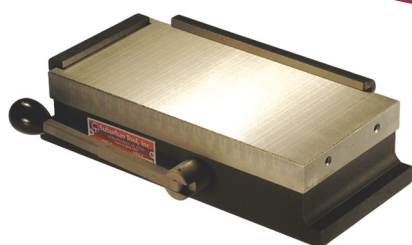
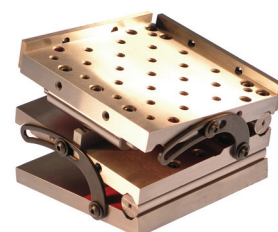
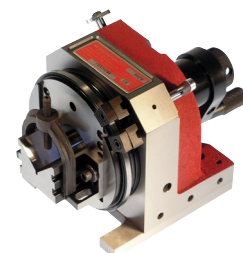
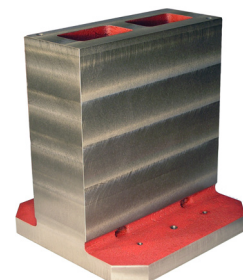


Suburban Tool, Inc.

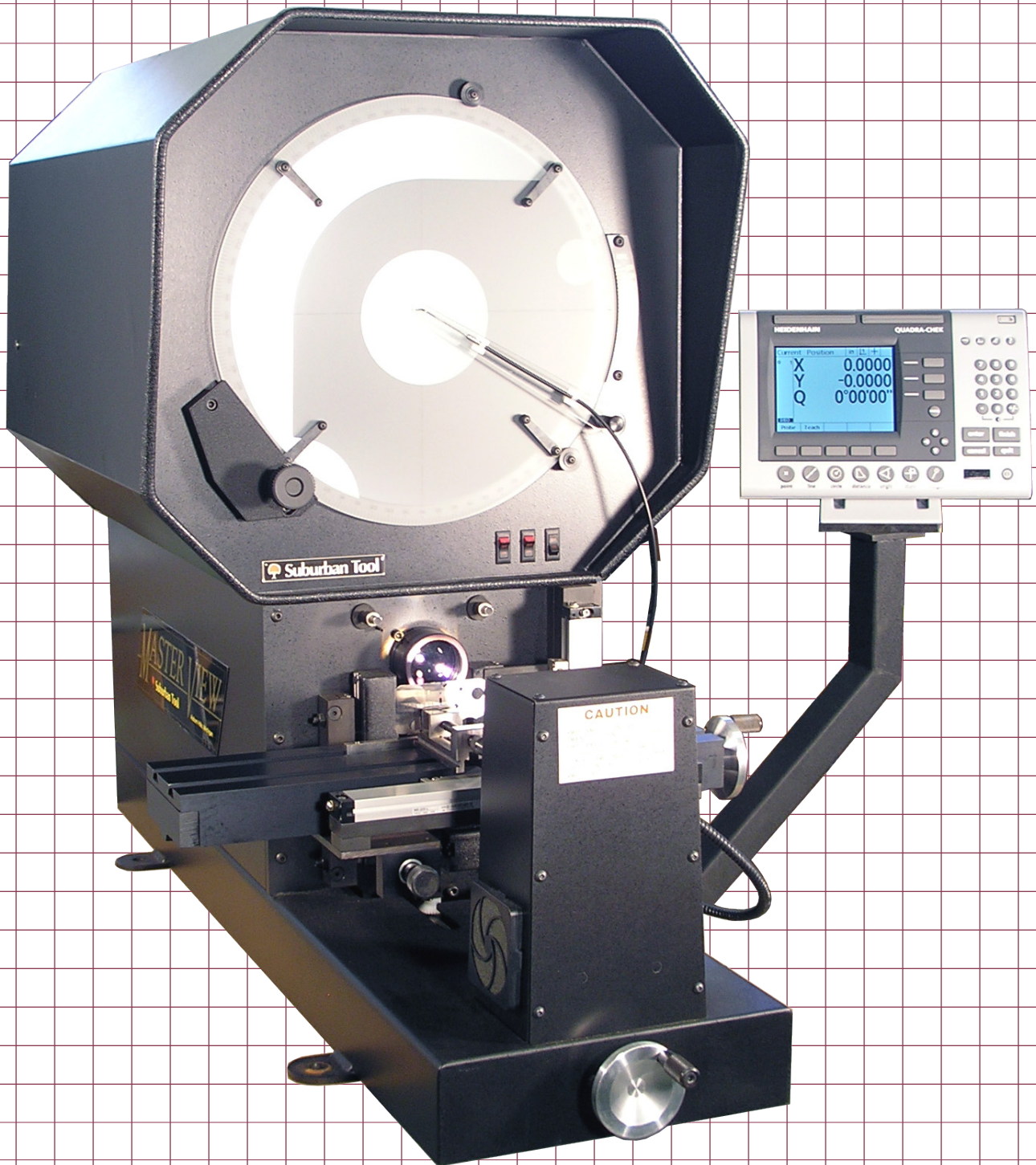
Taft-Peirce Metrology

Workholding and Inspection Equipment

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Suburban's 64,000 square foot facility in Auburn Hills, Michigan

SUBURBAN TOOL, INC. has 40+ years experience in manufacturing the highest quality workholding products and inspection equipment. A significant part of Suburban's quality is due to our experienced craftsmen adhering to precision standards. Suburban's products are manufactured by using exacting procedures. These products are intended for use by knowledgeable and experienced people.

Take time to review the ever growing product line in the pages that follow. The products shown are proudly **MADE IN THE USA**, unless otherwise specified.

Suburban Tool is a member of the:

Association for Manufacturing Technology
(AMT)

www.amtonline.org

Eastern Michigan Tool & Die Collaborative
(EMTD)

www.emtd.net

Industrial Supply Association
(ISA)

www.isapartners.org

Michigan Manufacturers Association
(MMA)


www.mma-net.org

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MASTER-VIEW™ 14" OPTICAL COMPARATORS

MV-140-QRE WITH ERECT IMAGE

- Heidenhain Quadra-Chek® ND1200 series 3-axis digital readout with:
 - 5.7" LCD screen.
 - Direct measurement of points, lines, circles, distance and angles.
 - Graphic display of measurement results.
 - Automatic recognition of geometries (Measure Magic).
 - Programming of features and parts.
 - Entry of tolerances.
 - 360° digital protractor.
 - Multiple languages.
 - RS-232 and USB data interface.
 - Metric / inch conversion.
 - Skew capability.
- 1 micron glass scales.
- Display reads to 0.0001".
- Two long-life tungsten-halogen light sources.
- Extra bright surface illumination through duplex fiber optics.
- Individual switches select profile, surface or combination surface and profile illumination modes.
- High capacity 4-1/2" X 19" stage with 8" horizontal and 4" vertical travel.
- Ball way construction handles loads to 100 pounds.
- Heavy-duty monorail type welded steel frame.
- Rotating frosted glass screen with 90° crosslines and 360° protractor markings.
- Vernier readings to 5 arc minutes.
- 10 power lens system (20 & 50X optional).
- Edge detection is standard on the MV-140-QRE.
- Screen mounted overlay chart clips.
- Weighs 275 pounds.
- Measures 46-1/2" long x 22-1/2" wide x 35-1/2" high.



MV-140-QRE

Additional MV-140 Models:

- MV-140-H** Similar to above with Heidenhain ND120 series 2-axis digital readout without edge detection.
- MV-140-M** Similar to above with Mitutoyo QM-Data200 2-axis digital readout without edge detection.
- MV-140-Q** Similar to above with Heidenhain ND1200 series 2-axis digital readout without edge detection.
- MV-140-QE** Similar to above with Heidenhain ND1200 series 2-axis digital readout & fiber optic edge detection.
- MV-140-QR** Similar to above with Heidenhain ND1200 series 3-axis digital readout without edge detection.

MASTER-VIEW™ 14" OPTICAL COMPARATORS

MV-14

- Digital LCD scales on X and Y axes provide readings to 0.0005".
- Output from scales that is compatible with most SPC systems.
- Two long-life tungsten-halogen light sources.
- Extra bright surface illumination through duplex fiber optics.
- Individual switches select profile, surface or combination surface-profile illumination modes.
- High capacity 4-1/2" X 19" stage with 8" horizontal and 4" vertical travel.
- Ball way construction handles loads to 100 pounds.
- Heavy-duty monorail type formed steel frame.
- Rotating frosted glass screen with 90° crosslines and 360° protractor markings.
- Vernier readings to 5 arc minutes.
- 10 power lens system.
- Overlay chart clips.
- Weighs 188 pounds.
- Measures 48-1/2" long x 22-1/2" wide x 34" high.



MV-14

MV-14-P

Includes MV-14 features plus:

- Fagor NV-20 2-axis digital readout* with:
 - Linear compensation.
 - Inch-mm conversion.
 - Absolute-incremental switch.
- 5 micron glass scales.
- Display reads to 0.0005".
- Weighs 215 pounds.

* Does not have SPC output.



MV-14-P

MV-14-H

Includes MV-14 features plus:

- Heidenhain ND123 3-axis digital readout with:
 - Large LCD screen.
 - Direct measurement of points, lines and circles.
 - Type B USB data interface.
 - Graphic display of measurement results.
 - Entry of tolerances.
- 360° digital protractor.
- 1 micron glass scales.
- Display reads to 0.0001".
- Weighs 218 pounds.



MV-14-H

MASTER-VIEW™ 14" OPTICAL COMPARATORS

MV-14-M

Includes MV-14 features plus:

- Mitutoyo QM-Data200 Digital Readout with:
 - Large LCD screen.
 - Direct measurement of points, lines, circles & slots.
 - Printer interface.
 - Output to spreadsheet in CSV format through RS232 port.
 - Inch-mm conversion.
- 5 micron glass scales.
- Display reads to 0.0001".
- Weighs 215 pounds.



MV-14-M

MV-14-Q

Includes MV-14 features plus:

- Heidenhain Quadra-Chek® ND1200 series readout with:
 - Geometric functions.
 - Easily calculate distance, angle, intersection, radius, diameter, part skew, etc.
 - Output to printer or PC.
- 1 micron glass scales.
- Display reads to 0.0001".
- Weighs 220 pounds.



MV-14-Q

Additional MV-14-Q Models:

MV-14-QE

MV-14-Q with fiber optic edge detection.

MV-14-QR

MV-14-Q with digital protractor.

MV-14-QRE

MV-14-Q with fiber optic edge detection and digital protractor.

MASTER-VIEW™ ACCESSORIES

LENSES

- Bayonet mount for quick change-out.

MODEL #	DESCRIPTION	WT (#)
MV-14-10X	10 Power Lens	2
MV-14-20X	20 Power Lens	2
MV-14-50X	50 Power Lens	2



MV-14-20X



MV-14-50X

CABINET BASE

- Has inside shelf to store charts, fixtures, etc.
- Includes casters.

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
MV-14-BASE	46-1/2"	24"	34-1/2"	185



MV-14-BASE

HOOD

- Reduces shadows and glare from overhead lights.
- Easily attaches with two screws.
- For use with MV-14 models only.

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
MV-14-HOOD	10-7/16"	20-5/8"	9-3/4"	8



MV-14-HOOD

REMOTE DIGITAL READOUT

- Provides easy to read remote x-axis & y-axis display.
- For use on the model MV-14 only.
- Includes all cables and a bracket for mounting to the MV-14 housing.

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
MV-14-RD2	4-1/2"	8-1/4"	6-1/2"	7



MV-14-RD2

MASTER-VIEW™ ACCESSORIES

CENTERS

- Features a spring-loaded tailstock.
- Fits all MV-14 and MV-140 models.

MODEL #	CAPACITY	WT (#)
MV-14-CTR	14" Long X 3" Diameter	10



MV-14-CTR

V-BLOCK

- Easily hold round parts.
- Includes clamp and screws.
- Square and parallel within 0.0002".
- Vee square to locating pins within 0.001".
- Fits all MV-14 and MV-140 models.

MODEL #	V-BLOCK SIZE			CAPACITY (DIA.)	WT (#)
	LENGTH	WIDTH	HEIGHT		
MV-14-VB	2-1/2"	2-1/2"	2"	1-5/8"	4



MV-14-VB

ROTARY VISE

- Graduated 360° in 1° increments.
- Fits all MV-14 and MV-140 models.

MODEL #	LENGTH	WIDTH	HEIGHT	JAW CAPACITY	WT (#)
RRV-473	5-5/8"	7-1/8"	3-1/8"	2-1/8"	9



RRV-473

PROTECTIVE COVERS

- Made from black, polyurethane-coated nylon.
- Meets California Technical Bulletin 117 Section E requirements for flame retardancy.
- Two heavy duty zippers for easy on and off.

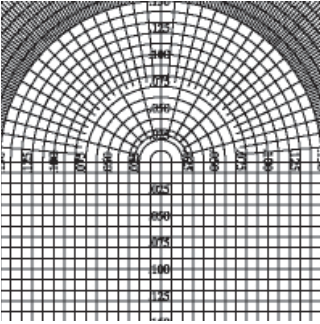
MODEL #	DESCRIPTION	WT (#)
MV-14-COVER1	Fits Basic MV-14 Model	4
MV-14-COVER2	Fits All MV-14 M, P, Q & S Models	4
MV-140-COVER	Fits All MV-140 Models	4



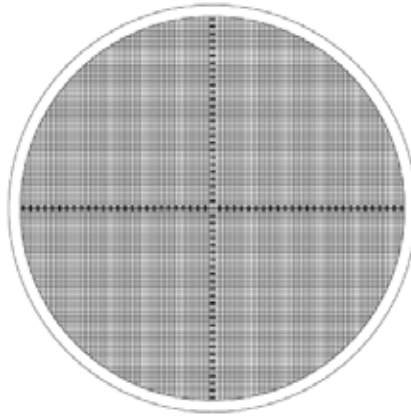
MV-14-COVER1

MASTER-VIEW™ ACCESSORIES

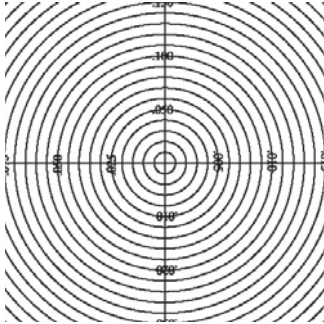
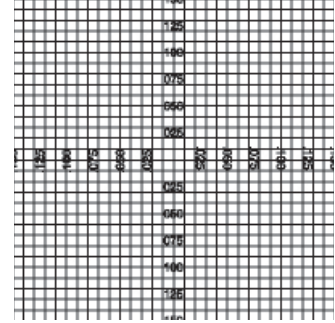
OVERLAY CHARTS



OC-1 Style

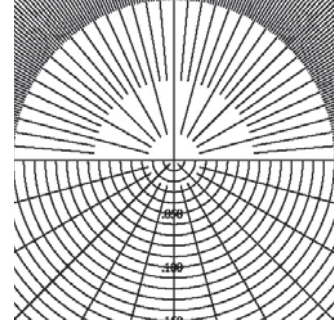


OC-2 Style



OC-6

- Made of 13-3/4" diameter x 0.007" thick Mylar®.
- Designed to work with all of Suburban's 14" optical comparators.



OC-10 Style

MODEL #	USE WITH LENS POWER	DESCRIPTION	WT (#)
OC-1-10X	10X	Combination Grid / Radius Chart	2
OC-1-20X	20X	Combination Grid / Radius Chart	2
OC-1-50X	50X	Combination Grid / Radius Chart	2
OC-2-10X	10X	Grid Chart	2
OC-2-20X	20X	Grid Chart	2
OC-2-50X	50X	Grid Chart	2
OC-6	10X, 20X or 50X	Radius Chart	2
OC-10-10X	10X	Radius / Angle Chart	2
OC-10-20X	20X	Radius / Angle Chart	2
OC-10-50X	50X	Radius / Angle Chart	2
OC-29-10X	10X	Screw Thread Chart (8 - 56 T.P.I.)	2
OC-29-20X	20X	Screw Thread Chart (7 - 80 T.P.I.)	2
OC-29-50X	50X	Screw Thread Chart (4 - 80 T.P.I.)	2

MASTER HEIGHT™ HEIGHT GAGES



MH-450-M

- Both USB and RS232 ports for data transfer.
- Swivel adjustment on readout for easy viewing.
- Motorized and manual movements with rapid jog.
- Air bearing cushion with built-in air pump.
- Multiple reference points.
- Can be used as a “go / no go” gauge.
- Quick manual squareness measurement.
- Optional printer attachment.
- CE approved.

Measuring Functions

- Contact above / below.
- Shaft.
- Bore.
- Groove / ledge.
- Squareness (with optional attachment).
- Flatness / parallelism deviation.
- Angle.
- 2D.
- Chain measurements.
- Multiple reference points.



Readout Face



Bolt Circle Measurement



Slot Measurement



Hole Measurement

All **MASTER HEIGHT™** height gages have the following features:

Maximum measurement speed: 600 mm/sec.
 Battery operation time: 8 hours.
 Rapid jog speed: 35 mm / second.
 SPC capabilities.
 Programmable readout.

Measuring force: 1 N ± 0.2.
 Operation temperature: 10 to 40°C.
 mm / inch conversion.
 1000-step memory.

MODEL *	MEASURING RANGE	EXPANDED RANGE	RESOLUTION	REPEATABILITY	MAXIMUM ERROR **	SQUARENESS ***	WT (#)
MH-450-M	450 mm	800 mm	0.01 / 0.001 / 0.0005 mm	0.002 mm	3 + L/400 µm	5 µm	51
MH-450-U	450 mm	800 mm	0.01 / 0.001 / 0.0005 / 0.0001 mm	0.001 mm	2 + L/400 µm	5 µm	51
MH-600-M	600 mm	950 mm	0.01 / 0.001 / 0.0005 mm	0.002 mm	3 + L/400 µm	6 µm	55
MH-600-U	600 mm	950 mm	0.01 / 0.001 / 0.0005 / 0.0001 mm	0.001 mm	2 + L/400 µm	6 µm	55
MH-1000-M	1000 mm	1350 mm	0.01 / 0.001 / 0.0005 mm	0.002 mm	3 + L/400 µm	10 µm	66
MH-1000-U	1000 mm	1350 mm	0.01 / 0.001 / 0.0005 / 0.0001 mm	0.001 mm	2 + L/400 µm	10 µm	66

* Models ending in M have magnetic scales. U models have glass scales.

