	9.700	225.430	246.380	C-37	3	C-14	C-11	C-12	C-13				
C-01 & C-06	9.687	10.500	246.050	266.700	C-37	3	C-14	C-11	C-12	C-13	C-10	6	C-08	18
C-02 & C-06	10.375	11.125	263.530	282.580	C-37	3	C-14	C-11	C-12	C-13				
C-03 & C-06	11.000	11.812	279.400	300.030	C-37	3	C-14	C-11	C-12	C-13				
C-04 & C-06	11.750	12.500	298.450	317.500	C-37	3	C-14	C-11	C-12	C-13				
C-03 & C-07	12.400	13.250	314.960	336.550	C-37	3	C-14	C-11	C-12	C-13	C-10	6	C-08	18
C-04 & C-07	13.125	14.000	333.380	355.600	C-37	3	C-14	C-11	C-12	C-13				

Clamp Rib Sets, C-01, C-02, C-03 and C-04, Clamp Pad Sets C-05, C-06 and C-07 and Retention Spring C-10.

Mandrel, Roll Pin, Actuator and Draw Rod
C-37, C-12, C-11 and C-14.

Replacement Clamp Pad Corners and Screws C-10 and C-08 are used with Clamp Pad sets C-05, C-06 and C-07.

Tool Post and Tool Post screws
C-52 and C-55.

The Commander MILLHOG® is equipped with two Tool Posts and a third Tool Post can be added as an option. All Tool Posts are interchangeable and share the same screws and wedges.

Commander Tool Post, Blade Locks and Screws

Tool Post Part #	Tool Post Size	Tool Post Per Tool	Tool Post Screws Part #	Tool Post Screws Per Post	Blade Lock Part #	Blade Lock Per Post	Lock Screw Part #	Lock Screw Per Lock
C-52	4.25	2	C-55	4	C-54	5	C-53	1

* The available third Tool Post is optional

Blade Lock Screw and Blade Lock
C-53 and C-54.

Commander and Dictator MILLHOG® motors are interchangeable and switching is easily accomplished with a simple hex key.

Specifications: Commander

Working Range	3.750in (95.25 mm) I.D. to 14in (355.6 mm) O.D.		
Motor	Pneumatic	Electric	Hydraulic
	3 hp (2237 W)	120 V AC 50/60 Hz 1800 W, or	5 hp / 8-12 gpm (30.3-45.4 lt/min)
	90 psi (6.2 bar)	230 V AC 50/60 Hz 1800 W	5 - 10 gpm @ 1500 psi
	95 cfm (2690 lt/min)		20 gallon reservoir
Speed	24 rpm	13 rpm - 45 rpm	1 rpm - 22 rpm
Speed with Off-Set Gear Reducer	12 rpm with gear reducer	6.5 rpm - 22.5 rpm	1 rpm - 11 rpm
Minimum Clearance	11.50in (323.9 mm)	11.50in (323.9 mm)	11.50in (323.9 mm)
Head Length	26in (660.4 mm)	26in (660.4 mm)	26in (660.4 mm)
Working Weight	89 lbs (40.4 kg)	91 lbs (41.3 kg)	93 lbs (42.2 kg)
Shipping Weight	200 lbs (91 kg)	202 lbs (92kg)	204 lbs (93kg)
Shipping Dimensions	32in x 15in x 17in	32in x 15in x 17in	32in x 15in x 17in
	813 mm x 381 mm x 432 mm	813 mm x 381 mm x 432 mm	813 mm x 381 mm x 432 mm

Dictator MILLHOG®

Model D-418
I.D. Clamping Pipe Beveling Tool
4.5" I.D. to 18" O.D.
114.3 mm I.D. to 457.2 mm O.D.

Bevels heavy wall pipe and is easy to use offering an affordable alternative to specialized machines

The Dictator can bevel, face and bore heavy wall pipe at any angle at the same time quickly and accurately for perfect fit-up and precision welding.

The Dictator MILLHOG® pipe tool performs any degree of bevel on pipe up to 18" schedule 160 without cutting fluid while assuring maximum cutter blade life. It has wide self-centering clamps that produce a superior clamping force for chatter-free bevels on all types of highly alloyed pipe.

Simple to operate and maintain, the Dictator features a choice of three motor: pneumatic, electric and hydraulic. They can be easily switched with a simple hex wrench. The tool's robust spur gear drive train and dual opposed bearing system are made of premium steels, heat treated, hardened and designed for trouble free service.

