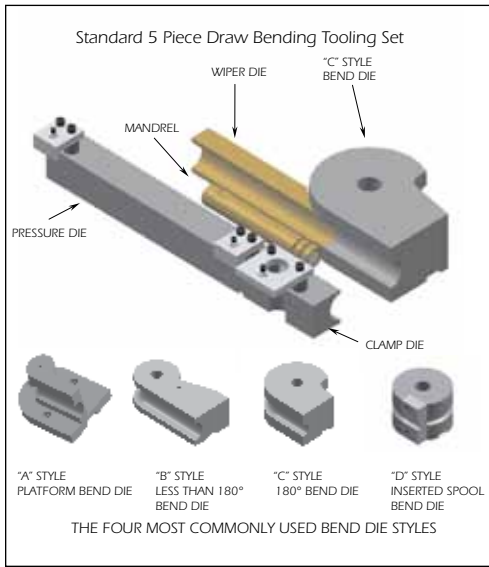


The Bending Tool Specialists

Guaranteed Performance Bending Tools

STANDARD DRAW BEND TOOLS



BEND DIE

The bend die is the primary tool around which the tube is formed to produce a specific bend radius.

CLAMP DIE

The clamp die is used with the bend die to grip the tube. Surfalloys and serrations are features that can be added to the grip section to ensure proper tooling grip.

PRESSURE DIE

The pressure die functions as a containment tool during bending. The pressure die provides constant pressure at tangent and follows the tube through the bend.

WIPER DIE

The primary function of the wiper die is to prevent the tube from wrinkling during bending. H&H will also specify the material of the wiper die based on the material of the tubing being bent.

MANDREL

The mandrel is the tooling component that provides support to the inside of the tube. Many different variations of mandrels exist. The simplest design style is the plug mandrel and the most complex design style is the Uni-Flex mandrel. The Uni-Flex ball mandrel is designed to internally support the tube beyond tangent and depending on the number of ball segments, throughout the entire bend.



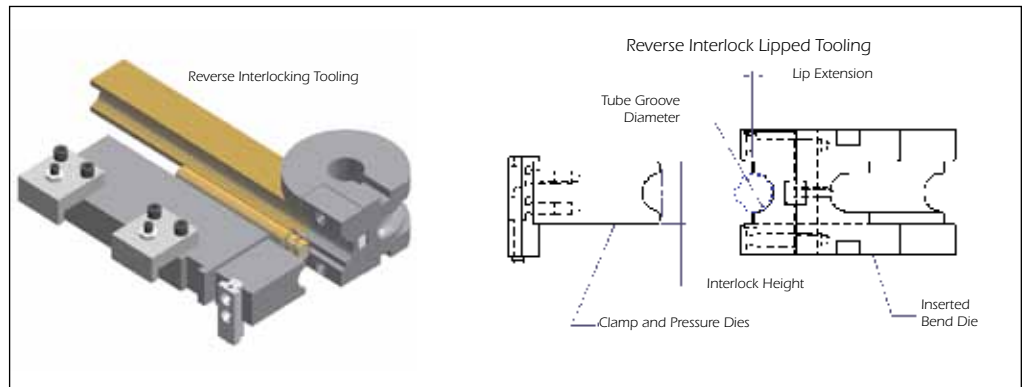
REVERSE INTERLOCKING AND LIPPED DRAW BEND TOOLS

U.S. PATENT 3457753

Originally designed and patented by H&H Tooling in 1963, Interlock tooling is distinctive due to its self-aligning rail design. Since the clamp die and pressure die interlock with the bend die, tool alignment is automatic reducing set-up time and material scrap. Interlock tooling also virtually eliminates tool marking because the pressure die weight is self-supporting at the bend tangent. The constant alignment during bending helps compensate for machine wear and material inconsistencies. lipped bend, clamp and pressure dies are

made to precision specifications. It is usually incorporated in thin wall applications

to prevent the tubing from extruding at the vertical parting line of the tools.