** Values valid with standard ball probe at 20°C ± 0.5°C.

*** With electronic probe MagnascanPH.

IMPORTED

MASTER HEIGHT™ HEIGHT GAGE ACCESSORIES



ME-EMR-BE-0648



MH-EMA-DP-0078



MH-EMA-DC-1048



MH-EMC-BE-0448



MH-EMC-GT-1548



MH-EMC-BC-1048

INDIVIDUAL PROBES

MODEL #	DESCRIPTION	INCLUDED IN SET			WT (#)
MH-EMA-DC-1048	ø10mm x 48mm Steel Disc Probe	--	B	C	1
MH-EMA-DC-2048	ø20mm x 48mm Steel Disc Probe	A	B	C	1
MH-EMA-DP-0078	78mm Depth Probe	A	B	C	1
MH-EMA-MG-0000	Magnascan Holder for Master Height	--	B	C	1
MH-EMC-BC-0472	ø4mm x 72mm Carbide Ball Probe - Concentric	--	B	C	1
MH-EMC-BC-04A0	ø4mm x 100mm Carbide Ball Probe - Concentric	--	B	C	1
MH-EMC-BC-1048	ø10mm x 48mm Carbide Ball Probe - Concentric	A	B	C	1
MH-EMC-BC-10A0	ø10mm x 100mm Carbide Ball Probe - Concentric	--	--	C	1
MH-EMC-BE-0448	ø4mm x 48mm Carbide Ball Probe - Eccentric	A	B	C	1
MH-EMC-GT-0148	ø1mm Carbide Pin Type Probe for Groove & Thread	--	--	C	1
MH-EMC-GT-1548	ø1.5mm Carbide Pin Type Probe for Groove & Thread	--	--	C	1
MH-EMC-GT-0248	ø2mm Carbide Pin Type Probe for Groove & Thread	A	B	C	1
MH-EMR-BC-0148	ø1mm x 48mm Ruby Ball Probe - Concentric	--	B	C	1
MH-EMR-BC-1548	ø1.5mm x 48mm Ruby Ball Probe - Concentric	--	--	C	1
MH-EMR-BE-0248	ø2mm x 48mm Ruby Ball Probe - Eccentric	A	B	C	1
MH-EMR-BE-0348	ø3mm x 48mm Ruby Ball Probe - Eccentric	--	--	C	1
MH-EMR-BE-0548	ø5mm x 48mm Ruby Ball Probe - Eccentric	--	--	C	1
MH-EMR-BE-0648	ø6mm x 48mm Ruby Ball Probe - Eccentric	--	B	C	1

PROBE SETS

MODEL #	DESCRIPTION	WT (#)
MH-EMA-0A-0000	6 Piece Probe Set 'A' in Wooden Case	2
MH-EMA-0B-0000	12 Piece Probe Set 'B' in Wooden Case	3
MH-EMA-0C-0000	18 Piece Probe Set 'C' in Aluminum Case (Formerly MH-PSET-B)	4

SPECIALTY PROBES

MODEL #	DESCRIPTION	WT (#)
MH-EMA-MG-0010	Magnascan Probe for Perpendicularity (Formerly MHMP-00-010)	1

IMPORTED

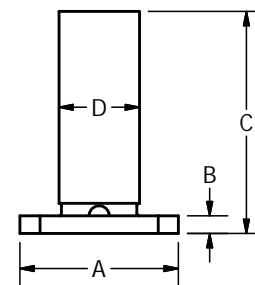
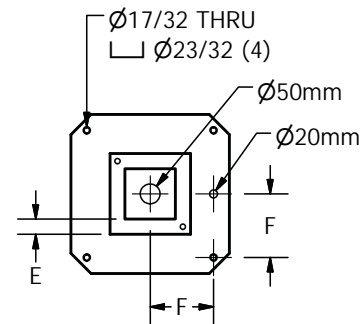
Pallet-Master™ SQUARE COLUMN PALLET FIXTURES



TSC-1

- Tombstone fixtures provide a solid base for mounting vises, fixtures, or sub-plates.
- Made from one-piece, class 40 cast iron that has been stress relieved.
- Base and sides milled flat, square & square within 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- All square columns have drilled and tapped lifting holes in the top surface and coolant drain holes at the base of the column.
- Available standard as plain milled or custom made with your own hole pattern.
- A large number of standard size castings are in stock.
- Other materials available on request.

MODEL #	A	B	C	D	E	F	WT (#)
TSC-1	400mm	1-3/4"	22"	8"	1-1/2"	6.30"	275
TSC-2	400mm	1-3/4"	26"	10"	1-1/2"	6.30"	440
TSC-400836	400mm	1-3/4"	36"	8"	1-1/2"	6.30"	455
TSC-4001036	400mm	1-3/4"	36"	10"	1-1/2"	6.30"	565
TSC-4001236	400mm	1-3/4"	36"	12"	1-1/2"	6.30"	670
TSC-3	500mm	2"	22"	8"	1-1/2"	7.87"	360
TSC-4	500mm	2"	26"	10"	1-1/2"	7.87"	530
TSC-500836	500mm	2"	36"	8"	1-1/2"	7.87"	695
TSC-5001036	500mm	2"	36"	10"	1-1/2"	7.87"	804
TSC-5001236	500mm	1-3/4"	36"	12"	1-1/2"	7.87"	954
TSC-5	630mm	2-1/4"	28-1/2"	12"	2-1/4"	9.84"	950
TSC-6	630mm	2-1/4"	28-1/2"	15-3/4"	2-1/4"	9.84"	1180
TSC-6301036	630mm	2-1/4"	36"	10"	2-1/4"	9.84"	980
TSC-6301236	630mm	2-1/4"	36"	12"	2-1/4"	9.84"	1110
TSC-6301436	630mm	2-1/4"	36"	14"	2-1/4"	9.84"	1267
TSC-6301636	630mm	2-1/4"	36"	16"	2-3/8"	9.84"	1510

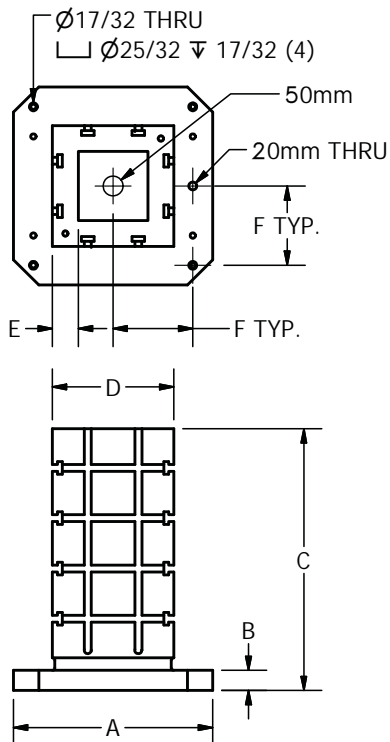


Pallet-Master™ T-SLOTTED PALLET FIXTURES



TSL0T-2

- Tombstone fixtures with standard 5/8 t-slots provide for quick and easy set-ups.
- Made from one-piece, class 40 cast iron that has been stress-relieved.
- Base and sides milled flat, square & parallel to 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- All have drilled and tapped lifting holes in the top surface and coolant drain holes at the base of the column.
- T-slot spacing in 5" pattern for standard mounting of most workholding devices.
- A large number of standard size castings in stock.
- Other materials available on request.



MODEL #	A	B	C	D	E	F	WT (#)
TSL0T-1	400mm	1-3/4"	26"	10"	2"	6.30"	445
TSL0T-2	500mm	2"	26"	12"	2"	7.87"	625

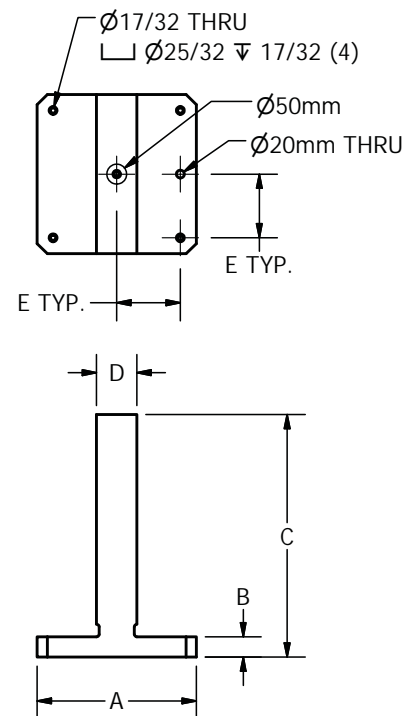
Pallet-Master™ T-TYPE PALLET FIXTURES



TST-5

- Tombstone fixtures provide an accurate vertical base for mounting vises, fixtures, or sub-plates.
- Made from one piece, class 40 cast iron that has been stress relieved.
- Base and sides milled flat, square & parallel to 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- Available standard as plain milled or custom made with your own hole pattern.
- A large number of standard size castings in stock.
- Other materials available on request.

MODEL #	A	B	C	D	E	WT (#)
TST-1	400mm	1-3/4"	18"	3"	6.30"	310
TST-2	400mm	1-3/4"	24"	4"	6.30"	480
TST-400536	400mm	1-3/4"	36"	5"	6.30"	978
TST-3	500mm	2"	18"	3"	7.87"	450
TST-4	500mm	2"	24"	4"	7.87"	660
TST-500536	500mm	2"	36"	5"	7.87"	1075
TST-5	630mm	2-1/4"	28-1/2"	5"	9.84"	1188
TST-630636	630mm	2-1/4"	36"	6"	9.84"	1645

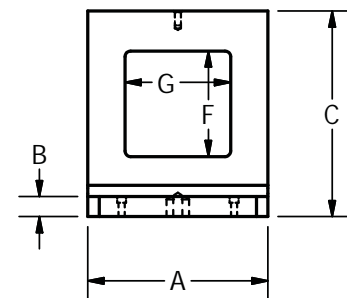
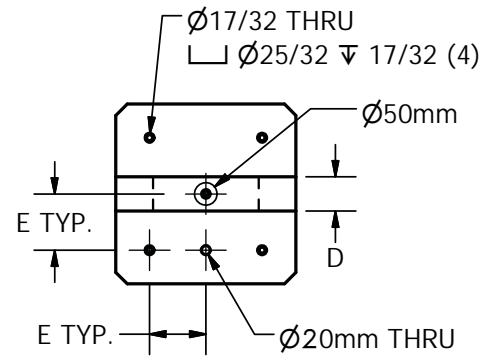


Pallet-Master™ WINDOW TYPE PALLET FIXTURES



TSW-1

- Tombstone fixtures provide an accurate base for mounting tooling and fixture plates.
- Allows for front and back machining of parts.
- Made from one-piece, class 40 cast iron that has been stress-relieved.
- DIN mounting standard, JIS mounting optional.
- Base and sides milled flat, parallel, and square to 0.001" in 12".
- A large number of standard size castings in stock.
- Other materials available on request.



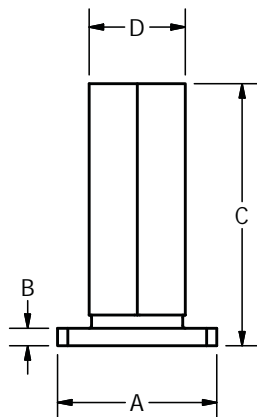
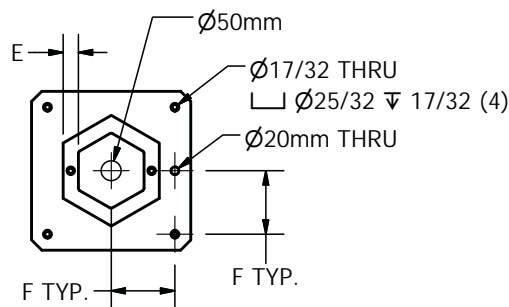
MODEL #	A	B	C	D	E	F	G	WT (#)
TSW-1	400mm	1-3/4"	18"	3"	6.30"	9-1/4"	9-1/4"	245
TSW-2	400mm	1-3/4"	24"	4"	6.30"	15-1/4"	9-1/4"	330
TSW-3	500mm	2"	18"	3"	7.87"	9-1/4"	12-3/4"	355
TSW-4	500mm	2"	24"	4"	7.87"	15-1/4"	12-3/4"	455

Pallet-Master™ HEXAGONAL COLUMN PALLET FIXTURES



TSH-2

- Tombstone fixtures with 6 accurate mounting surfaces, for an easy way to increase production.
- Made from one-piece, class 40 cast iron.
- Base and sides milled flat, parallel & square to 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- All have drilled and tapped lifting holes in the top surface and coolant drain holes at the base of the column.
- Available standard as plain milled or custom made with your own hole pattern.
- A large number of standard size castings in stock.
- Other materials available on request.



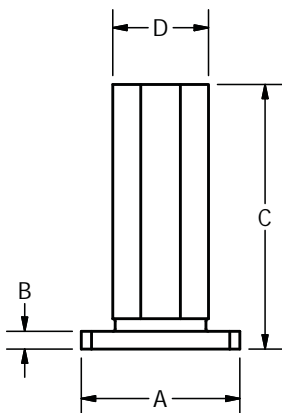
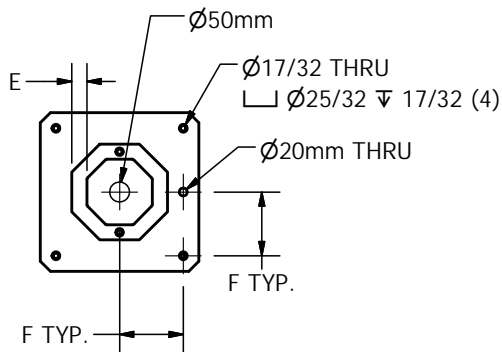
MODEL #	A	B	C	D	E	F	WT (#)
TSH-1	400mm	1-3/4"	26"	9-1/2"	1-1/2"	6.30"	375
TSH-2	500mm	1-3/4"	26"	13"	1-3/4"	7.87"	610

Pallet-Master™ OCTAGONAL COLUMN PALLET FIXTURES



TSO-1

- Tombstone fixtures with 8 mounting surfaces are ideal for high part volume applications.
- Made from one-piece, stress-relieved, class 40 cast iron.
- Base and sides milled flat, parallel, and square to 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- All have drilled and tapped lifting holes in the top surface and coolant drain holes at the base of the column.
- Available standard as plain milled or custom made with your own hole pattern.
- A large number of standard size castings in stock.
- Other materials available on request.

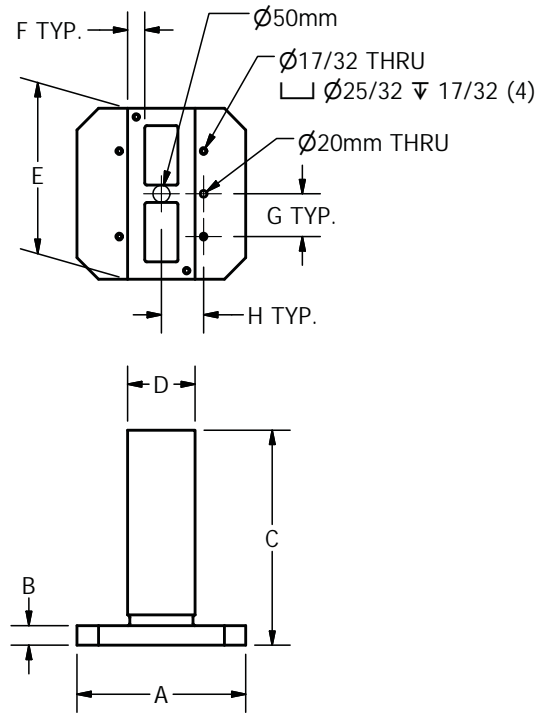


MODEL #	A	B	C	D	E	F	WT (#)
TSO-1	400mm	1-3/4"	26"	9-1/2"	1-1/2"	6.30"	360
TSO-2	500mm	1-3/4"	26"	13"	1-3/4"	7.87"	590

Pallet-Master™ RECTANGULAR COLUMN PALLET FIXTURES



TSR-5



- Tombstone fixtures provide a solid base for mounting vises, fixtures or sub-plates.
- Made from one-piece, stress-relieved, class 40 cast iron.
- Base and sides milled flat, parallel, and square to 0.001" in 12".
- DIN mounting standard, JIS mounting optional.
- Available standard as plain milled or custom made with your own hole pattern.
- A large number of standard size castings in stock.
- Other materials available on request.

MODEL #	A	B	C	D	E	F	G	H	WT (#)
TSR-400636	400mm	2-1/4"	36"	6"	400mm	1-1/2"	4.92"	6.30"	818
TSR-5	500mm	2-1/4"	22"	7.87"	500mm	2-1/4"	4.92"	4.92"	840
TSR-500836	500mm	2-1/4"	36"	8"	500mm	2"	4.92"	6.30"	1078
TSR-6	630mm	2-1/4"	28-1/2"	9.84"	630mm	2-1/4"	9.84"	9.84"	1350
TSR-6301036	630mm	2-1/4"	36"	10"	630mm	2-1/4"	9.84"	9.84"	1640

CUSTOM PALLET FIXTURES

You may require pallet fixtures in sizes or shapes that are not listed in this catalog. We can supply custom built tools to help you with your production needs.

This worksheet is for specifying a custom order pallet fixture. You'll find it useful for taking the proper measurements and having the information at hand, when requesting a quote on a special pallet fixture.

Using the labeled dimensions in the diagrams on the following pages, make a copy of this page and fill in the table with the type of column required and the appropriate dimensions for your custom order fixture. Use the "notes" area at the bottom for any explanations you feel are needed to complete the description of the column you want us to build.

If the custom order is a shape other than the ones shown, please send a sketch or drawing. Feel free to send any additional attachments you think will help us with your quote.

Company Name: _____

Contact Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Email: _____ Country: _____