Key Features

- One mandrel and 8 sets of clamps cover entire range
- Wide clamps spread the contact for superior clamping force and rigidity
- Three powerful motor choices that are easily switched and interchangeable with the Commander pneumatic, electric and hydraulic
- Available gear box lowers rpm and doubles the torque at the cutter blade
- The Esco Lock cutter blade holding system holds the blades securely in place to produce a thick chip for fast pipe beveling and increased cutter blade life
- Bevels super alloyed pipe
- Patented Safety Spring hanger ensures accurate alignment when clamping
- Low maintenance dual opposed tapered roller bearing design provide years of trouble free service
- Fully portable for on-site use

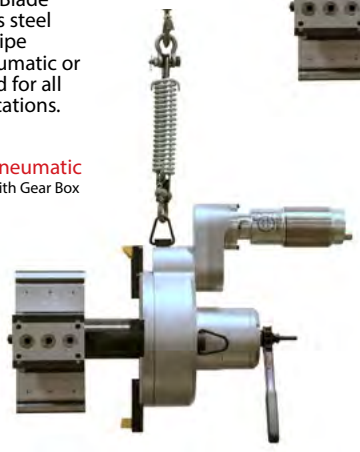
Dictator II, 4.5" I.D. to 24" O.D. Consult factory for availability

The tools are shown with the available patented Safety Chain Lanyard with Spring Hanger. This innovative hanger provides a perceptible feel that the tool is aligned to the pipe as the clamps tighten. The safety chain prevents the possibility of over extending the spring and provides a failsafe catch in the event of a spring failure.

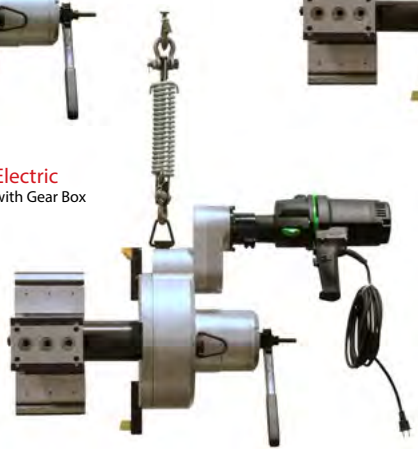
The Gear Box reduces the rpm and doubles the torque at the Cutter Blade for beveling stainless steel and highly alloyed pipe when using the pneumatic or hydraulic motors and for all electric motor applications.

Pneumatic

Hydraulic



Pneumatic
with Gear Box



Electric
with Gear Box

Hydraulic
with Gear Box

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Dictator MILLHOG®

Model C-314
I.D. Clamping Pipe Beveling Tool
3.75" I.D. to 14" O.D.
95.25 mm I.D. to 355.6 mm O.D.

Clamp System Features

- Only 8 sets of clamps for entire range
- All clamps work on one Mandrel
- Clamp Pads have replaceable corners
- All key clamping components, including Draw Rod are heat treated and hardened.

Unrivaled Stability and Reliability

MILLHOG® innovative V shaped Clamp Pads make six contact points with the pipe I.D. for unrivaled clamping stability and reliability. Heat treated and hardened steel Pad Corners are used on the Clamp Pads where they make contact with pipe I.D. for maximum durability. When they eventually wear out, they are easily and economically replaced.

Clamp Ribs Sets D-01, D-02 and D-03
Clamp Pad Sets D-04, D-05, D-06, D-07 and D-08
and Retention Spring D-14

Dictator Clamp Rib Selector and corresponding spares
Mandrel, Draw Rod, Actuator, Roll Pins, Retention Bands and Springs

Clamp Set	I.D. Range in		I.D. Range mm		Mandrel Part #	Mandrel Size (in)	Draw Rod	Actuator Part #	Actuator Roll Pin	Retention Spring
D-01	4.5	5.625	114.3	142.9	D-37	4	D-15	D-12	D-13	D-14
D-02	5.5	6.625	139.7	168.3	D-37	4	D-15	D-12	D-13	D-14
D-03	6.5	7.625	165.1	193.7	D-37	4	D-15	D-12	D-13	D-14
D-02 & D-04	7.5	8.625	190.5	219.1	D-37	4	D-15	D-12	D-13	D-14
D-03 & D-04	8.5	9.625	215.9	244.5	D-37	4	D-15	D-12	D-13	D-14
D-02 & D-05	9.5	10.625	241.3	269.9	D-37	4	D-15	D-12	D-13	D-14
D-03 & D-05	10.5	11.625	266.7	295.3	D-37	4	D-15	D-12	D-13	D-14
D-02 &D-06	11.5	12625	292.1	320.7	D-37	4	D-15	D-12	D-13	D-14
D-03 & D-06	12.5	13.625	317.5	346.1	D-37	4	D-15	D-12	D-13	D-14
D-02 & D-06 & D-07	13.5	14.625	342.9	371.5	D-37	4	D-15	D-12	D-13	D-14
D-03 & D-06 & D-07	14.5	15.625	368.3	369.9	D-37	4	D-15	D-12	D-13	D-14
D-02 & D-08	15.5	16.625	393.7	422.3	D-37	4	D-15	D-12	D-13	D-14
D-03 & D-08	16.5	17.625	419.1	447.7	D-37	4	D-15	D-12	D-13	D-11

Mandrel, Draw Rod, Actuator and Roll Pin
D-37, D-15, D-12 and D-13

Replacement Clamp Pad Corners and Screws are available for Clamp Pad sets D-04, D-05, D-06, D-07 and D-08.