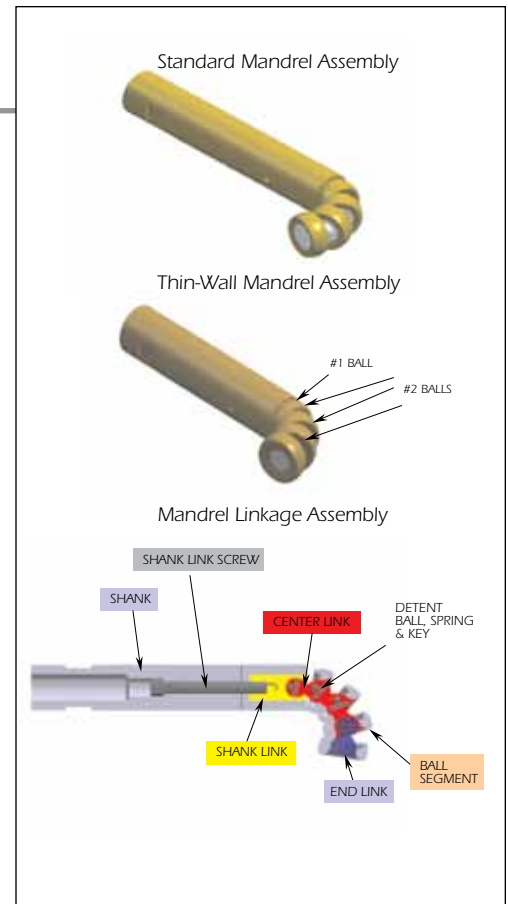
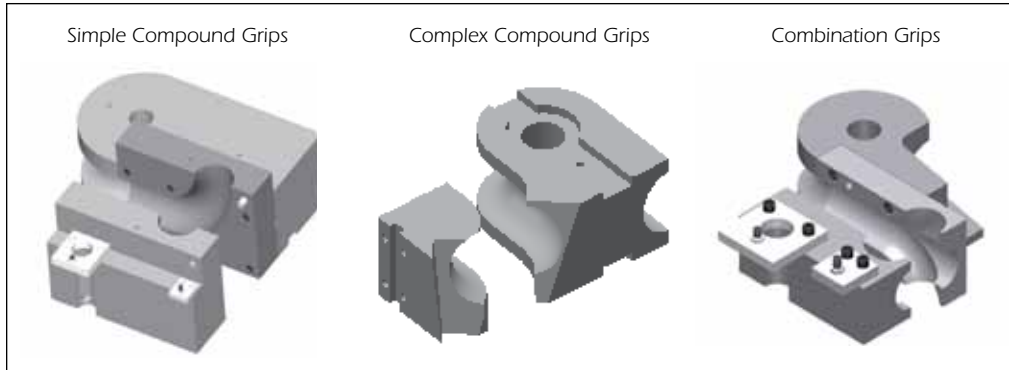


COMPOUND TOOLING

Occasionally, short distances between bends are unavoidable.

A compound grip is essentially a grip or clamp area with a machined tube groove matching the contour of the previous bend. These grip sections are defined as either simple or complex depending on the specific plane rotation between bends. Simple

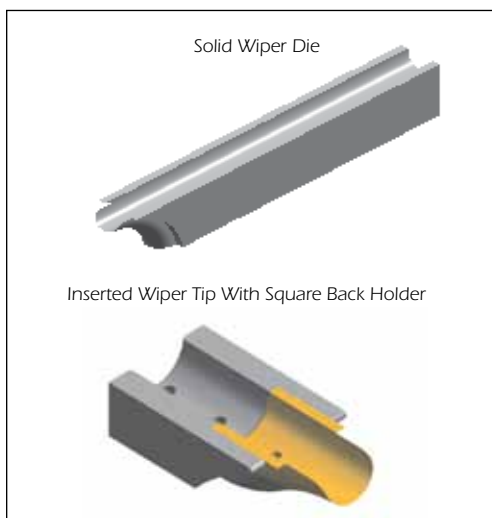
compounds are the easiest to machine and therefore the least expensive. Simple compounds consist of plane of bend rotations equal to 0°, 90°, 180° or 270°. All other plane of bend rotations are considered to be complex and are more challenging to design and manufacture.