Phone: _____ Fax: _____

COLUMN TYPE >				NOTES
DIM	SIZE	DIM	SIZE	

CUSTOM PALLET FIXTURES



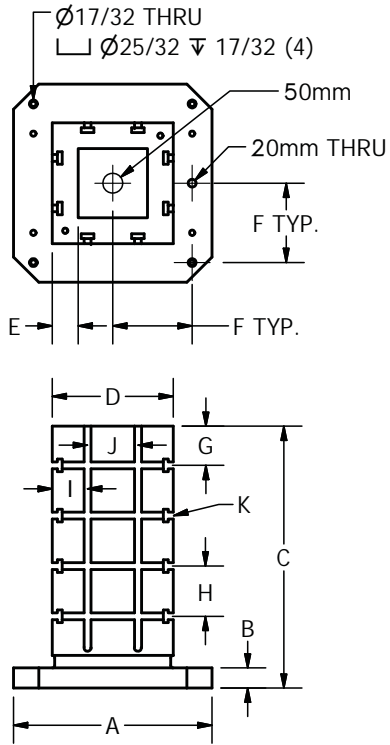
CUSTOM TOMBSTONE MANUFACTURED
FOR WEN TECHNOLOGY, INC.
RALEIGH, NC

ANY SIZE & SHAPE

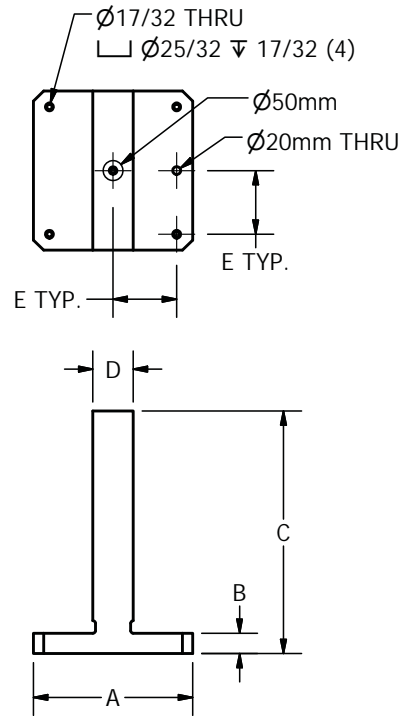


CUSTOM PALLET FIXTURES

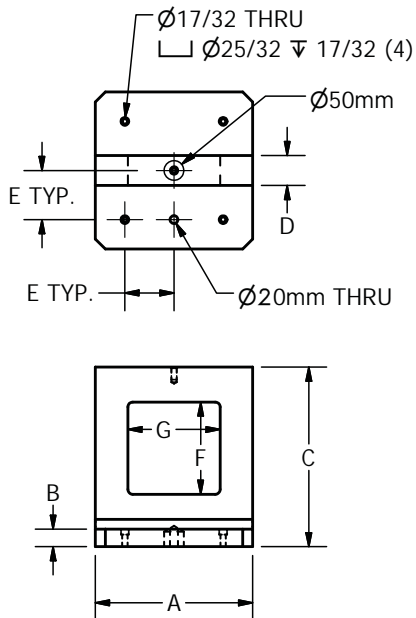
T-SLOT TYPE



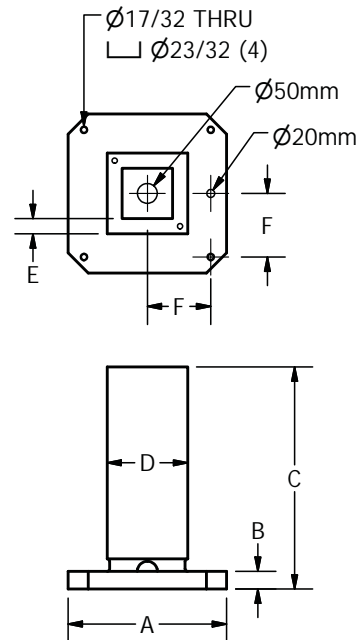
T TYPE



WINDOW TYPE

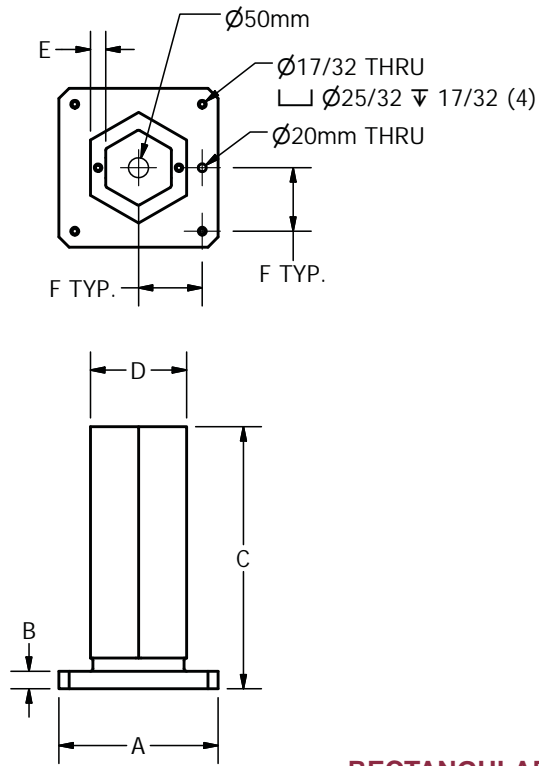


SQUARE TYPE

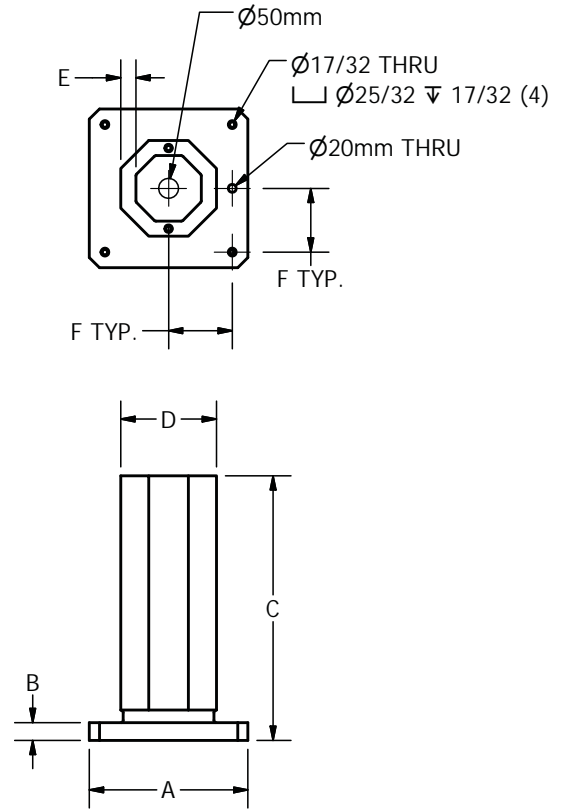


CUSTOM PALLET FIXTURES

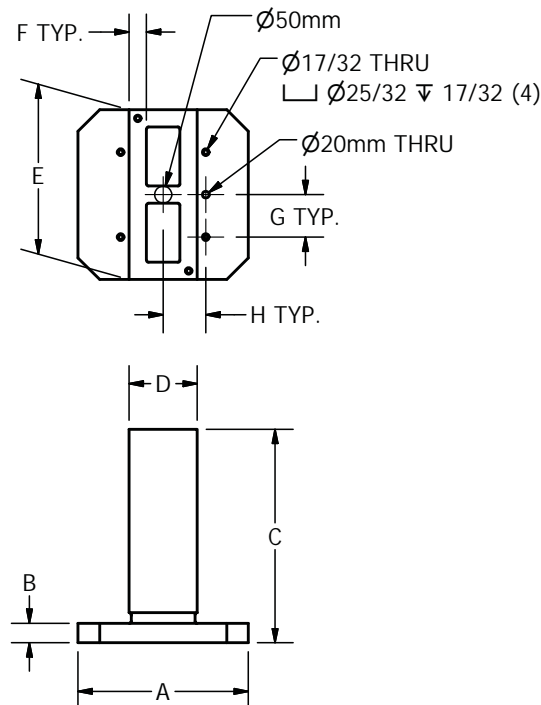
HEXAGONAL TYPE



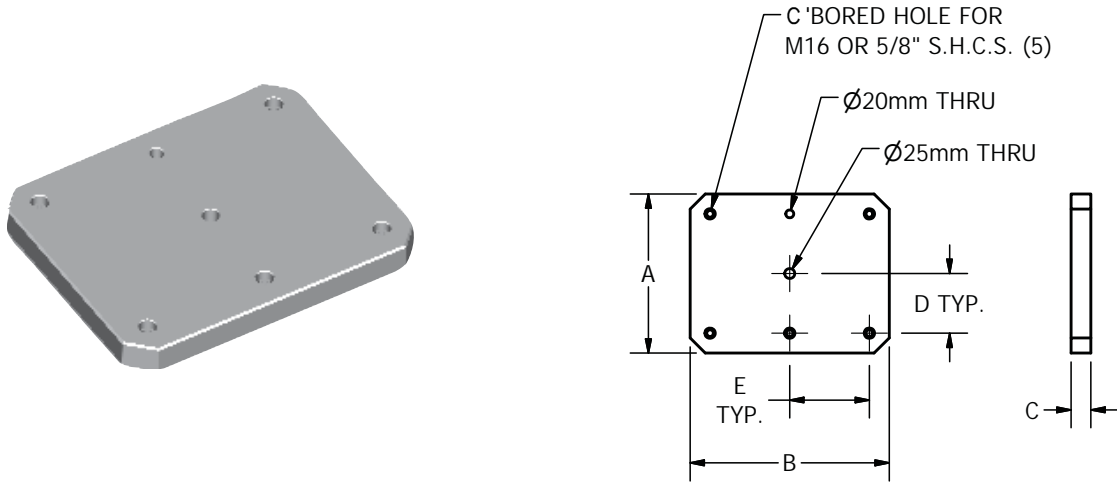
OCTAGONAL TYPE



RECTANGULAR TYPE



Pallet-Master™ TOOLING PLATES



- Plain tooling / riser plates provide a convenient base for custom workholding solutions.
- Made from class 40 cast iron, stress-relieved and annealed.
- Top and bottom flat & parallel within 0.001" per 12".
- Available standard as plain ground or custom made with your own hole pattern.
- A large number of standard size castings in stock.
- Other materials available on request.

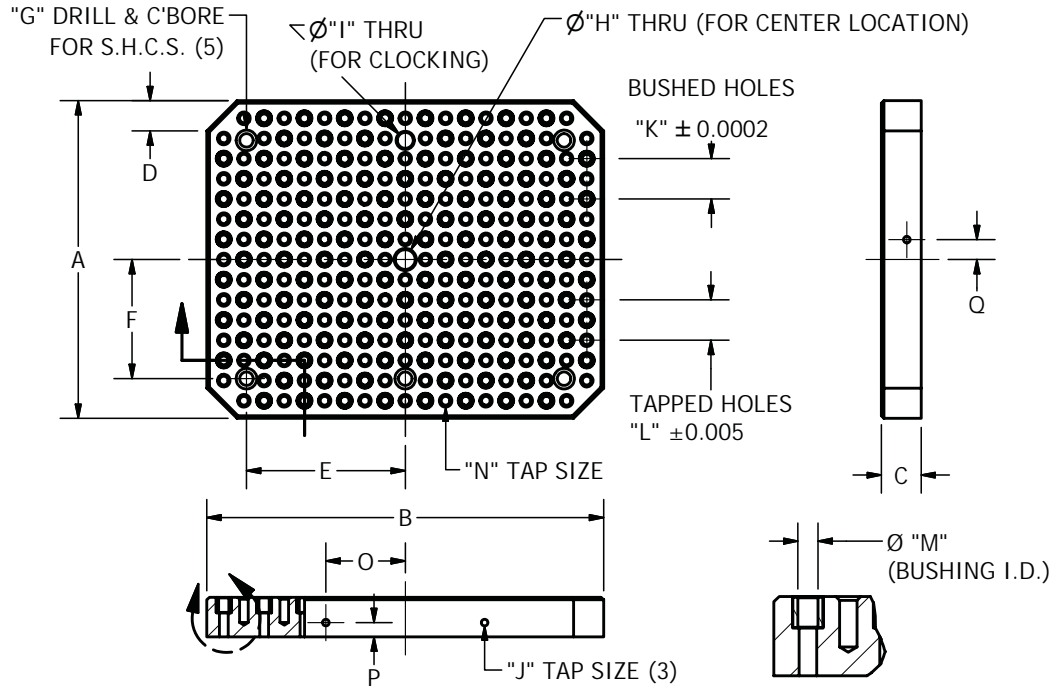
SQUARE TOOLING PLATES

MODEL #	A	B	C (±0.0254mm)	D	E	WT (#)
TTPS-1616200	400mm	400mm	50mm	160mm	160mm	150
TTPS-2020200	500mm	500mm	50mm	200mm	200mm	233
TTPS-2424200	630mm	630mm	50mm	250mm	250mm	346
TTPS-3232238	800mm	800mm	60mm	300mm	300mm	660

RECTANGULAR TOOLING PLATES

MODEL #	A	B	C (±0.0254mm)	D	E	WT (#)
TTPR-1620200	400mm	500mm	50mm	150mm	200mm	187
TTPR-2024200	500mm	630mm	50mm	200mm	250mm	291
TTPR-2432238	630mm	800mm	60mm	250mm	300mm	525

CUSTOM TOOLING PLATES



Company Name: _____

Contact Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Email: _____ Country: _____

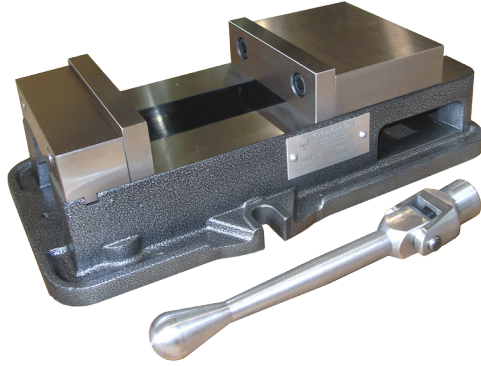
Phone: _____ Fax: _____

DIMENSION	SIZE	DIMENSION	SIZE	DIMENSION	SIZE
A		G		M	
B		H		N	
C		I		O	
D		J		P	
E		K		Q	
F		L			
NOTES					

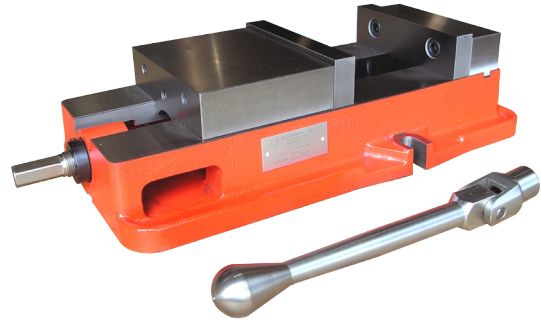
NOTES

MILL-MASTER™ VISES

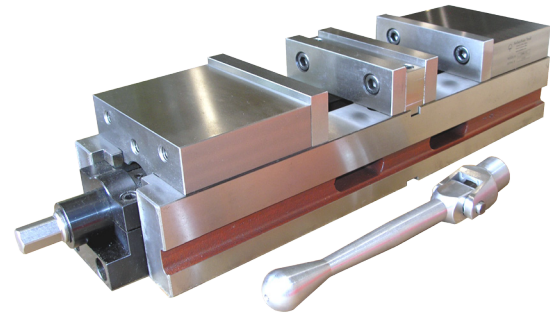
VERSATILE VISES FOR MILLING MACHINES



VMM-6



VMM-8



VMM-D-6

- Stress relieved 80,000 psi ductile iron body.
- Flame hardened bed.
- Finished surfaces are square & parallel within $\pm 0.0005"$.
- Non-lifting moveable jaw design.
- Semi-hard nickel plated steel screw.
- Needle bearing allows greater clamping force & ease of use.
- Machined steel handle.
- Hardened jaws.
- Powder coated body.

MODEL #	LENGTH	WIDTH	HEIGHT	BED HEIGHT 0.0005"	JAW OPENING	MAXIMUM CAPACITY	JAW WIDTH	KEYWAY	WT (#)
VMM-5	7-5/8"	4"	2.500"	5"	11-15/16"	1"	5"	11/16"	53
VMM-6	9"	4-39/64"	2.875"	7-15/16"	16-1/4"	1-1/2"	6"	11/16"	80
VMM-8	11-1/2"	5-17/32"	3.312"	9-27/32"	20-1/2"	2"	8"	13/16"	170
VMM-D-6	6-1/8"	4-55/64"	3.125"	(2) 4"	21-23/64"	2-1/2"	6"	11/16"	105

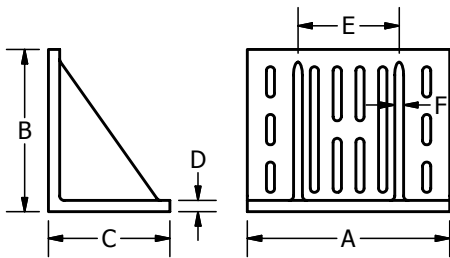
Rev B

GIANT SLOTTED WEBBED ANGLE PLATES



GAW-161209

MODEL #		A	B	C	D	E	F	WT (#)
MACHINED	GROUND							
GAW-122418	--	12"	24"	18"	1-1/2"	5"	1-3/16"	268
GAW-161209	GAW-161209-G	16"	12"	9"	1-1/8"	8"	7/8"	115
GAW-183024	--	18"	30"	24"	1-3/4"	9"	1-3/8"	620
GAW-201612	GAW-201612-G	20"	16"	12"	1-1/8"	10"	7/8"	210



- Made from class 35-40 cast iron.
- All ends machined square and parallel within 0.002" per 6".
- Machined finish - Square and parallel within 0.002" per 6".
- Ground finish (up to 20") - Square within 0.0005" per 6".
- Extra thickness and heavy ribbed construction.
- Multiple 13/16" wide slots for many bolting and clamping possibilities.

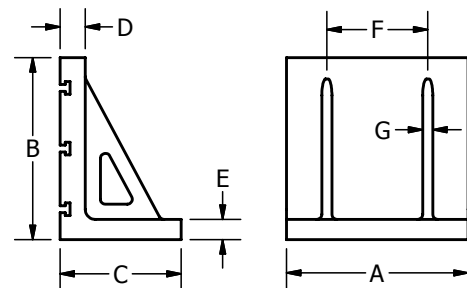
T-SLOTTED WEBBED ANGLE PLATES



TAP-121818

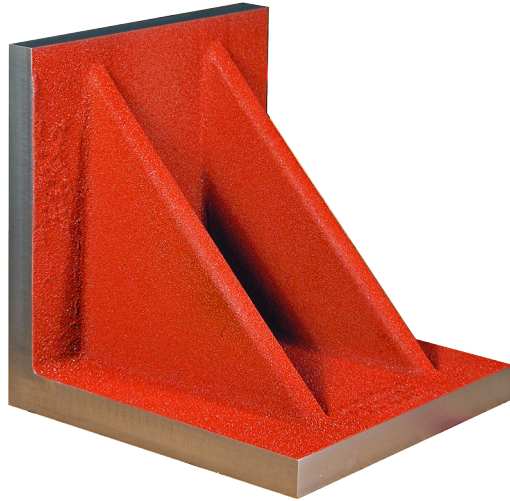
- Provides an accurate vertical base for mounting vises, sub-plates, parts or fixtures.
- Standard 5/8" T-slots on 6" centers.
- Made from one piece, class 35-40 cast iron.
- Extra heavy 2-1/2" wall thickness provides stability during milling operations.
- Faces and edges machined flat, square and parallel within 0.001" per 12".

MODEL #	A	B	C	D	E	F	G	WT (#)
TAP-121818	18"	18"	12"	2-1/2"	2"	10"	1"	450
TAP-122424	24"	24"	12"	2-1/2"	2"	12"	1-1/2"	566



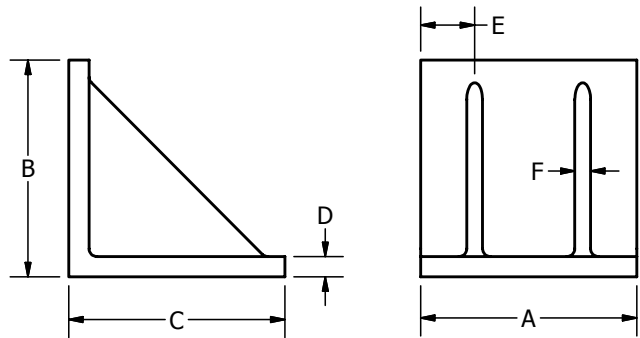
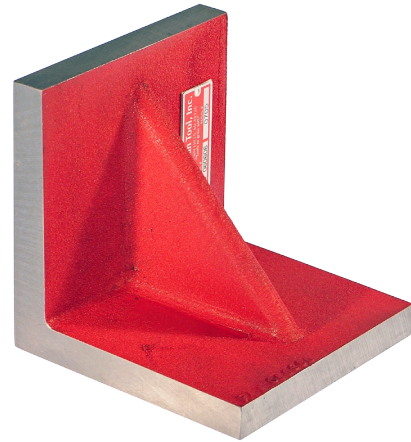
Rev B

PLAIN WEBBED ANGLE PLATES



PAW-121212

PAW-060606



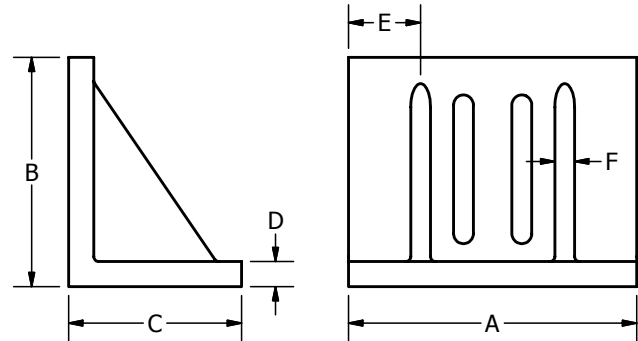
- Made from class 35-40 cast iron.
- All ends machined square and parallel within 0.002" per 6".
- Extra thick ribbed construction.
- Machined finish - square and parallel within 0.002" per 6".
- Ground finish - square within 0.0005" per 6" on the two working faces only.

MODEL #		A	B	C	D	E	F	# OF WEBS	WT (#)
MACHINED	GROUND								
PAW-020202	PAW-020202-G	2"	2"	2"	1/2"	1"	7/16"	1	1
PAW-030303	PAW-030303-G	3"	3"	3"	1/2"	1-1/2"	7/16"	1	3
PAW-040404	PAW-040404-G	4"	4"	4"	5/8"	2"	1/2"	1	7
PAW-050505	PAW-050505-G	5"	5"	5"	11/16"	2-1/2"	9/16"	1	11
PAW-060606	PAW-060606-G	6"	6"	6"	3/4"	3"	5/8"	1	18
PAW-060810	PAW-060810-G	10"	6"	8"	1"	2-1/2"	3/4"	2	50
PAW-080808	PAW-080808-G	8"	8"	8"	7/8"	2"	11/16"	2	42
PAW-081006	PAW-081006-G	6"	10"	8"	1-1/4"	3"	3/4"	1	45
PAW-101010	PAW-101010-G	10"	10"	10"	1"	2-1/2"	3/4"	2	70
PAW-121212	PAW-121212-G	12"	11-3/4"	11-3/4"	1-1/8"	3"	7/8"	2	125

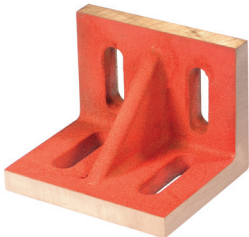
Rev B

SLOTTED ANGLE PLATES - WEBBED & OPEN END

- Made from class 35-40 cast iron.
- Multiple clamping slots for easy mounting of workpieces.
- Webbed type - 2 working faces and all ends machined square and parallel within 0.002" per 6".
- Open end type - 4 working faces and all ends machined square and parallel within 0.002" per 6".
- Also available ground with working faces square within 0.0005" per 6".