The EscoLock blade lock system and double threaded lock screw hold the blade securely in place to produce a thick chip that helps prolong blade life by transferring the heat to the chip and away from the Cutter Blade.

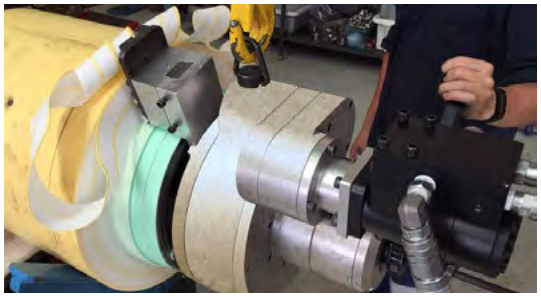
Tool Post and Tool Post screws
D-52 and D-55.

Dictator Tool Post, Blade Locks and Screws

Tool Post Part #	Tool Post Size	Tool Post Per Tool	Tool Post Screws Part #	Tool Post Screws Per Post	Blade Lock Part #	Blade Lock Per Post	Lock Screw Part #	Lock Screw Per Lock
D-52	5.125	2	D-55	4	D-54	6	D-53	1

* The available third Tool Post is optional

Blade Lock Screw and Blade Lock
D-54 and D-53.



6" (152 mm) of polyethylene is removed from a steel pipe O.D. and beveled for welding spool pieces together.

Specifications: Dictator MILLHOG®

Working Range	4.5in (114.3 mm) I.D. to 18in (457.2 mm) O.D.		
Motor	Pneumatic	Electric	Hydraulic
	3 hp (2237 W)	120 V AC 50/60 Hz 1800 W, or	5 HP / 8-12 gpm (pump)
	90 psi (6.2 bar)	230 V AC 50/60 Hz 1800 W	@ 1500 psi (102 bar)
	95 cfm (2690 lt/min)		20 gallon reservoir
Speed	15 rpm	13 rpm - 45 rpm	1 rpm - 14 rpm
Speed with Off-Set Gear Reducer	7.5 rpm with gear reducer	6.5 rpm - 22.5 rpm	1 rpm - 7 rpm
Minimum Clearance	14.75in (374.7 mm)	14.75 in (374.7 mm)	14.75in (374.7 mm)
Head Length	28in (711.2 mm)	28in (711.2 mm)	28in (711.2 mm)
Working Weight	140 lbs (63.5 kg)	143lbs 64.9 kg)	144 lbs (65.32 kg)
Shipping Weight	290 lbs (131.6 kg)	293 lbs (133 kg)	294 lbs (133.4 kg)
Shipping Dimensions	38in x 20in x 20in	38in x 20in x 20in	38in x 20in x 20in
	965.2 mm x 508 mm x 508 mm	965.2 mm x 508 mm x 508 mm	965.2 mm x 508 mm x 508 mm

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Terminator MILLHOG®

I.D. Clamping Pipe Beveling tool
8.75" I.D. to 36" O.D.
222.25 mm I.D. to 914.4 mm O.D.

Portable, easy to align and secure to heavy wall pipe up to 36" O.D.

Key Features

- Rigidly clamps to pipe up to 36"
- Pneumatic or hydraulic motor choices
- 8 sets of clamp ribs and pads and 2 wedges cover entire range
- Formed tool bits can be used for m.w.t. up to 2.5"
- Preps all pipe alloys
- Bevels any angle of weld prep
- Simple to operate
- Patented safety chain and dual spring hanger makes tool alignment easy and safe
- Available I.D. tracker, adjustable height facing and tool posts with preset angles
- Sliding tool post is simple to adjust and easy to secure

The patented Dual Spring Hanger and Safety Chain provide a perceptible feel that the tool is aligned to the pipe as the clamps tighten. The safety chain prevents the possibility of over extending the spring and provides a failsafe catch should the springs fail.

The Terminator MILLHOG® Bevels all pipe alloys at any angle for precision fit-up on wall thicknesses up to 2.5" (63.5 mm) using formed tool bits.

Rugged, built for the toughest applications

The Terminator MILLHOG® is a ruggedly constructed precision pipe beveling machine for performing weld joint bevels at any angle on pipe ends up to 36".

Built with state of the art materials that are precision machined, heat treated and hardened, the Terminator is designed to provide years of trouble free service on the toughest applications.

A gearbox torque multiplier can be added that doubles the torque and slows the rpm which permits the cutter blade to get under the material and pull a thick chip on alloys prone to work hardening such as stainless, duplex and other super alloys.

The included safety chain spring hanger permits the Terminator to be safely and easily aligned and secured square to the pipe. The available I.D. tracker creates precision symmetrical bevels on out of round pipe at any angle and formed tool bits are available for pipe with wall thicknesses up to 2.5".

The I.D. tracker is ideal for end preps that require a consistent bevel on pipe with varying wall thickness.

Compound bevels of 37.5° x 10° can be achieved with formed cutters.