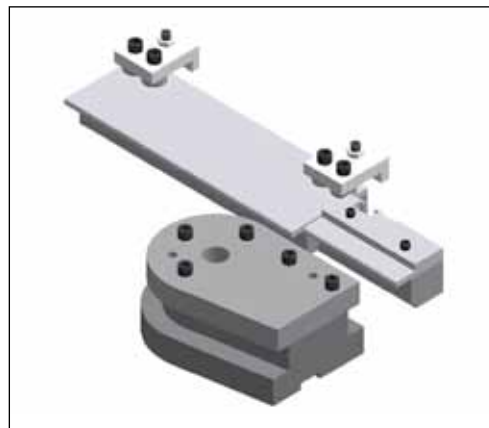
WIPER DIES AND TIPS

Wiper dies are available in the standard solid style or in the replaceable tip style. Solid wiper dies are generally best for most applications of bending. Replaceable tip wipers are ideal for high production round tubing runs where short set-up times are required. Replaceable tip wipers should only be used for round tubing less than four inches in diameter and with bend centerline radii greater than two times the outside diameter of the tubing.

Chromed grooves are also available with steel wiper dies.



SINGLE FINGER TOOLS



Square and rectangular tubing present challenges that do not occur when bending round tubing. The inside wall of the square tube tends to grow or expand vertically during the bending process and clings to the cavity of the bend die. Unfortunately, few benders are equipped with a split die actuator, here single finger tools must be utilized.

Single finger tools utilize a finger attached to a flat clamp and pressure die. The finger fills a void in the bend die cavity above or below the part. After a bend is made the clamp and pressure die open, exposing the void so the part can be easily removed and/or re-positioned for the next bend.

UNI-FLEX MANDRELS

U.S. Patents 3190106 and 3408850

Patented by H&H Tooling in 1962 the Uni-Flex mandrel has become the world standard for internal ball style mandrels. The unique ball and socket linkage design of the Uni-Flex mandrel provides unmatched setup and bending characteristics. Uni-Flex mandrels are available in standard pitch, thin-wall and ultra-thin-wall styles for every conceivable wall factor.

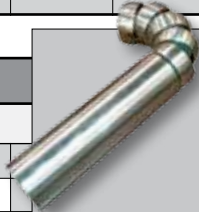
Please reference mandrel and wiper die selection chart on page 15 of this brochure.

- Balls can be added or removed with ease.
- Mandrel balls flex in any plane, accommodating compound bends and eliminating setup time for plane alignment.
- Balls will flex to handle bends on centerline radii down to 1 x tube O.D.
- Provides maximum wall support as balls overlap and are designed on pitch of approximately the tube O.D. or less.
- Balls are held by detents in a straight-line position for easy tube loading.
- Ball and socket design provides maximum tensile strength to resist stretching or breakage.
- Balls are free to rotate, distribute wear and give maximum tool life.



AB18 Used For Stainless Steel & Inconel

AB18 Stocked Mandrels						
Tube O.D.	Wall Thicknesses					
0.375	0.028	0.035				
0.500	0.028	0.035	0.049	0.065		
0.625	0.028	0.035	0.049			
0.750	0.028	0.035	0.049	0.065		
0.875	0.028	0.035	0.049	0.065		
1.000	0.028	0.035	0.049	0.065	0.083	
1.125	0.035	0.049	0.065			
1.250	0.028	0.035	0.049	0.065		
1.375	0.049					
1.500	0.028	0.035	0.049	0.065		
1.750	0.028	0.035	0.049	0.065		
2.000	0.028	0.035	0.049	0.065		
2.500	0.065					
3.000	0.065					



TSC Used For Anything Other Than S.S.