SAO-060504



SAW-060504

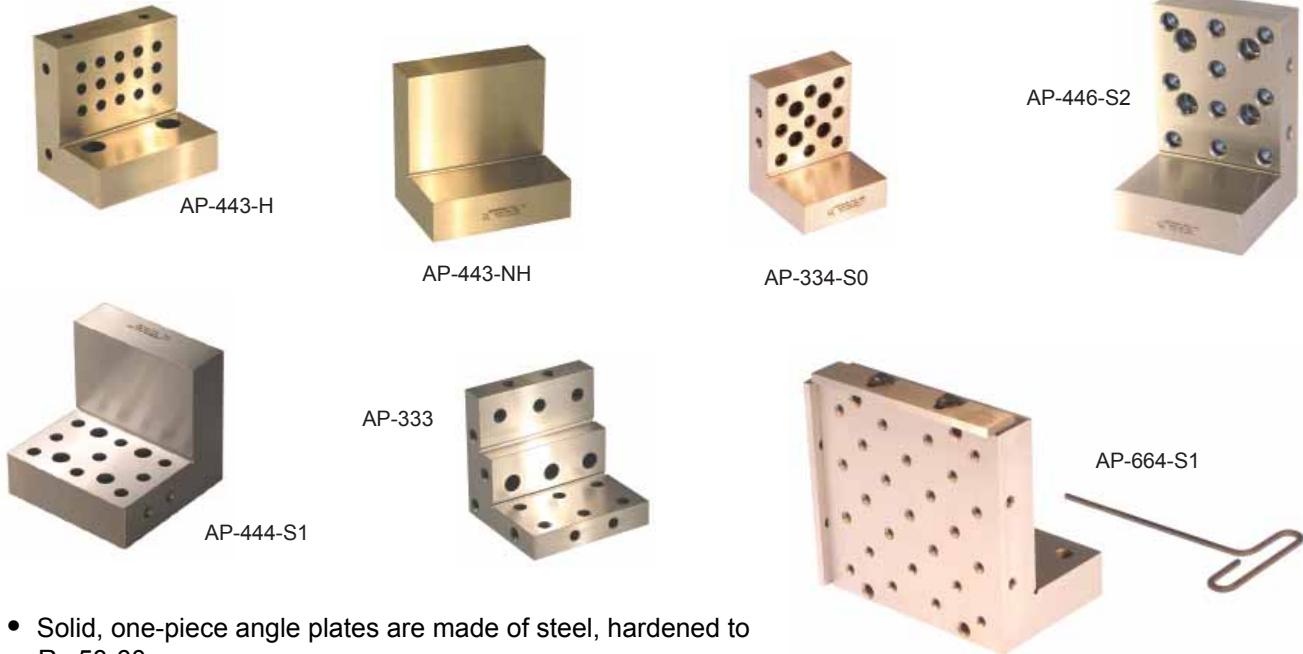
OPEN END STYLE

MODEL #		A	B	C	D	SLOTS	WT (#)
MACHINED	GROUND						
SAO-040303	SAO-040303-G	4-1/2"	3-1/2"	3"	5/8"	(4) 9/16"	4
SAO-060504	SAO-060504-G	6"	5"	4-1/2"	13/16"	(7) 9/16"	12
SAO-070504	SAO-070504-G	7"	5-1/2"	4-1/2"	13/16"	(8) 9/16"	14
SAO-080605	SAO-080605-G	8"	6"	5"	15/16"	(8) 9/16"	20
SAO-090706	SAO-090706-G	9"	7"	6"	15/16"	(13) 11/16"	24
SAO-100806	SAO-100806-G	10"	8"	6"	1-1/16"	(13) 11/16"	33
SAO-120908	SAO-120908-G	12"	9"	8"	1-3/16"	(13) 11/16"	62

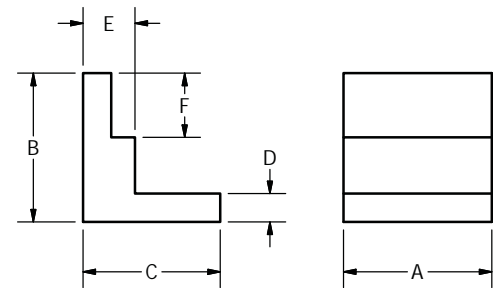
MODEL #		A	B	C	D	E	F	# OF WEBS	SLOTS	WT (#)
MACHINED	GROUND									
SAW-030302	SAW-030302-G	3-1/2"	3"	2-1/2"	9/16"	1-3/4"	1/2"	1	(4) 7/16"	4
SAW-040303	SAW-040303-G	4-1/2"	3-1/2"	3"	9/16"	2-1/4"	1/2"	1	(4) 9/16"	5
SAW-060504	SAW-060504-G	6"	5"	4-1/2"	11/16"	3"	9/16"	1	(4) 11/16"	13
SAW-070504	SAW-070504-G	7"	5-1/2"	4-1/2"	11/16"	3-1/2"	9/16"	1	(4) 11/16"	14
SAW-080605	SAW-080605-G	8"	6"	5"	3/4"	2"	5/8"	2	(4) 9/16"	22
SAW-090706	SAW-090706-G	9"	7"	6"	3/4"	2-1/4"	5/8"	2	(4) 11/16"	28
SAW-100806	SAW-100806-G	10"	8"	6"	7/8"	2-1/2"	11/16"	2	(4) 11/16"	37
SAW-120908	SAW-120908-G	12"	9"	8"	1"	3"	3/4"	2	(11) 11/16"	63

Rev B

PRECISION GROUND STEEL ANGLE PLATES



- Solid, one-piece angle plates are made of steel, hardened to Rc 58-60.
- AP-443-H & AP-443-NH are square and parallel within 0.0001". All other models are held to 0.0002".
- All models ending in '-NH' have no holes. All others are furnished with tapped holes.
- SineSet® models are made to bolt directly to sine plates and compound sine plates of the same series.



MODEL #		SineSet® SERIES	A	B	C	D	E	F	HOLES	WT (#)	
SINGLE	PAIR									SINGLE	PAIR
SineSet® COMPATIBLE											
AP-334-S0	AP-334-M-S0	S0	3"	4"	3"	1"	--	--	(13) 1/4-20 (4) 5/16" X 7/16" C'BORE	6	11
AP-444-S1	AP-444-M-S1	S1	4"	4"	4"	1-1/4"	--	--	(13) 1/4-20 (4) 5/16" X 7/16" C'BORE	10	19
AP-446-S2	AP-446-M-S2	S2	4"	6"	4"	1-1/4"	--	--	(14) 3/8-16 (4) 7/16" X 5/8" C'BORE	14	27
AP-664-S1	AP-664-M-S1	S1	6"	6"	4"	1-1/4"	--	--	(31) 1/4-20 (6) 5/16" X 7/16" C'BORE	20	39
NOT SineSet® COMPATIBLE											
AP-333	AP-333-M	--	3"	2-3/4"	3"	9/16"	1"	1-1/4"	(24) 1/4-20	5	9
AP-334-NH	AP-334-NH-M	--	3"	4"	3"	1"	--	--	--	6	11
AP-443-H	--	--	4"	4"	3"	1-1/8"	--	--	(31) 1/4-20 (2) 13/32" X 19/32" C'BORE	9	--
AP-443-NH	AP-443-NH-M	--	4"	4"	3"	1-1/8"	--	--	--	9	17
AP-444-NH	AP-444-NH-M	--	4"	4"	4"	1-1/4"	--	--	--	10	19
AP-446-NH	AP-446-NH-M	--	4"	6"	4"	1-1/4"	--	--	--	14	27
AP-664-NH	AP-664-NH-M	--	6"	6"	4"	1-1/4"	--	--	--	20	39



AP-445 with optional AP-445-FC

V-STEP ANGLE PLATE

- The model AP-445 is an extremely versatile angle plate with a vee, slots and a step for holding a wide variety of workpieces.
- Square and parallel within 0.0002".
- Optional face clamp, side clamp and adjustable yoke clamp are available to extend the usefulness of the angle plate even more.
- Made of steel, hardened to Rc 58-60.

MODEL #		LENGTH	WIDTH	HEIGHT	THICKNESS	HOLES	WT (#)	
SINGLE	PAIR						SINGLE	PAIR
AP-445	AP-445-M	4"	4"	4-1/2"	1" (3/4" AT STEP)	(25) 5/16-18 (4) 13/32" X 19/32" C'BORE	9	17

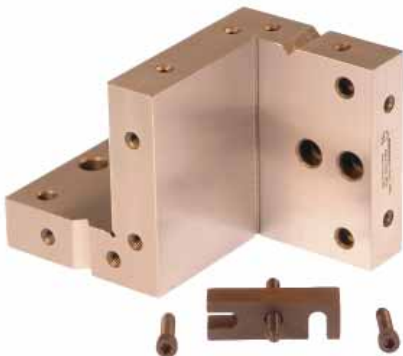


AP-445 with optional AP-445-AY & AP-445-SC

OPTIONAL ACCESSORIES FOR THE AP-445

MODEL #	DESCRIPTION	WT (#)
AP-445-AY	YOKE CLAMP	1
AP-445-FC	FACE CLAMP	1
AP-445-SC	SIDE CLAMP	2

COMPOUND ANGLE PLATE

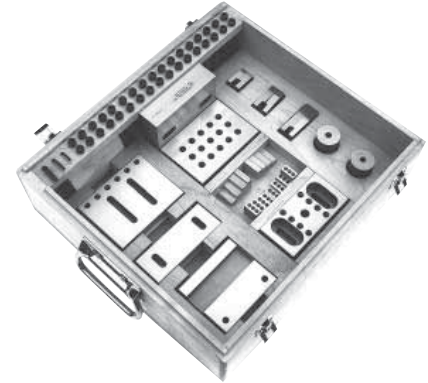


- Solid, single piece construction provides stable and reliable positioning for compound use.
- Ground vees for convenient holding of small parts.
- Square and parallel within 0.0002".
- Clamp & screws included.
- Made of steel, hardened to Rc 58-60.

MODEL #		LENGTH	WIDTH	HEIGHT	THICKNESS	HOLES	WT (#)	
SINGLE	PAIR						SINGLE	PAIR
CAP-46	CAP-46-M	6"	4"	4"	1"	(16) 1/4-20 (4) 11/32" X 1/2" C'BORE	11	21

Tool-Master™ ANGLE PLATE SET

- Ideal for use on jig borers, jig grinders, milling machines, surface grinders, and for inspection and toolmaker's setup.
- Contains angle plate, and a multitude of convenient and easy to use accessories.
- Storage case has a place for everything. Minimizes the chance of losing screws, straps, washers, etc.
- Straps and blocks can be mixed and matched for practically unlimited clamping possibilities.
- Angle plate made of steel, hardened to Rc 58-60.
- Thirty-one 1/4-20 tapped holes in angle plate.



AP-443-H-KIT

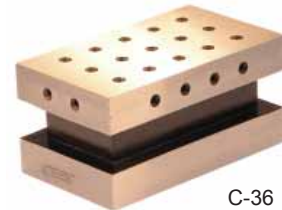
SET CONTENTS

- | | |
|---|--------------------------|
| (1) AP-443-H Angle Plate (see page 29) | (6) Work Protectors |
| (2) Universal Stops | (2) Matched Legs |
| (6) Assorted Strap Clamps | (2) Side Straps |
| (8) Assorted Spacing Blocks | (6) Washers |
| (1) Adjustable Stop | (1) Wooden Storage Case |
| (34) Assorted 1/4-20 Socket Head Cap Screws | (3) Hex Wrenches |
| (1) Adjustable Strap | (12) Half Dog Set Screws |

MODEL #	CASE DIMENSIONS			WT (#)
	LENGTH	WIDTH	HEIGHT	
AP-443-H-KIT	14-1/2"	13-1/4"	4-1/2"	28

CUBE

- Solid, one-piece steel construction.
- Hardened to Rc 58-60.
- Top, bottom & 4 sides ground flat, square & parallel within 0.0002".
- Slotted on all sides for extra clamping possibilities.



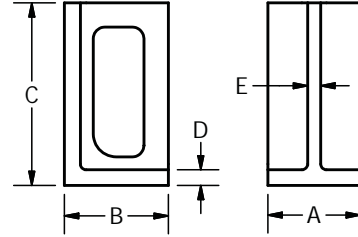
C-36

MODEL #		LENGTH	WIDTH	HEIGHT	HOLES	WT (#)	
SINGLE	PAIR					SINGLE	PAIR
C-36	C-36-M	6"	3-1/2"	3"	(27) 1/4-20	15	29

UNIVERSAL RIGHT ANGLE IRONS



URA-040508



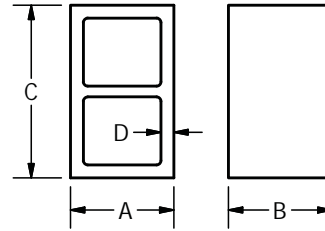
- Useful for clamping work in multiple positions.
- Ideal for squaring operations.
- Made from class 35-40 cast iron.
- All faces and ends finished square and parallel.
- Machined finish - Square and parallel within 0.002" per 6".
- Ground finish - Square within 0.0005" per 6". Parallel within 0.00025" per 6".

MODEL #		A	B	C	D	E	WT (#)
MACHINED	GROUND						
URA-030405	URA-030405-G	3-3/4"	4"	5"	3/4"	5/8"	10
URA-040406	URA-040406-G	4"	4"	6"	7/8"	11/16"	12
URA-040506	URA-040506-G	4-1/2"	5"	6"	7/8"	11/16"	16
URA-040508	URA-040508-G	4"	5"	8"	1"	3/4"	21
URA-050710	URA-050710-G	5-1/2"	7"	10"	1-1/8"	7/8"	37
URA-050810	URA-050810-G	5-1/2"	8"	10"	1-1/8"	7/8"	40
URA-050812	URA-050812-G	5"	8"	12"	1-1/4"	1"	44
URA-060608	URA-060608-G	6"	6"	8"	1"	3/4"	32
URA-080916	URA-080916-G	8"	9"	16"	1-3/8"	1-1/8"	94
URA-081012	URA-081012-G	8"	10"	12"	1-1/4"	1"	86

BOX PARALLELS



BXP-060608-G



- Made from class 35-40 cast iron.
- All faces and ends finished square and parallel.
- Machined finish - Size $\pm 0.015"$. Square and parallel within 0.002" per 6".
- Ground finish - Size $\pm 0.002"$. Square and parallel within 0.0005" per 6".

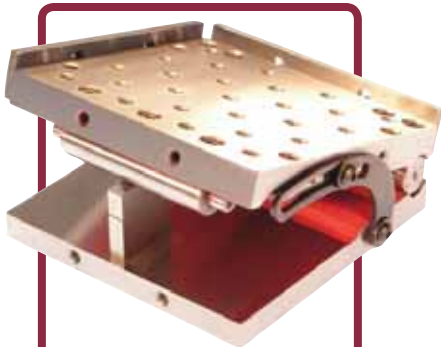
MODEL #		A	B	C	D	# OF WEBS	WT (#)
MACHINED	GROUND						
BXP-040404	BXP-040404-G	4"	4"	4"	5/8"	0	12
BXP-040406	BXP-040406-G	4"	4"	6"	3/4"	0	16
BXP-040606	BXP-040606-G	4"	6"	6"	3/4"	0	20
BXP-050505	BXP-050505-G	5"	5"	5"	11/16"	0	17
BXP-051010	BXP-051010-G	5"	10"	10"	11/16"	1	73
BXP-060606	BXP-060606-G	6"	6"	6"	3/4"	0	25
BXP-060608	BXP-060608-G	6"	6"	8"	3/4"	1	35
BXP-061212	BXP-061212-G	6"	12"	12"	3/4"	1	105
BXP-080808	BXP-080808-G	8"	8"	8"	5/8"	2	71

The complete system

SineSet®

SineSet® ACCESSORIES

SineSet®
BUILDING BLOCKS



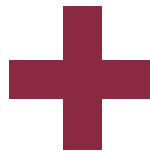
SINE PLATES



COMPOUND
SINE PLATES



90°
CONVERSION PLATE



ANGLE
PLATES



ELECTROMAGNETIC
CHUCKS



PERMANENT
MAGNETIC
CHUCKS



INDEX
FIXTURE



SINE
VISES



VACUUM
CHUCKS



V-BLOCKS

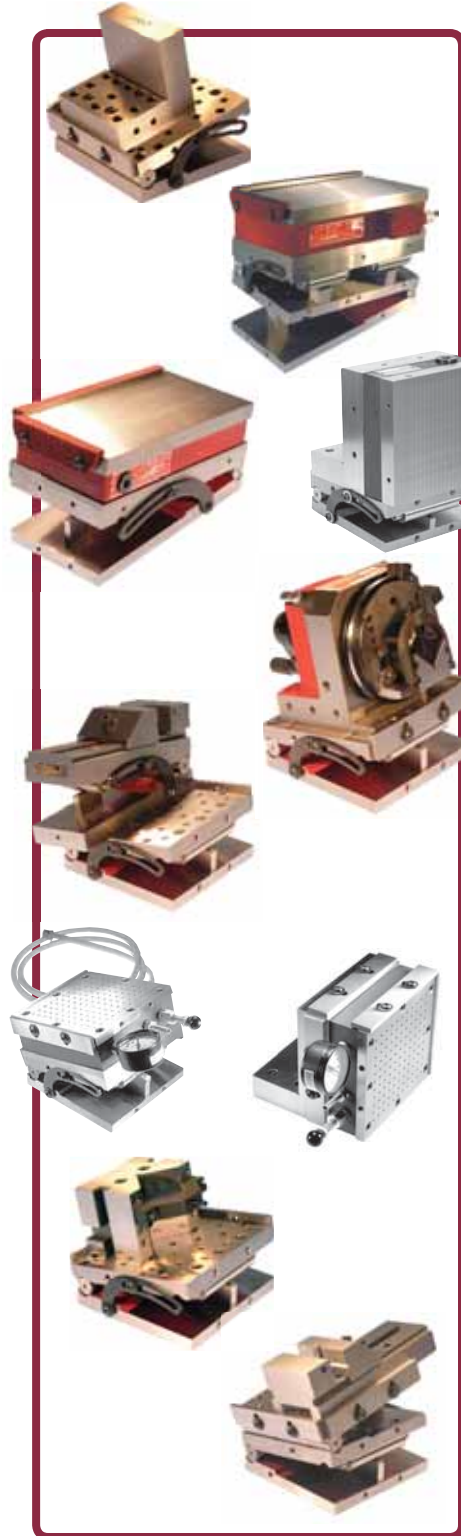


VICES



of bolt-together tools

THE SineSet® SYSTEM



- Saves TIME and MONEY.
- Gives you the COMPETITIVE EDGE.
- Allows QUICK SETUPS.
- Requires LESS INVESTMENT IN TOOLS.
- ELIMINATES CLAMPING.
- Needs little or NO INDICATING.
- An almost limitless number of TOOL COMBINATIONS.
- All tools can be used INDEPENDENTLY or as a SINE SYSTEM.
- Available in fitted wooden cases as **Complete SineSets®**.