Pneumatic
5 hp pneumatic motor with available Gear Box Torque Multiplier

Hydraulic
5 hp hydraulic motor with available Gear Box Torque Multiplier

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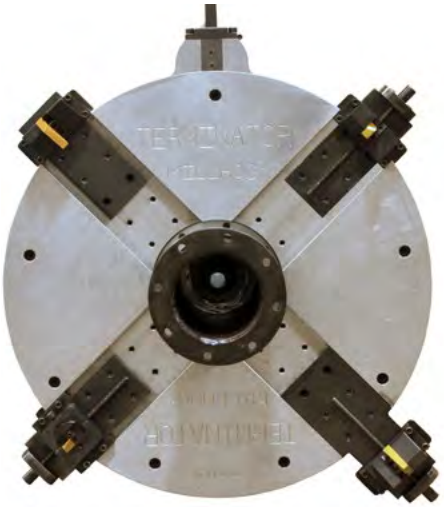
Terminator MILLHOG®

I.D. Clamping Pipe Beveling tool
8.75" I.D. to 36" O.D.
222.25 mm I.D. to 914.4 mm O.D.



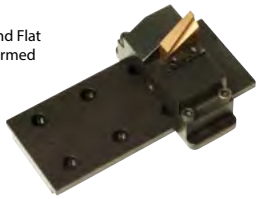
The Terminator has four positions for cutting tools. Each position accepts a Tool Post Base Assembly and a Tool Post. Standard equipment for the Terminator includes two Tool Post Base Assemblies and one Flat Tool Post.

The Tool Post Base Assembly Includes feed screw assembly for precise Tool Post and Cutter Blade alignment.

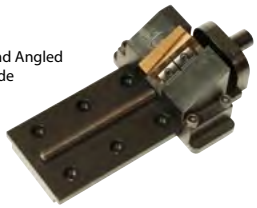
Flat Tool Posts
Holds formed Cutter Blades

Tool Posts with preset angles are designed for heavy wall applications and share common Cutter Blades to achieve different angles of bevel.

Tool Post Base and Flat Tool Post with formed Cutter Blade



Tool Post Base and Angled Tool Post flat blade



Tool Post Base and adjustable height facing blade

Mandrel
Either of the two Wedges can be bolted to it.

Wedges are interchangeable to achieve a huge range with the fewest Clamps.

Actuators and Draw Rods
The Actuator captures one end of each T1 Clamp Rib and when the Draw Rod is activated it permits them to evenly expand and contract on the tapered Mandrel.

1 Clamp Rib Set
The T1 Clamp Ribs are made of hardened steel. Clamp Pads and Clamp Extensions attach to them.

2 Clamp Rib Extension Sets
Clamp Extensions fit between Clamp Ribs and Clamp Pads to effectively increase their range and reduce the amount of more costly Clamp Pads.

5 Clamp Pad Sets
Clamp pads are made of aircraft quality aluminum and have heat treated Pad Corners that make contact with the pipe I.D. and are replaceable when worn.

Small wedge with T1 Clamp Ribs, 219 Extension and T6 Clamp Ribs

Large Wedge with T1 Clamp Ribs 314 Extension and T6 Clamp Ribs

Terminator Clamp Ribs, Pad and Extension Selector

I.D. Range (in)		I.D. Range (mm)		Clamp Combination		Wedge Part No.	Actuator Part No.	Draw Rod Part No.
8.625	10.75	219.08	273.05	T1	Clamp Rib	T-17	T-14	T-16
10.50	12.75	266.70	323.85	T1 & T2	Clamp Rib & Pad Set	T-17	T-14	T-16
12.50	14.75	317.50	374.65	T1 & T3	Clamp Rib & Pad Set	T-17	T-14	T-16
14.50	16.75	368.30	425.45	T1 & T4	Clamp Rib & Pad Set	T-17	T-14	T-16
16.50	18.75	419.10	476.25	T1 & T5	Clamp Rib & Pad Set	T-17	T-14	T-16
18.50	20.75	469.90	527.05	T1 & T-219 Extension & T2	Clamp Rib & Extension & Pad Set	T-17	T-14	T-16
20.50	22.75	520.70	577.85	T1 & T-219 Extension & T3	Clamp Rib & Extension & Pad Set	T-17	T-14	T-16
22.50	24.75	571.50	628.65	T1 & T-219 Extension & T4	Clamp Rib & Extension & Pad Set	T-17	T-14	T-16
24.50	26.75	622.30	679.45	T1 & T-219 Extension & T5	Clamp Rib & Extension & Pad Set	T-17	T-14	T-16
14.75	16.25	374.65	412.75	T1	Clamp Rib	T-18	T-15	T-16
16.00	18.50	406.40	469.90	T1 & T2	Clamp Rib & Pad Set	T-18	T-15	T-16
18.00	20.50	457.20	520.70	T1 & T3	Clamp Rib & Pad Set	T-18	T-15	T-16
20.00	22.50	508.00	571.50	T1 & T4	Clamp Rib & Pad Set	T-18	T-15	T-16
22.00	24.50	558.80	622.30	T1 & T5	Clamp Rib & Pad Set	T-18	T-15	T-16
24.00	26.50	609.60	673.10	T1 & T6	Clamp Rib & Pad Set	T-18	T-15	T-16
26.00	28.50	660.40	723.90	T1 & T-374 Extension & T2	Clamp Rib & Extension & Pad Set	T-18	T-15	T-16
28.00	30.50	711.20	774.70	T1 & T-374 Extension & T3	Clamp Rib & Extension & Pad Set	T-18	T-15	T-16
30.00	32.50	762.00	825.50	T1 & T-374 Extension & T4	Clamp Rib & Extension & Pad Set	T-18	T-15	T-16
32.00	34.50	812.80	876.30	T1 & T-374 Extension & T5	Clamp Rib & Extension & Pad Set	T-18	T-15	T-16
34.00	36.50	863.60	927.10	T1 & T-374 Extension & T6	Clamp Rib & Extension & Pad Set	T-18	T-15	T-16