Tool Steel Stocked Mandrels						
Tube O.D.	Wall Thicknesses					
0.375	0.028	0.035				
0.500	0.028	0.035	0.049	0.065		
0.625	0.028	0.035	0.049			
0.750	0.028	0.035	0.049	0.065		
0.875	0.028	0.035	0.049	0.065		
1.000	0.028	0.035	0.049	0.065	0.083	
1.125	0.035	0.049	0.065			
1.250	0.028	0.035	0.049	0.065		
1.375	0.049	0.065				
1.500	0.028	0.035	0.049	0.065		
1.750	0.028	0.035	0.049	0.065		
2.000	0.028	0.035	0.049	0.065	0.083	0.120
2.250	0.049					
2.500	0.035	0.049	0.065	0.083		
3.000	0.065					

Mandrel and Wiper Die Selection Chart

W.F.	1D	1.25D	1.5D	2D	2.5D	3D	4D	5D
10	P	P	P	P	P	P	-	-
15	M1W	M1W	M1	M1	P	P	-	-
20	M2W	M1W	M1W	M1	M1	P	P	-
25	M3W	M2W	M1W	M2W	M1W	M1	P	-
30	M3W	M3W	M2W	M2W	M2W	M1	M1	M1
35	M3W	M3W	M3W	M3W	M3W	M2W	M2	M1
40	M4W	M3W	M3W	M3W	M3W	M3W	M2W	M2
45	M4W	M3W	M3W	M3W	M3W	M3W	M2W	M2W
50	M4W	M3W	M3W	M3W	M3W	M3W	M2W	M2W
60	M4W	M4W	M3W	M3W	M3W	M3W	M2W	M2W
70	M5W	M5W	M5W	M3W	M3W	M3W	M3W	M2W
80	M5W	M5W	M5W	M5W	M3W	M3W	M3W	M2W
90	M5W	M5W	M5W	M5W	M3W	M3W	M3W	M3W
100	M5W	M5W	M5W	M5W	M5W	M3W	M3W	M3W
125	M5W	M5W	M5W	M5W	M5W	M5W	M4W	M4W
150	M6W	M6W	M6W	M6W	M5W	M5W	M4W	M4W
175	M6W	M7W	M8W	M7W	M7W	M6W	M6W	M6W
200	M6W	M8W	M10W	M10W	M9W	M9W	M8W	M8W
225	-	M8W	M10W	M10W	M10W	M10W	M10W	M10W
250	-	-	M10W	M10W	M10W	M10W	M10W	M10W
275	-	-	M10W	M10W	M10W	M10W	M10W	M10W

W.F. = $\frac{\text{OUTSIDE DIAMETER}}{\text{WALL THICKNESS}}$ "D" = $\frac{\text{CENTERLINE RADIUS}}{\text{OUTSIDE DIAMETER}}$

W = WIPER DIE NUMERIC FIGURE = NUMBER OF BALLS ON MANDREL

M = BALL STYLE MANDREL P = PLUG STYLE MANDREL

GRAY AREA = NO WIPER DIE REQUIRED WHEN BENDING BRASS OR COPPER.

BLUE AREA = USE THIN WALL MANDRELS AND REVERSE INTERLOCKING TOOLS WITH LIP EXTENSION

GREEN AREA = USE ULTRA THIN WALL MANDRELS AND REVERSE INTERLOCKING TOOLS WITH LIP EXTENSION

Mandrel, Ball and End Links IN STOCK! It's Simple, just choose #56 End Ball Link and we ship today.