SineSet® COMPATIBILITY CHART



SINE PLATES COMPOUND SINE PLATE 90° CONVERSION PLATE	ANGLE PLATES	90° CONVERSION PLATE	ELECTROMAGNETIC CHUCKS	INDEX FIXTURE	PERMANENT MAGNETIC CHUCKS	SINE VISES	VACUUM CHUCKS	V-BLOCKS	VISES
S0 SERIES									
SP-44-S0 SPC-44-S0	AP-334-S0	--	--	--	MC-44-FP-S0	--	--	VB-222-S0	V-225-S0
S1 SERIES									
SP-66-S1 SPC-66-S1	AP-444-S1	AP664-S1	--	MG-5CV-S1	MC-66-S1 MC-66-FP-S1	SV-337-S1	VC-66-S1	VB-334-S1	V-237-S1 V-237-J-S1
AP-664-S1	AP-444-S1	--	--	--	--	--	--	--	--
S2 SERIES									
SP-612-S2 SP-126-S2 SPC-612-S2	AP-446-S2	--	EMC-612-L-S2 EMC-612-T-S2	--	MC-612-S2 MC-612-FP-S2	SV-411-S2 SV-612-S2	VC-612-S2	VB-466-S2	V-411-S2 V-612-S2
SP-618-S2 SP-186-S2 SPC-618-S2	AP-446-S2	--	EMC-618-L-S2 EMC-618-T-S2	--	MC-618-S2 MC-618-FP-S2	SV-411-S2 SV-612-S2	VC-618-S2	VB-466-S2	V-411-S2 V-612-S2
SP-812-S2 SP-128-S2 SPC-812-S2	AP-446-S2	--	--	--	MC-812-S2 MC-812-FP-S2	SV-411-S2 SV-612-S2	--	VB-466-S2	V-411-S2 V-612-S2
SP-1212-S2 SPC-1212-S2	AP-446-S2	--	--	--	MC-1212-S2 MC-1212-FP-S2	SV-411-S2 SV-612-S2	--	VB-466-S2	V-411-S2 V-612-S2
SP-1218-S2 SP-1812-S2 SPC-1218-S2	AP-446-S2	--	EMC-1218-L-S2 EMC-1218-T-S2	--	MC-1218-S2 MC-1218-FP-S2	SV-411-S2 SV-612-S2	--	VB-466-S2	V-411-S2 V-612-S2
SP-1224-S2 SP-2412-S2	AP-446-S2	--	EMC-1224-L-S2 EMC-1224-T-S2	--	MC-1224-S2 MC-1224-FP-S2	SV-411-S2 SV-612-S2	--	VB-466-S2	V-411-S2 V-612-S2

COMPLETE SineSets®



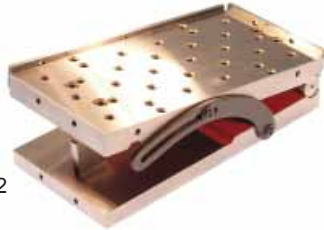
- Each patented SineSet® includes a complete matched system of bolt-together precision tools at a significant savings. Also included is a beautiful, fitted, wooden storage case.
- Each set includes a SineSet® sine plate or compound sine plate, a max-C-mag™ magnetic chuck, a vise and an angle plate. The SS-0 set also includes a v-block.
- Each set includes all necessary locking straps, rails, handles, bolts, screws & washers, as well as the proper T-handle hex wrench.
- Model numbers ending with 'F' include a **fine pole** magnetic chuck.
- Each of these SineSet® tools and the storage cases can be purchased separately.

MODEL #	SineSet® SERIES	TOOLS INCLUDED	WT (#)
SS-0AF	S0	SP-44-S0, AP-334-S0, V-225-S0, VB-222-S0 & MC-44-FP-S0	39
SS-0BF	S0	SPC-44-S0, AP-334-S0, V-225-S0, VB-222-S0 & MC-44-FP-S0	42
SS-1A	S1	SP-66-S1, AP-664-S1, V-237-S1, MC-66-S1	79
SS-1AF	S1	SP-66-S1, AP-664-S1, V-237-S1, MC-66-FP-S1	83
SS-1B	S1	SP-66-S1, AP-444-S1, V-237-S1, MC-66-S1	69
SS-1BF	S1	SP-66-S1, AP-444-S1, V-237-S1, MC-66-FP-S1	73
SS-1C	S1	SPC-66-S1, AP-664-S1, V-237-S1, MC-66-S1	88
SS-1CF	S1	SPC-66-S1, AP-664-S1, V-237-S1, MC-66-FP-S1	92
SS-1D	S1	SPC-66-S1, AP-444-S1, V-237-S1, MC-66-S1	78
SS-1DF	S1	SPC-66-S1, AP-444-S1, V-237-S1, MC-66-FP-S1	82

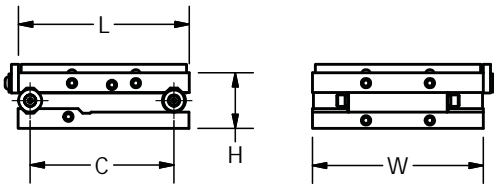
SINE PLATES



SP-66-S1



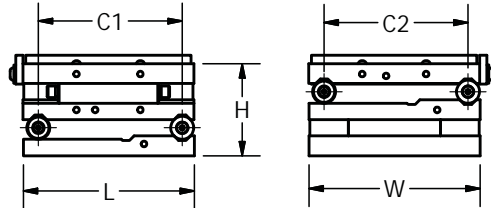
SP-126-S2



- Made of steel, hardened to Rc 58-60.
- Sizes up to 6" x 6" have 1/4-20 tapped holes, larger sizes have 3/8-16 tapped holes. Model # SP-555 has t-slots for 1/4" t-bolts.
- Gage block roll has two 0.200" minute steps for setting small angles with standard gage block sets.
- Models with the suffix S0, S1 or S2 are part of the SineSet® System. Other products with the same part number suffix will bolt directly to these sine plates (see page 32).
- A locking strap that always remains below the top surface and two self-storing, hardened & ground rails are standard.
- Angular accuracy guaranteed within 5 seconds of arc up to 15°, within 10 seconds up to 30°, & within 15 seconds up to 45°.

MODEL #	SineSet® SERIES	L	W	H	C	SQUARE & PARALLEL	WT (#)
SineSet® COMPATIBLE							
SP-44-S0	S0	4"	4"	2"	3" ±0.0002"	0.0002"	9
SP-66-S1	S1	6"	6"	2"	5" ±0.0002"	0.0002"	16
SP-612-S2	S2	6"	12"	2-5/8"	5" ±0.0002"	0.0003"	42
SP-126-S2	S2	12"	6"	2-5/8"	10" ±0.0002"	0.0003"	45
SP-618-S2	S2	6"	18"	3-3/8"	5" ±0.0002"	0.0004"	90
SP-186-S2	S2	18"	6"	3-3/8"	15" ±0.0003"	0.0004"	84
SP-812-S2	S2	8"	12"	2-5/8"	5" ±0.0002"	0.0003"	62
SP-128-S2	S2	12"	8"	2-5/8"	10" ±0.0002"	0.0003"	60
SP-1212-S2	S2	12"	12"	2-5/8"	10" ±0.0002"	0.0003"	90
SP-1218-S2	S2	12"	18"	3-3/8"	10" ±0.0003"	0.0004"	170
SP-1812-S2	S2	18"	12"	3-3/8"	15" ±0.0003"	0.0004"	200
SP-1224-S2	S2	12"	24"	4"	10" ±0.0004"	0.0005"	273
SP-2412-S2	S2	24"	12"	4"	20" ±0.0004"	0.0005"	267
NOT SineSet® COMPATIBLE							
SP-136	--	6"	3"	2"	5" ±0.0002"	0.0002"	9
SP-555	--	6"	5"	2-1/4"	5" ±0.0002"	0.0002"	17

COMPOUND SINE PLATES



SPC-66-S1



SPC-612-S2

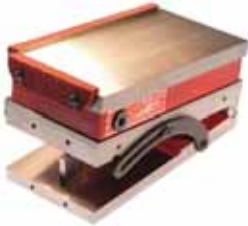
- Made of steel, hardened to Rc 58-60.
- Sizes up to 6" x 6" have 1/4-20 tapped holes, larger sizes have 3/8-16 tapped holes.
- Each gage block roll has two 0.200" minute steps for setting small angles with standard gage block sets.
- Models with the suffix S0, S1 or S2 are part of the SineSet® System. Other products with the same part number suffix will bolt directly to these sine plates (see page 32).
- Two locking straps that always remain below the top surface and two self-storing, hardened & ground rails are standard.
- Angular accuracy guaranteed within 5 seconds of arc up to 15°, within 10 seconds up to 30°, & within 15 seconds up to 45°.

MODEL #	SineSet® SERIES	L	W	H	C1	C2	SQUARE & PARALLEL	WT (#)
SPC-44-S0	S0	4"	4"	3-1/8"	3" ±0.0002"	3" ±0.0002"	0.0002"	12
SPC-66-S1	S1	6"	6"	3-1/8"	5" ±0.0002"	5" ±0.0002"	0.0002"	27
SPC-612-S2	S2	12"	6"	4-3/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	71
SPC-618-S2	S2	18"	6"	5-3/8"	15" ±0.0003"	5" ±0.0002"	0.0004"	134
SPC-812-S2	S2	12"	8"	4-3/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	93
SPC-1212-S2	S2	12"	12"	4-3/16"	10" ±0.0002"	10" ±0.0002"	0.0003"	137
SPC-1218-S2	S2	18"	12"	5-3/8"	15" ±0.0003"	10" ±0.0003"	0.0004"	278

PERMANENT MAGNETIC SINE PLATES

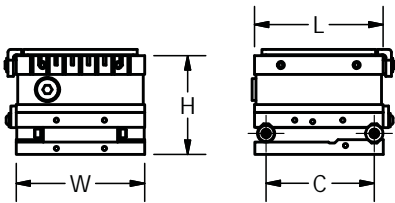


MSP-66-S1



MSP-126-FP-S2

- All chucks use ceramic magnets for superior holding power.
- Chucks are lubricated and sealed against dirt and liquids.
- A removable handle and two rails are included with each chuck.
- A locking strap and two self-storing, hardened & ground rails are included with each SineSet® sine plate.
- The gage block roll has two 0.200" minute steps for setting small angles with standard gage block sets.
- Models with the suffix "S0, S1 or S2" are part of the SineSet® System. The chuck can be removed, allowing the individual use of both the sine plate and magnetic chuck and allowing other products with the same part number suffix to bolt directly to the sine plate (see page 32).
- The sine plate portion is made of steel, hardened to Rc 58-60.



- STANDARD POLE : 1/4" poles and 1/8" separators produce deep flux lines for holding large and thick parts.
- FINE POLE: 1/8" poles and 1/8" separators produce shallow flux lines for holding small and thin parts.

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MODEL #		SineSet® SERIES	L	W	H	C	SQUARE & PARALLEL	WT (#)	
STANDARD	FINE POLE							STANDARD	FINE POLE
SineSet® COMPATIBLE									
--	MSP-44-FP-S0	S0	4"	4"	4-5/8"	3" ±0.0002"	0.0002"	--	21
MSP-66-S1	MSP-66-FP-S1	S1	6"	6"	4-5/8"	5" ±0.0002"	0.0002"	39	43
MSP-612-S2	MSP-612-FP-S2	S2	6"	12"	5-1/4"	5" ±0.0002"	0.0003"	89	94
MSP-126-S2	MSP-126-FP-S2	S2	12"	6"	5-1/4"	10" ±0.0002"	0.0003"	87	92
MSP-618-S2	MSP-618-FP-S2	S2	6"	18"	6"	5" ±0.0002"	0.0004"	155	160
MSP-186-S2	MSP-186-FP-S2	S2	18"	6"	6"	15" ±0.0003"	0.0004"	149	160
MSP-812-S2	MSP-812-FP-S2	S2	8"	12"	5-1/4"	5" ±0.0002"	0.0003"	120	125
MSP-128-S2	MSP-128-FP-S2	S2	12"	8"	5-1/4"	10" ±0.0002"	0.0003"	118	123
MSP-1212-S2	MSP-1212-FP-S2	S2	12"	12"	5-1/4"	10" ±0.0002"	0.0003"	190	196
MSP-1218-S2	MSP-1218-FP-S2	S2	12"	18"	6"	10" ±0.0003"	0.0004"	321	330
MSP-1812-S2	MSP-1812-FP-S2	S2	18"	12"	6"	15" ±0.0003"	0.0004"	318	327
MSP-1224-S2	MSP-1224-FP-S2	S2	12"	24"	6-5/8"	10" ±0.0004"	0.0005"	475	485
MSP-2412-S2	MSP-2412-FP-S2	S2	24"	12"	6-5/8"	20" ±0.0004"	0.0005"	469	479
NOT SineSet® COMPATIBLE (CHUCK NOT REMOVABLE)									
--	MSP-363-FP	--	6"	3"	4-1/4"	5" ±0.0002"	0.0002"	--	22
MSP-66	MSP-66-FP	--	6"	6"	4-1/4"	5" ±0.0002"	0.0002"	36	39

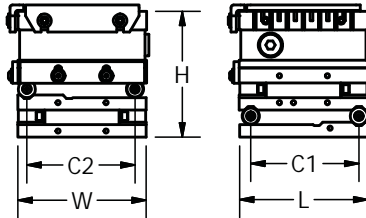
PERMANENT MAGNETIC COMPOUND SINE PLATES



MSPC-66-S1



MSPC-612-FP-S2



- All chucks use ceramic magnets for superior holding power.
- Chucks are lubricated and sealed against dirt and liquids.
- A removable handle and two rails are included with each chuck.
- Two locking straps and two self-storing, hardened & ground rails are included with each SineSet® compound sine plate.
- Each gage block roll has two 0.200" minute steps for setting small angles with standard gage block sets.
- Models with the suffix "S0, S1 or S2" are part of the SineSet® System. The chuck can be removed, allowing the individual use of both the compound sine plate and magnetic chuck and allowing other products with the same part number suffix to bolt directly to the compound sine plate (see page 32).
- The compound sine plate portion is made of steel, hardened to Rc 58-60.
- Angular accuracy guaranteed within 5 seconds of arc up to 15°, within 10 seconds up to 30°, & within 15 seconds up to 45°.
 - STANDARD POLE : 1/4" poles and 1/8" separators produce deep flux lines for holding large and thick parts.
 - FINE POLE: 1/8" poles and 1/8" separators produce shallow flux lines for holding small and thin parts.

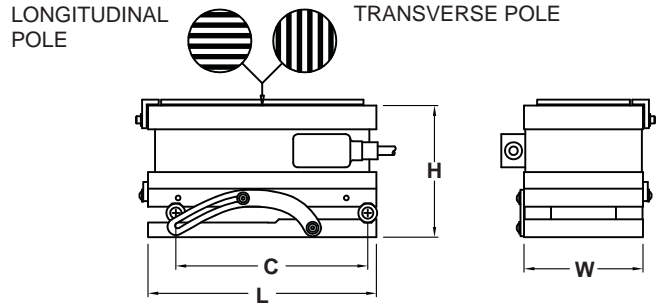
SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MODEL #		SineSet® SERIES	L	W	H	C1	C2	SQUARE & PARALLEL	WT (#)	
STANDARD	FINE POLE								STD.	F.P.
SineSet® COMPATIBLE										
--	MSPC-44-FP-S0	S0	4"	4"	5-3/4"	3" ±0.0002"	3" ±0.0002"	0.0002"	--	25
MSPC-66-S1	MSPC-66-FP-S1	S1	6"	6"	5-3/4"	5" ±0.0002"	5" ±0.0002"	0.0002"	48	52
MSPC-612-S2	MSPC-612-FP-S2	S2	12"	6"	6-13/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	113	118
MSPC-618-S2	MSPC-618-FP-S2	S2	18"	6"	8"	15" ±0.0003"	5" ±0.0002"	0.0004"	199	204
MSPC-812-S2	MSPC-812-FP-S2	S2	12"	8"	6-13/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	151	156
MSPC-1212-S2	MSPC-1212-FP-S2	S2	12"	12"	6-13/16"	10" ±0.0002"	10" ±0.0002"	0.0003"	237	243
MSPC-1218-S2	MSPC-1218-FP-S2	S2	18"	12"	8"	15" ±0.0003"	10" ±0.0003"	0.0004"	408	417
NOT SineSet® COMPATIBLE (CHUCK NOT REMOVABLE)										
MSPC-66	MSPC-66-FP	--	6"	6"	5-3/8"	5" ±0.0002"	5" ±0.0002"	0.0002"	44	48

ELECTROMAGNETIC SINE PLATES



ESP-612-T-S2



- Chuck top plates are laminated from 1/8" steel & 1/16" stainless steel, then furnace-brazed to form one solid piece.
- All units are sealed against dirt & liquids.
- Longitudinal (lengthwise) or transverse (crosswise) poles are available, based on the size & shape of the part to be held.
- **Chuck controls must be used with all electromagnetic chucks (see page 51)!**
- Sine plate and electromagnetic chuck can be used together or independently.

TRANSVERSE POLE MODELS

MODEL #	SineSet® SERIES	L	W	H	C	SQUARE & PARALLEL	WATTS	WT (#)
ESP-612-T-S2	S2	6"	12"	6-1/8"	5" ±0.0002"	0.0003"	72	122
ESP-126-T-S2	S2	12"	6"	6-1/8"	10" ±0.0002"	0.0003"	72	120
ESP-618-T-S2	S2	6"	18"	6-7/8"	5" ±0.0002"	0.0004"	130	207
ESP-186-T-S2	S2	18"	6"	6-7/8"	15" ±0.0003"	0.0004"	130	201
ESP-1218-T-S2	S2	12"	18"	6-7/8"	10" ±0.0003"	0.0004"	225	395
ESP-1812-T-S2	S2	18"	12"	6-7/8"	15" ±0.0003"	0.0004"	225	392
ESP-1224-T-S2	S2	12"	24"	7-1/2"	10" ±0.0004"	0.0005"	280	583
ESP-2412-T-S2	S2	24"	12"	7-1/2"	20" ±0.0004"	0.0005"	280	577

LONGITUDINAL POLE MODELS

MODEL #	SineSet® SERIES	L	W	H	C	SQUARE & PARALLEL	WATTS	WT (#)
ESP-612-L-S2	S2	6"	12"	5-7/8"	5" ±0.0002"	0.0003"	56	122
ESP-126-L-S2	S2	12"	6"	5-7/8"	10" ±0.0002"	0.0003"	56	120
ESP-618-L-S2	S2	6"	18"	6-5/8"	5" ±0.0002"	0.0004"	110	207
ESP-186-L-S2	S2	18"	6"	6-5/8"	15" ±0.0003"	0.0004"	110	201
ESP-1218-L-S2	S2	12"	18"	6-5/8"	10" ±0.0003"	0.0004"	150	395
ESP-1812-L-S2	S2	18"	12"	6-5/8"	15" ±0.0003"	0.0004"	150	392
ESP-1224-L-S2	S2	12"	24"	7-1/4"	10" ±0.0004"	0.0005"	200	583
ESP-2412-L-S2	S2	24"	12"	7-1/4"	20" ±0.0004"	0.0005"	200	577

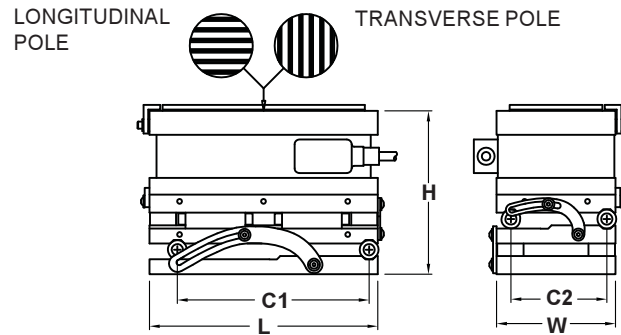
- Electromagnetic chuck can be quickly removed or replaced using only four bolts.
- Two self-storing, hardened & ground rails included for the sine plate.
- Two side rails included for the electromagnetic chuck.
- Gage block rolls provide dual 0.200" minute steps for setting small angles with standard gage blocks.
- Angular accuracy guaranteed within 5 seconds of arc up to 15°, within 10 seconds up to 30°, & within 15 seconds up to 45°.