Specifications: Terminator

Working Range	8.625in (219 mm) I.D. to 36in (914.4 mm) O.D.	
Motor	Pneumatic	Hydraulic
	5 hp (3728 W)	5 HP / 8-12 gpm (30.3-45.4 l/min)
	90 psi (6.2 bar)	@ 1500 psi (102 bar)
	95 cfm (2690 l/min)	20 gal (75.7 l) reservoir
Speed	4 rpm	1 rpm - 4 rpm
Speed with Off-Set Gear Reducer	2 rpm with gear reducer	1 rpm - 2 rpm
Minimum Clearance	30in (762 mm)	30in (762 mm)
Head Length	50in (1270 mm)	50in (1270 mm)
Working Weight	700 lbs (318 kg)	700 lbs (318 kg)
Shipping Weight	1375 lbs (623.7 kg)	1375 lbs (623.7 kg)
Shipping Dimensions	36in x 54in x 48in	36in x 54in x 48in
	915 mm x 1372 mm x 1219 mm	915 mm x 1372 mm x 1219 mm

These two pages show our most popular MILLHOG® Cutter Blades. They are available with TiN coating for extended blade life or Hard Lube for superior heat resistance and more end preps per blade.

Cutter Blades for the Ground, C-HOG, Mongoose and Tube Weasel MILLHOG®


GBB-1
37 1/2° Bevel TiN
3/8" wide (9.52mm)


GBB-2
37 1/2° Bevel TiN
5/8" wide (15.87mm)


GBB-3
30° Bevel TiN3/8" wide (9.52mm)


GBB-4
30° Bevel TiN
5/8" wide (15.87mm)


GBB-1HL
37 1/2° Bevel Hard Lube
3/8" wide (9.52mm)


GBB-2HL
37 1/2° Bevel Hard Lube
5/8" wide (15.87mm)


GBB-3HL
30° Bevel Hard Lube
3/8" wide (9.52mm)


GBB-4HL
30° Bevel Hard Lube
5/8" wide (15.87mm)


GBB-5
45° Bevel TiN
3/8" wide (9.52mm)


GBB-6
45° Bevel TiN
5/8" wide (15.87mm)


GLB-1
Land blade TiN
3/8" wide (9.52mm)


GLB-2
Land blade TiN
5/8" wide (15.87mm)


GJB-1
"J" Bevel TiN
Standard Bevel 22°
StandardRadius3/16"(4.7mm)


GJB-1
"J" Bevel TiN
Standard Bevel 22°
StandardRadius5/8"(15.87mm)


GBBP-1HL
37 1/2° + 1/4" (6.35mm)
Peel Back TiN
3/8" wide (9.52mm)


GBBP-2HL
337 1/2° + 1/4" (6.35mm)
Peel Back TiN
5/8" wide (15.87mm)


GCB-1 - Specify Angle
Counter Bore Blade TiN
3/8" wide (9.52mm)


GCB-2 Specify Angle
Counter Bore Blade TiN
5/8" wide (15.87mm)


GCB10S-1
10" Boring Blade
3/8" wide (9.52mm)


GCB10S-1
10" Boring Blade
5/8" wide (15.87mm)


GCBS-1
Straight Bore 18° Taper TiN
3/8" wide (9.52mm)

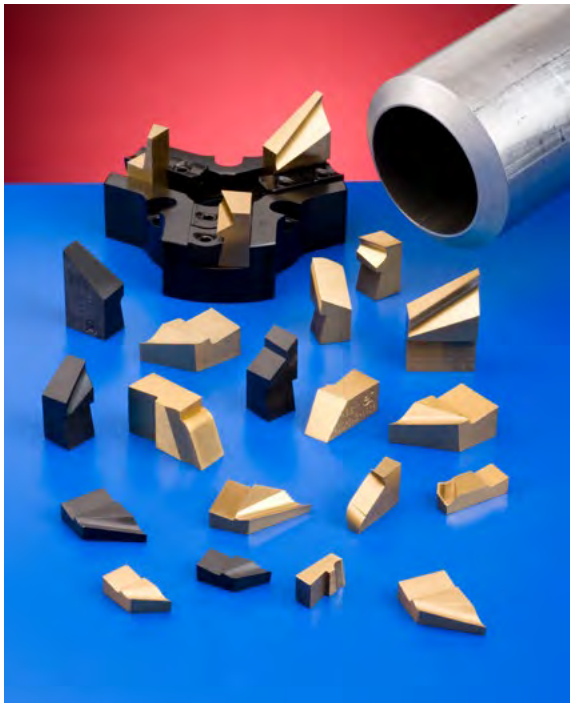

GCBS-2
Straight Bore 18° Taper TiN
5/8" wide (15.87mm)