SIZE	1	2	3	4	5	6	7	8	9	10	11	12	13	
Range	0.025 to .374	.375 to .499	.500 to .624	.625 to .749	.750 to .936	.937 to 1.249	1.250 to 1.499	1.500 to 1.749	1.750 to 2.124	2.125 to 2.624	2.625 to 3.374	3.375 to 4.624	4.625 to 6.000	TUBE OUTSIDE DIAMETER RANGE
Part No. *	31 301-0-001	32 302-0-000	33 303-0-000	34 304-0-000	35 305-0-000	36 306-0-000	37 307-0-000	38 308-0-000	39 309-0-000	310 310-0-000	311 311-0-000	312 312-0-000	313 313-0-000	MANDREL LINK
Part No. *	41 401-0-000	42 402-0-000	43 403-0-000	44 404-0-000	45 405-0-000	46 406-0-000	47 407-0-000	48 408-0-000	49 409-0-000	410 410-0-000	411 411-0-000	412 412-0-000	413 413-0-000	CENTER BALL LINK
Part No. *	51 501-0-000	52 502-0-000	53 503-0-000	54 504-0-000	55 505-0-000	56 506-0-000	57 507-0-000	58 508-0-000	59 509-0-000	510 510-0-000	511 511-0-000	512 512-0-000	513 513-0-000	END BALL LINK

* OUR MANUFACTURING PART NOS. Industry standard links manufactured in-house. All links come with a hardware kit. (Inc. Snap Rng plus Bolt & Key when applicable)

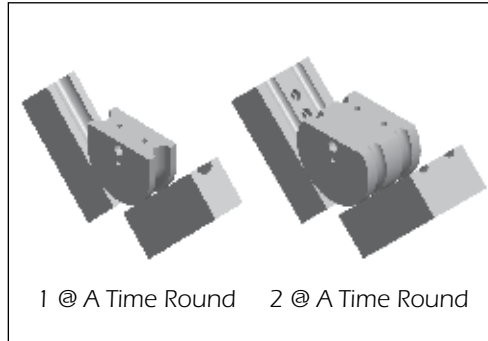
Multi Stack Tooling

Also available with:

- Single-piece multi-cavity (stacked) bend dies.
- Multilayer bend die sets (for multi-bend operations):
 - Integral-die locating keys and location donuts.
 - Compound clamps, both simple and complex.



VERTICAL PRESS TOOLING



1 @ A Time Round 2 @ A Time Round

Compression bending is the method used on bending presses as well as on some applications of rotary benders.

PUNCH DIE

The punch die is the primary tool around which the tube is formed to produce a specific bend radius.

WING DIES

Wing dies function as containment tools for the tube during the bending cycle. Throughout this cycle, the pivoting of the wing die is restrained by hydraulic pressure. This cushioning resistance confines the workpiece in the dies, thereby controlling metal flow.

STYLES

Many different configurations of press tools are available for all different shapes: Round, 2 @ a time round, washout round, square, washout square, crush, collapse and extrusions. All of which have been successfully compression bent on vertical presses.

Tooling Organizers

Custom configured tool boxes available for small machines.



The Bending Tool Specialists

Pines tooling brand - H&H Tooling pioneered the design of tube bending tools. H&H Tooling designs and builds bending tools for all types of Pines benders and other pipe bending machine manufacturers, eg: Eaton Leonard, Addison McKee, PHI, Wallace Coast, Eagle Precision Technologies, Horn Machine Tools, BLM, Schwarze-Robitec, Adaptive Motion, Eurobend, Crown, MiiC, Chiyoda, Pedrazolli, Herber, and SOCO.



A Brand of



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Wickliffe, OH 44092, USA
I (800) 207-8211 • (440) 278-7200
Fax: (440) 278-7210
info@hhtooling.com
www.hhtooling.com

SERPENTINE TOOLS FOR THE BOILER AND REFRIGERATION INDUSTRIES

Serpentine tools are designed to exact outside diameter/centerline radii specifications requiring continuous 180-degree plane change bends. The clamp die is designed to "ramp" in-between the centers of the serpentine bends and clamp against a straight leg.

Either mandrel bending or "pinch" style (elliptical tube groove) no mandrel bending can be used in serpentine applications.