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

ELECTROMAGNETIC COMPOUND SINE PLATES



ESPC-612-T-S2



- Chuck top plates are laminated from 1/8" steel & 1/16" stainless steel, then furnace-brazed to form one solid piece.
- All units are sealed against dirt & liquids.
- Longitudinal (lengthwise) or transverse (crosswise) poles are available, based on the size & shape of the part to be held.
- **Chuck controls must be used with all electromagnetic chucks (see page 51)!**
- The electromagnetic chuck can be quickly removed or replaced using only four bolts. The compound sine plate & electromagnetic chuck can be used together or independently.
- Two self-storing, hardened & ground rails included for the compound sine plate.
- Two side rails included for the electromagnetic chuck.
- Gage block rolls provide dual 0.200" minute steps for setting small angles with standard gage blocks.
- Angular accuracy guaranteed within 5 seconds of arc up to 15°, within 10 seconds up to 30°, & within 15 seconds up to 45°.

TRANSVERSE POLE MODELS

MODEL #	SineSet® SERIES	L	W	H	C1	C2	SQUARE & PARALLEL	WATTS	WT (#)
ESPC-612-T-S2	S2	12"	6"	7-11/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	72	146
ESPC-618-T-S2	S2	18"	6"	8-7/8"	15" ±0.0003"	5" ±0.0002"	0.0004"	130	251
ESPC-1218-T-S2	S2	18"	12"	8-7/8"	15" ±0.0003"	10" ±0.0003"	0.0004"	225	482

LONGITUDINAL POLE MODELS

MODEL #	SineSet® SERIES	L	W	H	C1	C2	SQUARE & PARALLEL	WATTS	WT (#)
ESPC-612-L-S2	S2	12"	6"	7-7/16"	10" ±0.0002"	5" ±0.0002"	0.0003"	56	146
ESPC-618-L-S2	S2	18"	6"	8-5/8"	15" ±0.0003"	5" ±0.0002"	0.0004"	110	251
ESPC-1218-L-S2	S2	18"	12"	8-5/8"	15" ±0.0003"	10" ±0.0003"	0.0004"	150	482

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

THE ROBBINS LINE

FORMERLY BY EX-CELL-O / ROBBINS

OUR
BEST

This premium line of sine plates from Suburban Tool is a result of the purchase in 1989 of the EX-CELL-O/ROBBINS sine plate line from Micro Precision, a subsidiary of Textron, Inc. We have maintained the quality of these products by following the same blueprints and production procedures. Some changes have been made to improve the product.

In this section of the catalog, you will find sine plates for precision grinding, light and heavy machining, and inspection applications. There are many models available for single and compound angular set-ups in a wide range of sizes from 4" x 4" to 60" x 60". Within this wide range there are three different types, shown below: the **MASTER-SINE™**, a non-magnetic plate for inspection and light machining; the **MAGNA-SINE™**, a magnetic-type employing fine pole ceramic magnets; and the **HEAVY-DUTY** sine plates, for tough machining.

MASTER-SINE™ SINE PLATES

FORMERLY BY EX-CELL-O / ROBBINS

- Made of steel, hardened to Rc58-60.
- B-3-SP and B-5-SP have 1/4-20 tapped holes. The remaining models have 5/16-18.
- The roll bar is made from hardened steel, ground and lapped for straightness and roundness.
- Swivel block provides full face contact with gage blocks keeping them securely in place.
- Exclusive locking device inside the hinge roll provides a positive lock with an expanding action. Both screws lock toward the front of the unit, pulling the top plate down on the setup gage blocks without distortion. Hinge is made from hardened steel, ground and lapped.
- Angular accuracy of set-ups is guaranteed to be within 5 seconds of arc up to 15°, 10 seconds up to 30°, and 15 seconds up to 45°.
- Side and back rail included.

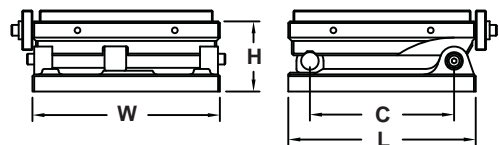


B-5-SP



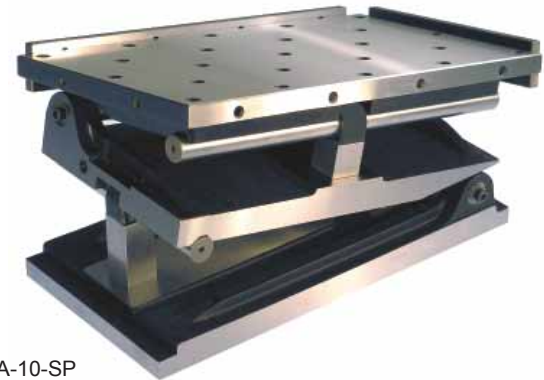
B-10-SP

MODEL #	L	W	H	C	SQUARE & PARALLEL	WT (#)
B-3-SP	4"	4"	2"	3" ±0.0002"	0.0002"	8
B-5-SP	6-1/2"	6-1/2"	2-1/2"	5" ±0.0002"	0.0002"	22
B-10-SP	12-1/2"	7-3/4"	2-7/8"	10" ±0.0002"	0.0003"	55
B-15-SP	18-1/4"	6-3/4"	3-3/4"	15" ±0.0003"	0.0004"	98

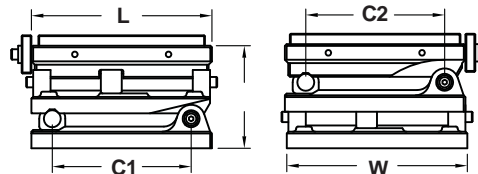


MASTER-SINE™ COMPOUND SINE PLATES

FORMERLY BY EX-CELL-O / ROBBINS



- Made of steel, hardened to Rc58-60.
- A-5-SP has 1/4-20 tapped holes. The remaining models have 5/16-18.
- The roll bar is made from hardened steel, ground and lapped for straightness and roundness.
- Swivel block provides full face contact with gage blocks, keeping them securely in place.
- Exclusive locking device inside the hinge roll provides a positive lock with an expanding action. Both screws lock toward the front of the unit, pulling the top plate down on the set-up gage blocks without distortion. Hinge is made from hardened steel, ground and lapped.
- Angular accuracy of set-ups is guaranteed to be within 5 seconds of arc up to 15°, 10 seconds up to 30°, and 15 seconds up to 45°.
- Side and back rail included.



MODEL #	L	W	H	C1	C2	SQUARE & PARALLEL	WT (#)
A-5-SP	6-1/2"	6-1/2"	3-3/4"	5" ±0.0002"	5" ±0.0002"	0.0002"	30
A-10-SP	12-1/2"	7-3/4"	4-5/8"	10" ±0.0002"	5" ±0.0002"	0.0003"	80
A-15-SP	18-1/4"	6-3/4"	5-3/4"	15" ±0.0003"	5" ±0.0002"	0.0004"	145

MASTER-SINE™ HEAVY-DUTY SINE PLATES

FORMERLY BY EX-CELL-O / ROBBINS

SINE PLATES FOR ANGULAR MACHINING WITH POSITIVE, REPETITIVE ACCURACY

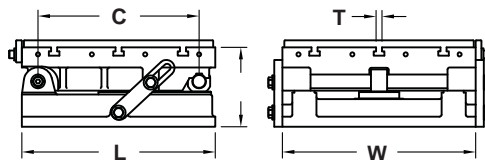


B-12



B-24

- The materials for HEAVY-DUTY sine plates are carefully selected to withstand the thrust and chatter of machining cuts, during a long life of accurate service.
- Heavy-Duty sine plates incorporate all of the features of the standard Master-Sine™ plates, plus include the following additional features:
 - The top and bottom plates are made from heavy-sectioned class 35-40 cast iron for extra strength.
 - Top plates of all models are t-slotted for convenient clamping of work pieces. T-slots are held parallel with the sides of the top plate within 0.0005" per 12".
 - Models B-24 and B-34 are supplied with a built-in screw elevating mechanism for safe and easy opening and closing.
 - All models, except the B-12, have a hand-flaked top surface. The B-12 is ground.
 - All models include extra-heavy locking straps.



MODEL #	L	W	H	C	T	SQUARE & PARALLEL	WT (#)
B-12	12"	12"	5"	10" ±0.0003"	3/8" (Fits 5/16" T-Nut)	0.0003"	115
B-24	24"	24"	7-1/2"	20" ±0.0005"	11/16" (Fits 5/8" T-Nut)	0.0005"	630
B-34	34"	34"	10-1/2"	25" ±0.0005"	13/16" (Fits 3/4" T-Nut)	0.0005"	2,700

MAGNA-SINE™ MAGNETIC SINE PLATES

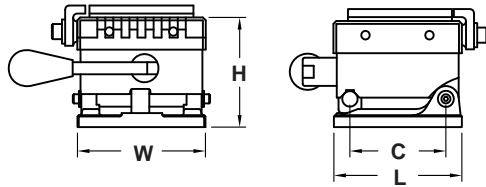
FORMERLY BY EX-CELL-O / ROBBINS



B-10-MS



B-5-MS



B-3-MS

- MAGNA-SINE™ sine plates are equipped with extremely powerful ceramic magnet chucks. Having stationary magnets in the top plate and a movable magnet core, these chucks provide an average holding power of up to 100 pounds per square inch.
- The chucks provide maximum holding of both small & large parts due to a combination fine / standard pole spacing.
- All but the chuck is made of steel hardened to Rc 58-60.
- The gage block & hinge rolls are ground and lapped for straightness and roundness.
- The swivel block provides full face contact with gage blocks, keeping them securely in place.
- An exclusive locking device inside the hinge roll provides a positive lock with an expanding action. Both screws lock toward the front of the unit, pulling the top plate down on the setup gage blocks without distortion.
- The angular accuracy is guaranteed to be within 5 seconds of arc up to 15°, 10 seconds up to 30°, and 15 seconds up to 45°.
- Side and back rails are included.

MODEL #	L	W	H	C	SQUARE & PARALLEL	WT (#)
B-3-MS	4"	4"	3-1/2"	3" ±0.0002"	0.0002"	13
B-5-MS	6-1/2"	6-1/2"	3-7/8"	5" ±0.0002"	0.0002"	37
B-10-MS	6-1/2"	12"	4-1/2"	5" ±0.0002"	0.0003"	70
B-15-MS	6-3/4"	18-1/4"	4-15/16"	5" ±0.0003"	0.0004"	125

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MAGNA-SINE™ MAGNETIC COMPOUND SINE PLATES

FORMERLY BY EX-CELL-O / ROBBINS

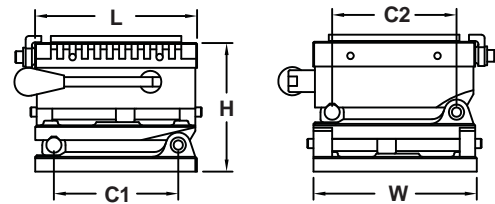
- MAGNA-SINE™ compound magnetic sine plates are equipped with extremely powerful ceramic magnet chucks. Having stationary magnets in the top plate and a movable magnet core, these chucks provide an average holding power of up to 100 pounds per square inch. This is nearly twice the holding power of a standard chuck!
- The chucks provide maximum holding of both small & large parts due to a combination fine / standard pole spacing.
- All but the chuck is made of steel hardened to Rc 58-60.
- The gage block and hinge rolls ground and lapped for straightness and roundness.
- The swivel blocks provide full face contact with gage blocks, keeping them securely in place.
- An exclusive locking device inside each hinge roll provides a positive lock with an expanding action. The screws lock toward the open end of the unit, pulling the plate down on the setup gage blocks without distortion.
- The angular accuracy is guaranteed to be within 5 seconds of arc up to 15°, 10 seconds up to 30°, and 15 seconds up to 45°.
- Side and back rails are included.
- Available hinged as STANDARD (shown) or OPPOSITE-HAND.



A-5-MS



A-10-MS



MODEL #	L	W	H	C1	C2	SQUARE & PARALLEL	WT (#)
A-5-MS	6-1/2"	6-1/2"	5-3/16"	5" ±0.0002"	5" ±0.0002"	0.0002"	45
A-10-MS	12-1/2"	6-1/2"	6-1/8"	10" ±0.0002"	5" ±0.0002"	0.0003"	100
A-15-MS	18-1/4"	6-3/4"	6-7/8"	15" ±0.0003"	5" ±0.0003"	0.0004"	200

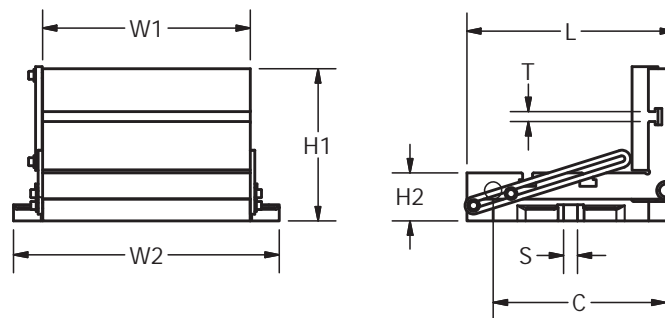
SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MILL-MASTER™

A VERSATILE SINE PLATE FOR MILLING MACHINES



- Specifically designed for use on milling machines.
- Mounts directly to table with standard t-bolts and nuts.
- Solid, class 35-40 cast iron construction.
- T-slots for 1/2" t-bolts or t-nuts in top plate for easy mounting of clamps or vises.
- Includes edge rail for quick locating of a workpiece.
- Can be used as standard angle plate in the closed position.



MODEL #	L	W1	W2	H1	H2	C	S	T	SQUARE & PARALLEL	WT (#)
SPBM-10	12"	12"	15-1/2"	8-3/4"	2-25/32"	10" ±0.001"	25/32"	9/16"	±0.001"	100

ELECTROMAGNETIC SINE PLATE CHUCKS



EMC-612-T-S2

- Designed to bolt directly, with little or no indicating, to a SineSet® sine plate or compound sine plate of the same size & series. See page 50 for electromagnetic surface grinder chucks.
- Top plates are laminated from 1/8" steel & 1/16" stainless steel, then furnace-brazed to form one solid piece.
- All units are sealed against dirt & liquids.
- Longitudinal (lengthwise) or transverse (crosswise) poles are available, based on the size & shape of the part to be held.
- **Chuck controls must be used with all electromagnetic chucks (see page 51)!**
- Two side rails are included with each chuck.

TRANSVERSE POLE MODELS

MODEL #	SineSet® SERIES	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	WATTS	WT (#)
EMC-612-T-S2	S2	12"	6"	3-1/2"	0.0003"	72	75
EMC-618-T-S2	S2	18"	6"	3-1/2"	0.0004"	130	117
EMC-1218-T-S2	S2	18"	12"	3-1/2"	0.0005"	225	225
EMC-1224-T-S2	S2	24"	12"	3-1/2"	0.0005"	280	310

LONGITUDINAL POLE MODELS

MODEL #	SineSet® SERIES	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	WATTS	WT (#)
EMC-612-L-S2	S2	12"	6"	3-1/4"	0.0003"	56	75
EMC-618-L-S2	S2	18"	6"	3-1/4"	0.0004"	110	117
EMC-1218-L-S2	S2	18"	12"	3-1/4"	0.0005"	150	225
EMC-1224-L-S2	S2	24"	12"	3-1/4"	0.0005"	200	310

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

PERMANENT MAGNETIC SINE PLATE CHUCKS



MC-66-S1



MC-66-S1
Used as a Squaring Chuck



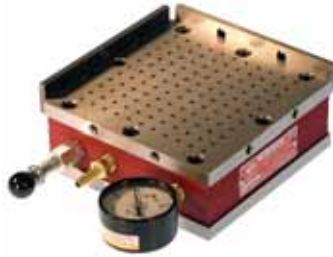
MC-612-FP-S2

- Models with the suffix "S0, S1 or S2" are part of the SineSet® System. The chucks are designed to bolt directly, with little or no indicating, to a SineSet® sine plate or compound sine plate of the same size and series to form a magnetic sine plate or magnetic compound sine plate. **See page 49 & 52 for permanent magnetic surface grinder chucks.**
- Can be used alone as a parallel chuck. The 4" x 4" and 6" x 6" models can also be used as squaring chucks.
- Made with ceramic magnets for superior holding power.
- Chucks are lubricated and sealed against dirt and liquids.
- Includes handle, side and back rails.
- 12" x 12" models and larger have a **non-removable** handle.
- STANDARD POLE: 1/4" poles and 1/8" separators produce deep flux lines for holding large and thick parts.
- FINE POLE: 1/8" poles and 1/8" separators produce shallow flux lines for holding small and thin parts.

MODEL #		SineSet® SERIES	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	WT (#)	
STANDARD	FINE POLE						STANDARD	FINE POLE
SineSet® COMPATIBLE								
--	MC-44-FP-S0	S0	4"	4"	2-5/8"	0.0002"	--	12
MC-66-S1	MC-66-FP-S1	S1	6"	6"	2-5/8"	0.0002"	21	25
MC-612-S2	MC-612-FP-S2	S2	12"	6"	2-5/8"	0.0003"	42	47
MC-618-S2	MC-618-FP-S2	S2	18"	6"	2-5/8"	0.0003"	65	70
MC-812-S2	MC-812-FP-S2	S2	12"	8"	2-5/8"	0.0003"	58	63
MC-1212-S2	MC-1212-FP-S2	S2	12"	12"	2-5/8"	0.0003"	100	106
MC-1218-S2	MC-1218-FP-S2	S2	18"	12"	2-5/8"	0.0004"	151	160
MC-1224-S2	MC-1224-FP-S2	S2	24"	12"	2-5/8"	0.0004"	202	212
NOT SineSet® COMPATIBLE (SQUARING CHUCK ONLY)								
--	MC-36-FP	--	6"	3"	2-5/8"	0.0002"	--	13
MC-99	MC-99-FP	--	9"	9"	2-5/8"	0.0004"	49	53

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

VACUUM SINE PLATE CHUCKS



VC-66-S1

- Provides an excellent means for holding non-magnetic workpieces for light machining or grinding.
- Designed to be bolted directly to a SineSet® sine plate or compound sine plate of the same size & series with little or no indicating. The VC-66-S1 also bolts directly to the AP-664-S1 angle plate.
- Each chuck has three 1/4 NPT holes for mounting the vacuum gage, relief valve and hose fitting.
- The vacuum gage and relief valve are included.
- All chucks have back and end rails provided for positive location of workpieces.

MODEL #	SineSet® SERIES	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	RECOMMENDED PUMP SIZE	WT (#)
VC-66-S1	S1	6"	6"	2-1/4"	0.0002"	1/4 H.P. OR LARGER	15
VC-612-S2	S2	12"	6"	2-1/4"	0.0003"	1/2 H.P. OR LARGER	28
VC-618-S2	S2	18"	6"	2-1/4"	0.0004"	1/2 H.P. OR LARGER	41

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

VACUUM PUMPS



VCP-34-MM

- All models are oilless, motor-mount, rotary vane design for maximum performance with minimum upkeep.
- Each unit has internal mufflers and filters. The filters were specifically designed to be easily removed and replaced.
- The pumps have built-in thermal overload protection.
- Each model includes a support base, the proper fittings and six feet of reinforced hose.