GRBB-1
37 1/2° Boring Blade TiN
3/8" wide (9.52mm)


GRBB-2
37 1/2° Boring Blade TiN
5/8" wide (15.87mm)

MILLHOG® Cutter Blades have a sharp edge that gets under the material and radical chip breaker that curls a thick chip and transfers heat away from the surface.

Titanium Nitride Coated (TiN) Cutter Blades for the entire MILLHOG® family of End Prep Tools produce a Thick Chip without cutting fluids.



An endless range of standard and custom cutter blades are offered with Titanium Nitride (TiN) coating. For extended blade life, try our new "Hard Lube" coated Cutter Blades which prove superior heat resistance and more end preps per blade.

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Cutter Blades for the C-Monster, Wart, Mini, Prepzilla, Commander, Dictator and Terminator MILLHOG®

For a custom blade request please fill in the appropriate information in the Your Spec column.

MBB-1
37-1/2° Bevel Blade TiN
1/2" wide (12.7mm)

MBB-2
37-1/2° Bevel Blade TiN
3/4" wide (19.1mm)

MBB-3
37-1/2° Bevel Blade TiN
1" (25.4mm)

MBB-4
37-1/2° Bevel Blade TiN
1-1/4" wide (31.8mm)

MBB-1 HL
37-1/2° Bevel Blade Hard Lube
(12.7mm)

MBB-2 HL
37-1/2° Bevel Blade Hard Lube
3/4" wide (19.1mm)

MBB-3HL
37-1/2° Bevel Blade Hard Lube
1" (25.4mm)

MBB-4 HL
37-1/2° Bevel Blade Hard Lube
1-1/4" wide (31.8mm)

MBB-5
37-1/2° x 10° Bevel Blade TiN
1-1/4" wide (31.8mm)

MBB-6
10° Bevel Blade TiN
1" wide (25.4mm)

MBB-7
30° Bevel Blade TiN
1/2" wide (12.7mm)

MBB-8
30° Bevel Blade Tin
3/4" wide (19.1mm)

MBB-9
30° Bevel Blade TiN
1" (25.4mm)

MBB-10
30° Bevel Blade TiN
1-1/4" wide (31.8mm)

MBB-4A
45° Bevel Blade TiN
1/2" wide (12.7mm)

MBB-5A
45° Bevel Blade TiN
3/4" wide (19.1mm)

MBB-6A
45° Bevel Blade TiN
1" (25.4mm)

MLB-1
Land Blade TiN
1/2" wide (12.7mm)

MLB-2
Land Blade TiN
3/4" wide (19.1mm)

MLB-3
Land Blade TiN
1" (25.4mm)

MCBSS-1
3/8° Straight Bore 18° Taper TiN
1/2" wide (12.7mm)
For I.D. smaller then 1.75" (44.4mm)

MCBSS-2
3/8° Straight Bore 18° Taper TiN
3/4" wide (19.1mm)
For I.D. smaller then 1.75" (44.4mm)

MCBSS-3
3/8° Straight Bore 18° Taper TiN
1" wide (25.4mm)
For I.D. smaller then 1.75" (44.4mm)

MCBSL-1
3/8° Straight Bore 18° Taper TiN
1/2" wide (12.7)
For I.D. larger then 1.75" (44.4mm)

MJB-1
"J" Bevel TiN
1/2" wide (12.7mm)
(Standard Bevel = 22°)
(Standard Radius = 3/16"/4.7mm)

MJB-2
"J" Bevel TiN
3/4" wide (19.1mm)
(Standard Bevel =22°)
(Standard Radius = 3/16"/4.7mm)

MJB-3
"J" Bevel TiN
1" (25.4mm)
(Standard Bevel = 22°)
(Standard Radius = 3/16"/4.7mm)

MJB-4
"J" Bevel TiN
1-1/4" wide (31.8mm) (Standard Bevel = 22°)
(Standard Radius = 3/16" /4.7mm)

MCBSL-2
3/8° Straight Bore 18° Taper TiN 3/4" wide (19.1mm)
For I.D. larger then 1.75" (44.4mm)

MCBSL-3
3/8° Straight Bore 18° Taper TiN
1" wide (25.4mm) TiN
For I.D. larger then 1.75" (44.4mm)

MRBB-1
37-1/2° Boring Blade TiN
1/2" wide (12.7mm)

MRBB-2
37-1/2° Boring Blade TiN
3/4" wide (19.1mm)