NOTE: Because electric motors are dual frequency, multi-voltage AC for worldwide applications, they are supplied without an electric cord, ready to be wired to user specifications.

MODEL #	ELECTRIC MOTOR	CFM FREE AIR			MAXIMUM VACUUM	WT (#)
		at 0" Hg	at 10" Hg	at 20" Hg		
VCP-14-MM	1/4 HP, 110-115/208-230V, 50-60 Hz, 1 Phase	4.5	2.6	1.0	10 PSI	35
VCP-34-MM	3/4 HP, 110-115/208-230V, 50-60 Hz, 1 Phase	8.0	5.0	2.4	10 PSI	54

PERMANENT MAGNETIC SURFACE GRINDER CHUCKS



MCB-618-FP

- Ceramic magnets provide superior holding power that never fades.
- Sealed against dirt and liquids.
- Front mounted handle is removable to eliminate interference.
- Handle, back rail, side rail and two clamps included.
- 8" x 15" models and larger have a **non-removable** handle.
- STANDARD POLE : 1/4" poles and 1/8" separators produce deep flux lines for holding large and thick parts.
- FINE POLE: 1/8" poles and 1/8" separators produce shallow flux lines for holding small and thin parts.

MODEL #		LENGTH	WIDTH	HEIGHT	WT (#)	
STANDARD	FINE POLE				STANDARD	FINE POLE
MCB-47	MCB-47-FP	7-1/2"	4"	2-5/8"	19	19
MCB-510	MCB-510-FP	10-1/2"	5"	2-5/8"	35	35
MCB-612	MCB-612-FP	12-1/2"	6"	2-5/8"	45	47
MCB-614	MCB-614-FP	14-1/2"	6"	2-5/8"	55	55
MCB-618	MCB-618-FP	18-1/2"	6"	2-5/8"	69	70
MCB-812	MCB-812-FP	12-1/2"	8"	2-5/8"	63	63
MCB-815	MCB-815-FP	15-1/2"	8"	2-5/8"	88	89
MCB-818	MCB-818-FP	18-1/2"	8"	2-5/8"	119	120
MCB-824	MCB-824-FP	24-1/2"	8"	2-5/8"	126	126
MCB-1015	MCB-1015-FP	15-1/2"	10"	2-5/8"	111	111
MCB-1018	MCB-1018-FP	18-1/2"	10"	2-5/8"	134	134
MCB-1024	MCB-1024-FP	24-1/2"	10"	2-5/8"	178	178
MCB-1212	MCB-1212-FP	12-1/2"	12"	2-5/8"	107	107
MCB-1218	MCB-1218-FP	18-1/2"	12"	2-5/8"	161	161
MCB-1224	MCB-1224-FP	24-1/2"	12"	2-5/8"	213	213

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

ELECTROMAGNETIC SURFACE GRINDER CHUCKS



EMCB-618-L

- Top plate has 1/8" steel poles and 1/16" stainless steel separators.
- Chucks are sealed against dirt and liquids.
- Longitudinal (lengthwise) or transverse (crosswise) pole models available.
- Two clamps, backrail and side rail included.
- **Chuck controls must be used with all electromagnetic chucks!**

TRANSVERSE POLE MODELS

MODEL #	LENGTH	WIDTH	HEIGHT	WATTS	WT (#)
EMCB-612-T	12-1/2"	6"	3-1/2"	72	75
EMCB-618-T	18-1/2"	6"	3-1/2"	130	117
EMCB-815-T	15-1/2"	8"	3-1/2"	125	132
EMCB-818-T	18-1/2"	8"	3-1/2"	150	160
EMCB-824-T	24-1/2"	8"	3-1/2"	220	180
EMCB-1015-T	15-1/2"	10"	3-1/2"	160	165
EMCB-1024-T	24-1/2"	10"	3-1/2"	240	255
EMCB-1036-T	36-1/2"	10"	3-1/2"	350	370
EMCB-1216-T	16-1/2"	12"	3-1/2"	200	200
EMCB-1218-T	18-1/2"	12"	3-1/2"	225	225
EMCB-1224-T	24-1/2"	12"	3-1/2"	280	310
EMCB-1230-T	30-1/2"	12"	3-1/2"	390	371
EMCB-1236-T	36-1/2"	12"	3-1/2"	430	442

LONGITUDINAL POLE MODELS

MODEL #	LENGTH	WIDTH	HEIGHT	WATTS	WT (#)
EMCB-612-L	12-1/2"	6"	3-1/4"	56	75
EMCB-618-L	18-1/2"	6"	3-1/4"	110	117
EMCB-815-L	15-1/2"	8"	3-1/4"	85	132
EMCB-818-L	18-1/2"	8"	3-1/4"	100	160
EMCB-824-L	24-1/2"	8"	3-1/4"	150	180
EMCB-1015-L	15-1/2"	10"	3-1/4"	100	165
EMCB-1024-L	24-1/2"	10"	3-1/4"	180	255
EMCB-1036-L	36-1/2"	10"	3-1/4"	300	370
EMCB-1216-L	16-1/2"	12"	3-1/4"	135	200
EMCB-1218-L	18-1/2"	12"	3-1/4"	150	225
EMCB-1224-L	24-1/2"	12"	3-1/4"	200	310
EMCB-1230-L	30-1/2"	12"	3-1/4"	250	371
EMCB-1236-L	36-1/2"	12"	3-1/4"	300	442

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

ELECTROMAGNETIC CHUCK CONTROLS



CC-150-MV



CC-300-AV

- Specifically matched to the input requirements of Suburban's electromagnetic chucks.
- 115 volts AC input.
- 0-110 volts DC output.
- Controls with automatic release cycle free operator from manual demagnetizing.
- Automatic release models also have touchpad controls for easy operation.
- **Chuck controls must be used with all electromagnetic chucks!**

MODEL #	OUTPUT POWER		RELEASE	WT (#)
	TYPE	WATTS		
CC-150-MV	Variable	0-150	Manual	8
CC-150-AV	Variable	0-150	Automatic	13
CC-300-AV	Variable	0-300	Automatic	16
CC-500-AV	Variable	0-500	Automatic	18

MAGNUM-FORCE™ SURFACE GRINDER CHUCKS

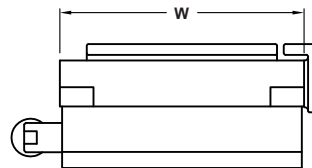
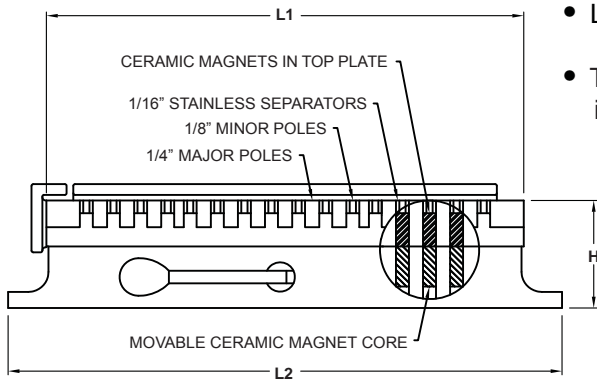
**OUR
STRONGEST
CHUCKS**



DMB-510

PERMANENT MAGNETIC CHUCKS WITH **DUAL MAGNETS**

- Made with ceramic magnets for superior holding power.
- Stationary magnets in the top plate and a movable magnet core provide an average holding power of up to 100 pounds per square inch. This is twice the power of a standard chuck.
- Chucks are lubricated and sealed against dirt and liquids.
- A rigid work surface is provided by the laminated and brazed top plate.
- These chucks provide maximum holding power of both small and large parts, due to the combination fine / standard pole spacing.
- Low height for more work clearance.
- Two hold-down clamps, one side rail and one end rail are included.



FULL 24 MONTH WARRANTY

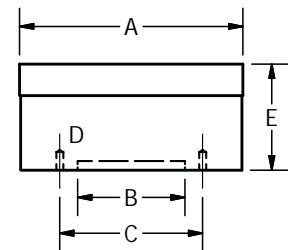
MODEL #	L1	L2	W	H	WT (#)
DMB-44	4"	4-3/4"	4"	2-3/8"	10
DMB-48	8"	9-1/8"	4"	2-3/8"	20
DMB-510	10"	11-1/8"	5"	2-3/4"	28
DMB-512	12"	13-1/8"	5"	2-3/4"	35
DMB-66	6"	7-1/8"	6-1/2"	2-3/4"	25
DMB-610	10"	11-1/8"	6"	2-3/4"	35
DMB-612	12"	13-1/8"	6"	2-3/4"	47
DMB-614	14"	15-1/2"	6"	2-3/4"	52
DMB-618	18"	20"	6"	2-3/4"	66
DMB-815	15"	15-3/4"	8"	2-3/4"	73

MODEL #	L1	L2	W	H	WT (#)
DMB-818	18"	18-3/4"	8"	2-3/4"	87
DMB-820	20"	20-3/4"	8"	2-3/4"	102
DMB-824	24"	24-3/4"	8"	2-3/4"	116
DMB-1015	15"	15-3/4"	10"	2-3/4"	90
DMB-1018	18"	18-3/4"	10"	2-3/4"	101
DMB-1020	20"	20-3/4"	10"	2-3/4"	125
DMB-1024	24"	24-3/4"	10"	3-1/2"	134
DMB-1218	18"	18-3/4"	12"	3-1/2"	170
DMB-1224	24"	24-3/4"	12"	3-1/2"	192

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

ROUND PERMANENT MAGNETIC CHUCKS

- Ideally suited for holding magnetic workpieces on I.D. grinders and other machinery requiring a rotating chuck.
- Ceramic magnets provide superior holding power that never fades and require no electrical controls or collector rings.
- Thick top plates are laminated from steel and stainless steel, then furnace brazed into one solid piece. The top plates can be drilled and tapped in places to three quarters of their thickness, if necessary.
- All models, **except the RMC-5**, which uses the swing-type on-off method, are sealed against water and other elements.
- Back surface of aluminum chuck body has tapped holes (D) and a turned counterbore (B) for convenient mounting to your machine.
- Removable on-off handle included with each chuck.
- **STANDARD POLE** : 1/4" poles and 1/8" separators produce deep flux lines for holding large and thick parts. (RMC-15 and RMC-20 have 3/8" poles and 3/8" separators).
- **FINE POLE**: 1/8" poles and 1/8" separators produce shallow flux lines for holding small and thin parts.



STANDARD POLE MODELS

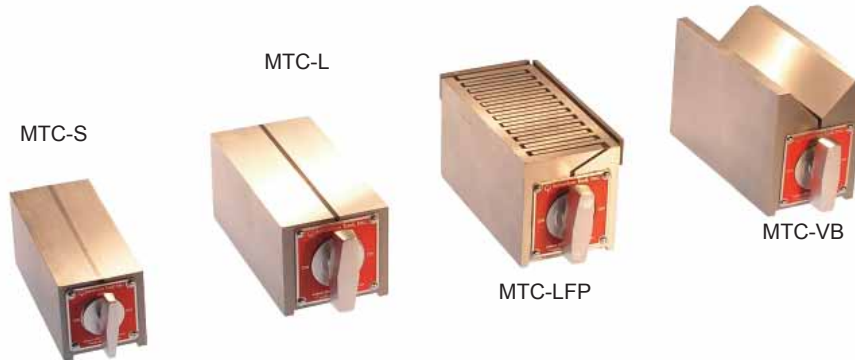
MODEL #	A	B	C	D	E	WT (#)
RMC-5	5-1/2"	3" x 1/8"	4"	(4) 1/4-20	3"	15
RMC-6	6-1/4"	3" x 1/8"	4"	(4) 1/4-20	3"	17
RMC-8	7-3/4"	4" x 3/16"	5"	(4) 3/8-16	2-15/16"	27
RMC-9	9-1/4"	4" x 3/16"	5"	(4) 3/8-16	3"	37
RMC-10	10-1/8"	4" x 3/16"	5"	(4) 3/8-16	3"	41
RMC-12	12-1/4"	4" x 3/16"	5"	(4) 3/8-16	3"	60
RMC-15	15-1/4"	6" x 1/4"	7-3/8"	(6) 5/16-18	3-1/2"	120
RMC-16	16-1/4"	8" x 3/16"	9"	(6) 3/8-16	3"	96
RMC-20	20-1/4"	11" x 1/4"	12-13/32"	(6) 3/8-16	3-1/2"	205

FINE POLE MODELS

MODEL #	A	B	C	D	E	WT (#)
RMC-6-FP	6-1/4"	3" x 1/8"	4"	(4) 1/4-20	2-15/16"	18
RMC-8FP	7-3/4"	4" x 3/16"	5"	(4) 3/8-16	2-15/16"	27
RMC-10-FP	10-1/8"	4" x 3/16"	5"	(4) 3/8-16	2-15/16"	43
RMC-12-FP	12-1/4"	4" x 3/16"	5"	(4) 3/8-16	2-15/16"	62

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MAGNETIC TOOLMAKER'S CHUCKS



- On-Off switch controls powerful Alnico magnet.
- Top and bottom magnetize simultaneously.
- Bottom surface relieved 1/8" to minimize loss of magnetism.
- Model MTC-LFP has 3/16" x 1/16" fine pole construction for holding small or thin parts. It also includes removable side and end rails.
- The vee on the MTC-VB models is central within 0.0005".

MODEL #		LENGTH	WIDTH	HEIGHT	90° VEE CAPACITY	FLAT, SQUARE & PARALLEL	WT (#)	
SINGLE	MATCHED PAIR						SINGLE	MATCHED PAIR
MTC-S	--	5"	2"	2"	--	0.0005"	6	--
MTC-L	--	5-1/2"	2-3/4"	2-1/2"	--	0.0005"	11	--
MTC-LFP	--	5-1/2"	2-3/4"	3"	--	0.0005"	12	--
MTC-VB	MTC-VB-M	5-1/2"	2-3/4"	3-5/8"	2-3/4"	0.0005"	13	26

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

MAGNA-SQUARE™ MAGNETIC ANGLE IRON



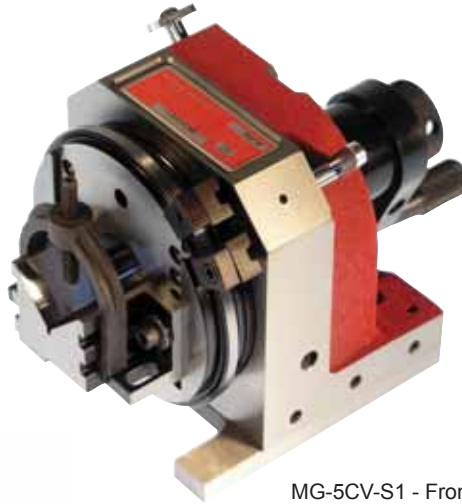
MAI-644

- A versatile tool for layout, inspection and squaring operations.
- Combines the advantages of a universal right angle iron and a magnetic chuck.
- Magnetic face is energized by turning recessed control knob.
- Can be placed on any side for workholding.
- Support rib provides structural strength and acts as a carrying handle.
- Body made from class 35-40 cast iron.

MODEL #	LENGTH	WIDTH	HEIGHT	FLAT, SQUARE & PARALLEL	WT (#)
MAI -644	4-3/4"	4-1/4"	6-1/2"	0.0003"	18

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

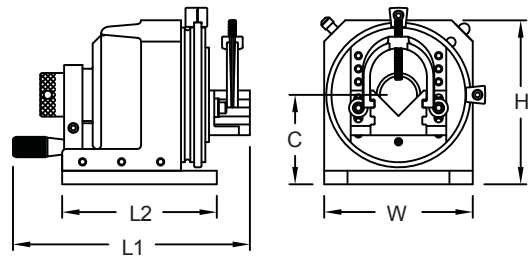
Master-Grind™ INDEX FIXTURE



MG-5CV-S1 - Front View



MG-5CV-S1 - Rear View



- V-Block & 5C collet in one fixture.
- 72 position index plate provides a hard stop every $5^\circ \pm 15$ arc seconds.
- Built-in 2.5" sine bar for setting angles between hard index locations.
- Horizontal or vertical v-block mounting.
- Spindle runs in two heavy-duty 4" tapered roller bearings.
- Maximum spindle runout of 0.000050".
- Fitted wooden case included.
- Bolts directly to a SineSet® sine plate or compound sine plate of the S1 series. Also bolts to the AP-664-S1 90° conversion plate.

FULL 24 MONTH WARRANTY

MODEL #	SineSet® SERIES	COLLET CAPACITY	V-BLOCK CAPACITY	THROUGH HOLE	C	L1	L2	W	H	SQUARE & PARALLEL	WT (#)
MG-5CV-S1	S1	1-1/16"	1-5/8"	1-1/4"	3"	8-15/16"	5-3/16"	5"	5-1/2"	0.0002"	32

Covered by design patent D327077.

ACCESSORIES FOR THE Master-Grind™ INDEX FIXTURE

MOTOR DRIVE KIT



MG5-MD



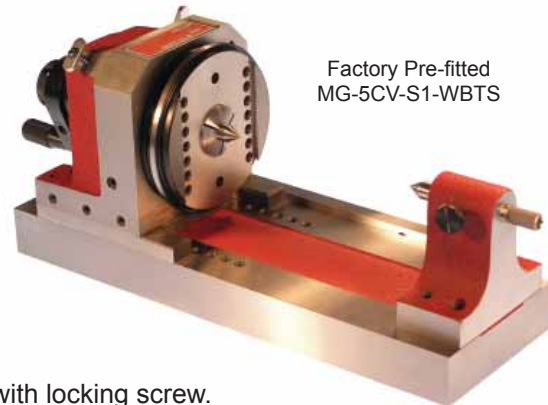
Optional MG5-MD
shown on
MG-5CV-S1

- 1/15 HP, reversible, variable speed, 60 to 300 RPM.
- Can be mounted on either side of the index fixture.
- Includes mounting bracket, motor pulley, drive belt & screws.

BASEPLATE & TAILSTOCK



MG5-BTS



Factory Pre-fitted
MG-5CV-S1-WBTS

- Tailstock has 1/2" diameter x 60°, spring loaded center with locking screw.
- Baseplate and edge guide are hardened and ground.
- 1/2" 5C collet and steel 60° headstock center included.

MODEL #	DESCRIPTION	LENGTH	WIDTH	HEIGHT	CAPACITY		WT (#)
					DIAMETER	LENGTH	
MG5-BTS *	BASEPLATE & TAILSTOCK	16-7/16"	5-1/2"	4-23/32"	5-3/4"	7-1/4"	22
MG5-MD	MOTOR DRIVE KIT	8-5/32"	3-15/16"	5-5/32"	--	--	8
MG-5CV-S1-WBTS	FACTORY PRE-FITTED MG-5CV-S1 & MG5-BTS	16-7/16"	5-1/2"	7"	5-3/4"	7-1/4"	54

* Factory fitting of the MG-5CV-S1 to the MG5-BTS is required. This is included at no charge, even when the Base & Tailstock is purchased separately from the Index Fixture.

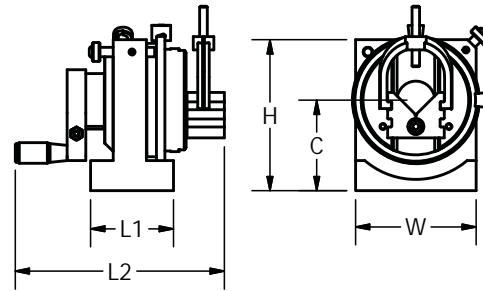
PUNCH MASTER™ INDEX FIXTURE



PM-V2 - Rear View



PM-V2 - Front View



- 48 position index plate provides a hard stop every $7\text{-}1/2^\circ \pm 15$ arc seconds.
- Built-in sine bar for setting angles between hard index locations.
- Ball and race design with 36 balls under preload for minimum deflection.
- Bearings are sealed to protect against grit.
- Maximum spindle runout ± 0.0001 ".
- Hardened steel base.
- Fitted wooden case included.