MBBP-1
37-1/2° + 1/4" (6.35mm)
Peel Back TiN
/2" wide (12.7mm)

MBBP-2
37-1/2° + 1/4" (6.35mm)
Peel Back TiN
3/4" wide (19.1mm)

MBBP-2HL
37-1/2° + 1/4" (6.35mm) Peel Back Hard Lube
3/4" wide (19.1mm)

MCB-1
Counter Bore Blade TiN
1/2" wide (12.7mm)

MRBB-3
37-1/2° Boring Blade TiN
1" wide (25.4mm)

MLRB-1
Facing Blade w/ O.D. Radius TiN
1/2" wide (12.7mm)

MLRB-2
Facing Blade w/ O.D. Radius TiN
3/4" wide (19.1mm)

MLRB-3
Facing Blade w/ O.D. Radius TiN
1" wide (25.4mm)

MCB-2
Counter Bore Blade TiN
3/4" wide (19.1mm)

MCB-3
Counter Bore Blade TiN
1" wide (25.4mm)

MCB10S-1
10° Boring Blade TiN
1/2" wide (12.7mm)
For I.D smaller then 1.75" (44.4mm)

MCB10S-2
10° Boring Blade TiN
3/4" wide (19.1mm)
For I.D smaller then 1.75" (44.4mm)

MTSR-1
Tube Stub Removal Blade TiN
1/2" wide (12.7mm)

MTSR-2 TiN
Tube Stub Removal Blade TiN
3/4" wide (19.1mm)

MTSR-3
Tube Stub Removal Blade TiN
1" wide (25.4mm)

MTSS-1
Tube Seat Blade TiN
1/2" wide (12.7mm)

MCB10S-3
10° Boring Blade TiN
1" wide (25.4mm)
For I.D. smaller then 1.75" (44.4mm)

MCB10L-1
10° Boring Blade TiN
1/2" wide (12.7mm)
For I.D. Larger then 1.75" (44.4mm)

MCB10L-2
10° Boring Blade TiN
3/4" wide (19.1mm)
For I.D Larger then 1.75" (44.4mm)

MCB10S-2
10° Boring Blade TiN
3/4" wide (19.1mm)
For I.D smaller then 1.75" (44.4mm)

MTSS-2
Tube Seat Blade TiN
3/4" wide (19.1mm)

MTSS-3
Tube Seat Blade TiN
1" wide (25.4mm)

MRB-8
Membrane / Overlay Removal
Insert (Golf T)
5/16" (8mm)

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"	

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°	

Action Request Form

Complete, scan, email or fax

Your Name _____

Company Name _____

Company Address _____

_____

Phone_____Fax_____e-mail_____

Briefly describe your application(s) and specification(s): _____

_____

_____

Pipe Size Tube O.D.	Pipe Sch M.W.T.	Quantity	End Prep Angle	Counterbore	Pipe/Tube Material	Location	Mechanical Restrictions

❑ Please quote the following:

We accept

Page	Item No.	Description	Quantity

Notes/Drawings

esco tool • 75 October Hill Road • Holliston, MA 01746 USA • 1.508.429.4441 • fax 1.508.429.2811 • email: millhog@escotool.com

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Pipe Chart

Nominal Pipe Size (Inches)	Schedule Number	Wall Thickness (Inches)	Inside Diameter (Inches)
1/8	10S	0.049	0.307
(0.405)	40ST, 40S	0.068	0.269
	80XS, 80S	0.095	0.215
1/4	10S	0.065	0.410
(0.540)	40ST, 40S	0.088	0.364
	80XS, 80S	0.119	0.302
3/8	10S	0.065	0.545
(0.675)	40ST, 40S	0.091	0.493
	80XS, 80S	0.126	0.423
1/2	5S	0.065	0.710
(0.840)	10S	0.083	0.674
	40ST, 40S	0.109	0.622
	80XS, 80S	0.147	0.546
	160	0.188	0.464
	XX	0.294	0.252
3/4	5S	0.065	0.920
(1.050)	10S	0.083	0.084
	40ST, 40S	0.113	0.824
	80XS, 80S	0.154	0.742
	160	0.219	0.612
	XX	0.308	0.434
1	5S	0.065	1.185
(1.315)	10S	0.109	1.097
	40ST, 40S	0.133	1.049
	80XS, 80S	0.179	0.957
	160	0.250	0.815
	XX	0.358	0.599
1-1/4	5S	0.065	1.530
(1.660)	10S	0.109	1.442
	40ST, 40S	0.140	1.380
	80XS, 80S	0.191	1.278
	160	0.250	1.160
	XX	0.382	0.896
1-1/2	5S	0.065	1.770
(1.900)	10S	0.109	1.682
	40ST, 40S	0.145	1.610
	80XS, 80S	0.200	1.500
	160	0.281	1.338
	XX	0.400	1.100
2	5S	0.065	2.245
(2.375)	10S	0.109	2.157
	40ST, 40S	0.154	2.067
	80XS, 80S	0.218	1.939
	160	0.344	1.687
	XX	0.436	1.503
2-1/2	5S	0.083	2.709
(2.875)	10S	0.120	2.635
	40ST, 40S	0.203	2.469
	80XS, 80S	0.276	2.323
	160	0.375	2.125
	XX	0.552	1.771
3	5S	0.083	3.334
(3.5)	10S	0.120	3.260
	40ST, 40S	0.216	3.068
	80XS, 80S	0.300	2.900
	160	0.438	2.624
	XX	0.600	2.300
3-1/2	5S	0.083	3.834
(4)	10S	0.120	3.760
	40ST, 40S	0.226	3.548
	80XS, 80S	0.318	3.364
4	5S	0.083	4.334
(4.5)	10S	0.120	4.260
	40ST, 40S	0.237	4.026
	80XS, 80S	0.337	3.826
	120	0.438	3.624
	160	0.531	3.438
	XX	0.674	3.152
5	5S	0.109	5.345
(5.563)	10S	0.134	5.295
	40ST, 40S	0.258	5.047
	80XS, 80S	0.375	4.813
	120	0.500	4.563
	160	0.625	4.313
	XX	0.750	4.063
6	5S	0.109	6.407
(6.625)	10S	0.134	6.357
	40ST, 40S	0.280	6.065
	80XS, 80S	0.432	5.761
	120	0.562	5.501
	160	0.719	5.187
	XX	0.864	4.897
8	5S	0.109	8.407
(8.625)	10S	0.148	8.329
	20	0.250	8.125
	30	0.277	8.071
	40ST, 40S	0.322	7.981
	60	0.406	7.813
	80XS, 80S	0.500	7.625
	100	0.594	7.437
	120	0.719	7.187
	140	0.812	7.001
	XX	0.875	6.875
	160	0.906	6.813
10	5S	0.134	10.482
(10.75)	10S	0.165	10.420
	20	0.250	10.250
	30	0.307	10.136
	40ST, 40S	0.365	10.020
	60XS, 80S	0.500	9.750
	80	0.594	9.562
	100	0.719	9.312
	120	0.844	9.062
	140, XX	1.000	8.750
	160	1.125	8.500
12	5S	0.156	12.438
(12.75)	10S	0.180	12.390
	20	0.250	12.250
	30	0.330	12.090
	ST, 40S	0.375	12.000
	40	0.406	11.938
	XS, 80S	0.500	11.750
	60	0.562	11.626
	80	0.688	11.374
	100	0.844	11.062
	120, XX	1.000	10.750
	140	1.125	10.500
	160	1.312	10.126
14	5S	0.156	13.688
(14)	10S	0.188	13.624
	10	0.250	13.500
	20	0.312	13.376
	30, ST	0.375	13.250
	40	0.438	13.124
	XS, 80S	0.500	13.000
	60	0.594	12.812
	80	0.750	12.500
	100	0.938	12.124
	120	1.094	11.812
	140	1.250	11.500
	160	1.406	11.188
16	5S	0.169	15.670
(16)	10S	0.188	16.624
	10	0.250	15.500
	20	0.312	15.376
	30, ST	0.375	15.250
	40, XS	0.500	15.000
	60	0.656	14.688
	80	0.844	14.312
	100	1.031	13.938
	120	1.219	13.562
	140	1.438	13.124
	160	1.594	12.812
18	5S	0.165	17.670
(18)	10S	0.188	17.624
	10	0.250	17.500
	20	0.312	17.376
	ST	0.375	17.250
	30	0.438	17.124
	XS	0.500	17.000
	40	0.562	16.876
	60	0.750	16.500
	80	0.938	16.124
	100	1.156	15.688
	120	1.375	15.250
	140	1.562	14.876
	160	1.781	14.438
20	5S	0.188	19.624
(20)	10S	0.218	19.564
	10	0.250	19.500
	20, ST	0.375	19.250
	30, XS	0.500	19.000
	40	0.594	18.812
	60	0.812	18.376
	80	1.031	17.938
	100	1.281	17.438
	120	1.500	17.000
	140	1.750	16.500
	160	1.969	16.062
24	5S	0.218	23.564
(24)	10, 10S	0.250	23.500
	20ST	0.375	23.250
	XS	0.500	23.000
	30	0.562	22.876
	40	0.688	22.324
	60	0.969	22.062
	80	1.219	21.562
	100	1.531	20.938
	120	1.812	20.376
	140	2.062	19.876
	160	2.344	19.312
30	5S	0.250	29.500
(30)	10, 10S	0.312	29.376
	ST	0.375	29.250
	20, XS	0.500	29.000
	30	0.625	28.750
32	10	0.312	31.376
	STD	0.375	31.250
	XS, 20	0.500	31.000
	30	0.625	30.750
	40	0.688	30.624
34	10	0.312	33.376
	STD	0.375	33.250
	XS, 20	0.500	33.000
	30	0.625	32.750
	40	0.688	32.624
36	10	0.312	35.376
	STD, 40S	0.375	35.250
	XS, 80S	0.500	35.000

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