MODEL #	V-BLOCK CAPACITY	THROUGH HOLE	C	L1	L2	W	H	SQUARE & PARALLEL	WT (#)
PM-V2	1-5/8"	1-1/4"	3"	2-3/4"	6-15/16"	4"	5"	0.0002"	12

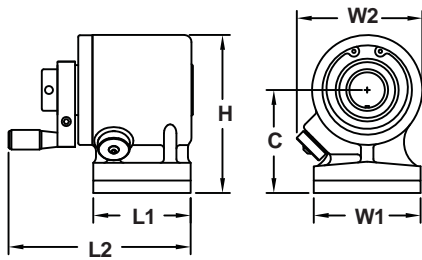
COLLET-MASTER™ INDEX FIXTURE



CM-5C - Front View



CM-5C - Rear View



Optional CM-5C-FVB

- 48 position index plate provides a hard stop every $7\text{-}1/2^\circ \pm 45$ arc seconds.
- Spindle rides in two sealed, pre-loaded ball bearings.
- Maximum spindle runout is 0.0001".
- All standard 5C collets can be used.
- Drawbar and fitted wooden case included.
- Hardened steel base.
- Optional faceplate & v-block (CM-5C-FVB) available for eccentric forms.

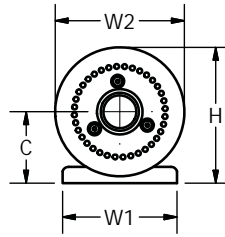
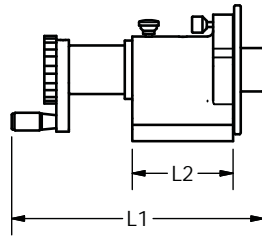
MODEL #	COLLET CAPACITY	THROUGH HOLE	C	L1	L2	W1	W2	H	SQUARE & PARALLEL	WT (#)
CM-5C	1-1/16"	1-1/4"	3-5/8"	3-13/32"	6-13/32"	3-3/4"	4-13/32"	5-9/16"	0.0002"	9

MODEL #	FACEPLATE DIAMETER	THROUGH HOLE	V-BLOCK CAPACITY	WT (#)
CM-5C-FVB	4-7/8"	3/4"	1-5/8"	15

SPIN-MASTER™ INDEX FIXTURE



SM-5C - Front View



SM-5C - Rear View

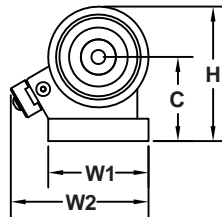
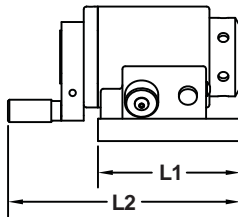
- 36 hole index plate allows direct indexing every 10°, graduated in 5° increments.
- 10 vernier holes allow 1° indexing.
- All standard 5C collets can be used.
- 2-5/16" spindle travel for flute grinding.
- Hardened and ground spindle rides in a sleeve bearing.
- Maximum runout of 0.0005" T.I.R.

MODEL #	COLLET CAPACITY	THROUGH HOLE	C	H	L1	L2	W1	W2	SQUARE & PARALLEL	WT (#)
SM-5C	1-1/16"	1-1/4"	2-3/4"	5-1/4"	9-11/16"	3-7/8"	4-3/8"	5"	0.0002"	15

MINI-MASTER™ INDEX FIXTURE



MM-25R - Front View



MM-25R - Rear View

- 72 position index plate provides a hard stop every 5 degrees ±15 arc seconds.
- Light weight for easy handling.
- Uses standard ER-25 spring collets.
- Spindle rides in preloaded ball bearings.
- Maximum spindle runout is 0.0002" T.I.R.
- Low height is ideal for small machine setups.
- Hardened steel base.
- Fitted wooden case and collet wrench included.

MODEL #	COLLET CAPACITY	THROUGH HOLE	C	L1	L2	W1	W2	H	SQUARE & PARALLEL	WT (#)
MM-25R	5/8"	5/8"	1-7/8"	3-3/16"	5-3/16"	2-1/4"	3-1/16"	3"	0.0002"	4

Original **LAST WORD™**

WHEEL DRESSER - MODEL 'A'
FORMERLY BY LAST WORD SALES COMPANY



LWD-A



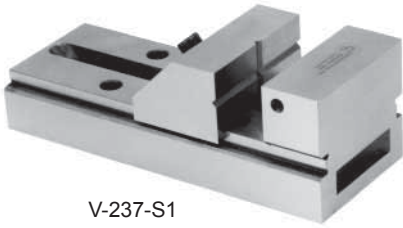
Storage Case (Included)

The Last Word™ in ANGLE TANGENT TO RADIUS wheel dressing.

- Reduces set-up & dressing time to a minimum.
- Wheel dressing is performed with wheel guard in place for operator safety.
- All actuation knobs are at the back of dresser, keeping operator's hands at a safe distance.
- Direct setting together with high precision lapped parts makes accurate dressing very simple.
- Original Last Word dresser works equally well on surface, O.D. & I.D. grinders. On O.D. & I.D. grinders it is simply clamped vertically on an angle plate.
- Large bearing surfaces & positive locking devices make this dresser the most rigid on the market.
- Manufactured of quality materials & engineered with service in mind, including adjustable gibs to compensate for wear, the Original Last Word dresser will give many years of satisfactory service with a minimum of upkeep.

MODEL #	CONVEX RADII	CONCAVE RADII	TANGENT TRAVEL	CENTERLINE HEIGHT	MAXIMUM WHEEL DIAMETER	OVERALL LENGTH	WT(#)
LWD-A	0 to 2-1/4"	0 to 4"	1-7/8"	3.400"	8"	14"	27

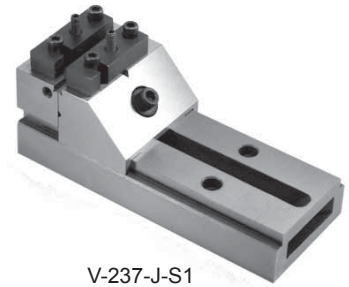
PRECISION VISES



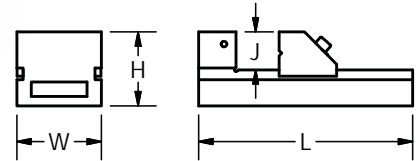
V-237-S1



V-612



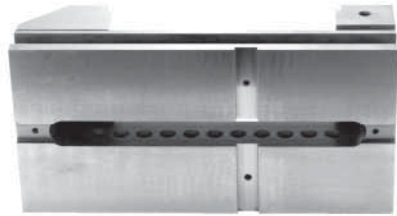
V-237-J-S1



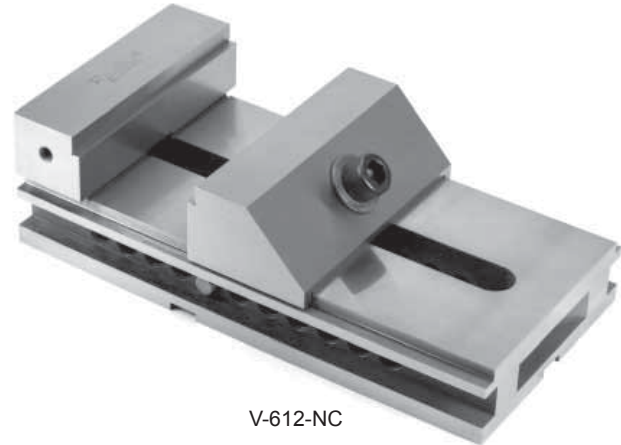
- High precision, solid one-piece steel construction with body and jaws hardened to Rc 58-62.
- Angled center channel provides extra holding capacity.
- Movable jaw pulls into base at 45 to 60° to insure maximum holding power and hold down force, eliminating tilting and lifting.
- V-237 models have a ratchet mechanism with notched pockets and one-piece drawbar.
- Jaw can be opened and closed without unbolting vise from work surface.
- End pockets for convenient clamping on V-237 models and larger.
- V-237 models and smaller have horizontal and vertical vees in the movable jaw. In addition, the “J” models have vees in the tops of the jaws and 1/8" x 1/8" steps at the top inside face of the jaws.
- SineSet® models bolt directly to a SineSet® sine plate or compound sine plate of the same series. S1 models also bolt to the AP-664-S1 90° conversion plate.

MODEL #	SineSet® SERIES	L	W	H	J	JAW CAPACITY	SQUARE & PARALLEL	WT (#)
SineSet® COMPATIBLE								
V-225-S0	S0	5-7/8"	2"	2"	1"	3-1/4"	0.0002"	5
V-237-J-S1	S1	7-1/2"	3"	2-5/8"	1-5/16"	5"	0.0002"	12
V-237-S1	S1	7-1/2"	3"	2-5/8"	1-5/16"	4-3/4"	0.0002"	11
V-411-S2	S2	11"	4"	3"	1-7/16"	7"	0.0003"	20
V-612-S2	S2	12"	6"	3-7/16"	1-11/16"	8"	0.0003"	41
NOT SineSet® COMPATIBLE								
V-225	--	5-7/8"	2"	2"	1"	3-1/4"	0.0002"	5
V-237	--	7-1/2"	3"	2-5/8"	1-5/16"	4-3/4"	0.0002"	11
V-237-J	--	7-1/2"	3"	2-5/8"	1-5/16"	5"	0.0002"	12
V-411	--	11"	4"	3"	1-7/16"	7"	0.0003"	20
V-612	--	12"	6"	3-7/16"	1-11/16"	8"	0.0003"	41

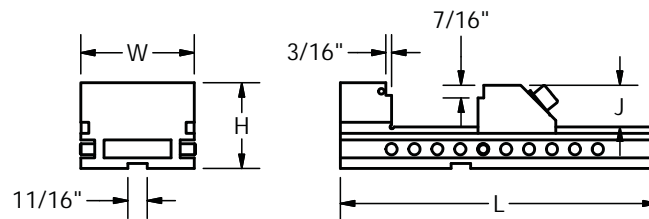
N/C VISES



V-612-NC
BOTTOM VIEW



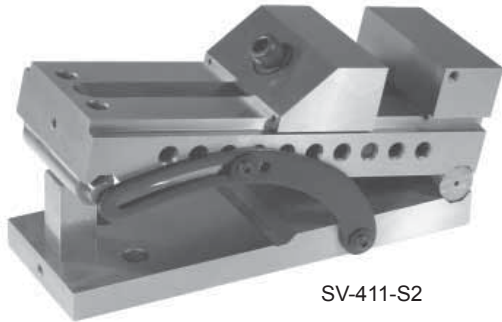
V-612-NC



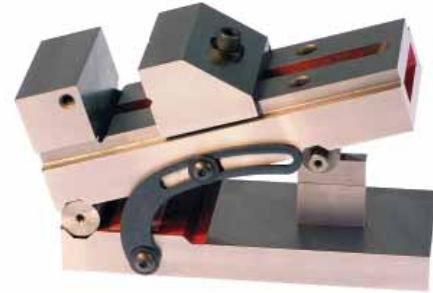
- Precision vises designed to bolt easily onto your N/C, milling, or other machine.
- Bi-directional 11/16" keyways ground in the bottom to allow rapid installation and automatic alignment.
- Slotted on all four sides to provide a multitude of clamping possibilities.
- Both fixed and movable jaws are stepped to permit the effortless holding of pieces as small as 1/2" x 1/2".
- Angled center channel allows extra holding capacity.
- Movable jaw pulls into base at 45 to 60° to insure maximum holding power and hold down force, eliminating tilting and lifting.
- Made of steel hardened to Rc 58-62.

MODEL #		L	W	H	J	JAW CAPACITY	SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR							SINGLE	PAIR
V-411-NC	V-411-NC-M	11"	4"	3"	1-7/16"	7-1/2"	0.0003"	19	38
V-612-NC	V-612-NC-M	12"	6"	3-7/16"	1-11/16"	8-1/2"	0.0003"	38	76

SINE VISES

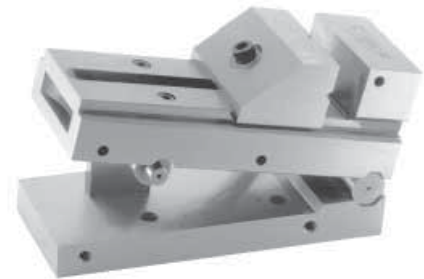


SV-411-S2

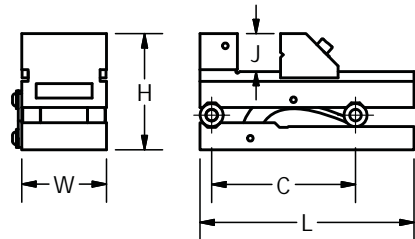


SV-337

- Provides a quick & accurate means of holding a workpiece at an angle for grinding or inspection.
- Angled center channel provides extra jaw capacity
- Solid, one-piece body.
- Made from steel, hardened to Rc 58-62.
- Movable jaw pulls into base at 45 to 60° to insure maximum holding power and hold down force, eliminating tilting and lifting.
- Dual 0.200" minute steps built into the gage roll allow setting small angles with standard gage blocks.
- SV-337 models have small horizontal and vertical vees in the movable jaw and a ratchet mechanism with notched pockets and one-piece drawbar.
- One locking strap included with each sine vise.
- SineSet® models bolt directly to a SineSet® sine plate or compound sine plate of the same series. S1 models also bolt to the AP-664-S1 90° conversion plate.

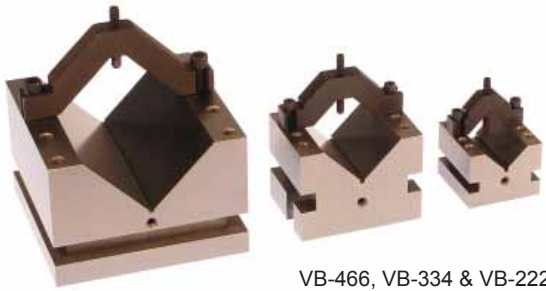


SV-337-S1

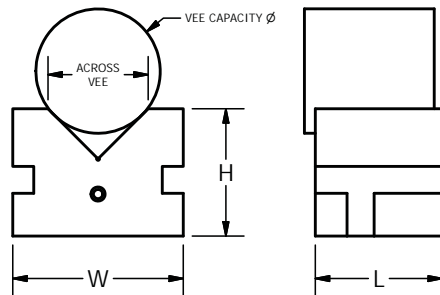


MODEL #	SineSet® SERIES	L	W	H	J	JAW CAPACITY	C	SQUARE & PARALLEL	WT (#)
SineSet® COMPATIBLE									
SV-337-S1	S1	7-1/2"	3"	3-5/8"	1-5/16"	4-3/4"	5" ±0.0002"	0.0002"	16
SV-411-S2	S2	11"	4"	4-5/8"	1-7/16"	7"	10" ±0.0002"	0.0003"	36
SV-612-S2	S2	12"	6"	5-1/8"	1-11/16"	8"	10" ±0.0002"	0.0003"	60
NOT SineSet® COMPATIBLE									
SV-337	--	7-1/2"	3"	3-5/8"	1-5/16"	4-3/4"	5" ±0.0002"	0.0002"	16
SV-411	--	11"	4"	4-5/8"	1-7/16"	7"	10" ±0.0002"	0.0003"	36
SV-612	--	12"	6"	5-1/8"	1-11/16"	8"	10" ±0.0002"	0.0003"	60

PRECISION STEEL V-BLOCKS



VB-466, VB-334 & VB-222



- Provides a quick, accurate & positive means of holding workpieces for layout, machining, grinding or inspection.
- Solid one-piece steel construction, hardened to Rc 58-62.
- One reversible, swing-away clamp is provided with each v-block.
- Side slots allow easy clamping to almost any work surface.
- SineSet® models bolt directly to a SineSet® sine plate or compound sine plate of the same series. S1 models also bolt to the AP-664-S1 90° conversion plate.
- Available in both 60° and 90° models.
- Pairs are matched within 0.0003".

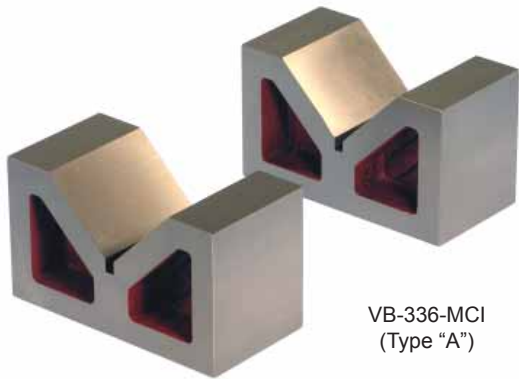
90° MODELS

MODEL #		SineSet® SERIES	L	W	H	ACROSS VEE	VEE CAPACITY (DIA.)	SQUARE, PARALLEL & CENTRAL	WT (#)	
SINGLE	PAIR								SINGLE	PAIR
SineSet® COMPATIBLE										
VB-222-S0	VB-222-M-S0	S0	2-1/2"	2-1/2"	2"	1-15/32"	1-5/8"	0.0002"	3	5
VB-334-S1	VB-334-M-S1	S1	3"	4"	3"	2-7/32"	2-7/8"	0.0002"	9	17
VB-466-S2	VB-466-M-S2	S2	6"	6"	4"	3-31/32"	4-3/8"	0.0003"	33	67
NOT SineSet® COMPATIBLE										
VB-222	VB-222-M	--	2-1/2"	2-1/2"	2"	1-15/32"	1-5/8"	0.0002"	3	5
VB-334	VB-334-M	--	3"	4"	3"	2-7/32"	2-7/8"	0.0002"	9	17
VB-335	VB-335-M	--	3"	5"	3"	3-1/4"	3-3/4"	0.0002"	11	22
VB-466	VB-466-M	--	6"	6"	4"	3-31/32"	4-3/8"	0.0003"	33	69
VB-467	VB-467-M	--	6"	7"	4"	4-15/16"	5-1/4"	0.0003"	45	90
VB-666	VB-666-M	--	6"	6"	6"	3-31/32"	4-3/8"	0.0005"	50	100

60° MODELS

MODEL #		SineSet® SERIES	L	W	H	ACROSS VEE	VEE CAPACITY (DIA.)	SQUARE, PARALLEL & CENTRAL	WT (#)	
SINGLE	PAIR								SINGLE	PAIR
SineSet® COMPATIBLE										
VB-602-S0	VB-602-M-S0	S0	2-1/2"	2-1/2"	2"	1-15/32"	1-3/8"	0.0002"	3	5
VB-604-S1	VB-604-M-S1	S1	3"	4"	3"	1-31/32"	2-1/8"	0.0002"	8	15
NOT SineSet® COMPATIBLE										
VB-602	VB-602-M	--	2-1/2"	2-1/2"	2"	1-15/32"	1-3/8"	0.0002"	3	5
VB-604	VB-604-M	--	3"	4"	3"	1-31/32"	2-1/8"	0.0002"	8	15

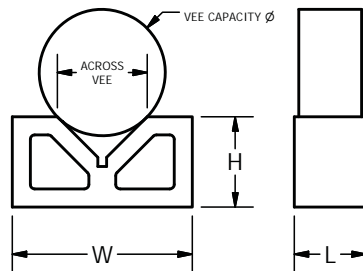
CAST IRON V-BLOCKS



VB-336-MCI
(Type "A")



VB-888-CI
(Type "B")



- Made from class 40 cast iron, stress relieved and annealed.
- All have 90° vees.
- Models VB-888-CI and VB-101010-CI (Type "B") are drilled and tapped on the top face, and supplied with one clamp and two clamp screws per v-block.
- Available as single v-blocks or pairs matched within 0.0005", as shown below.

MODEL #		L	W	H	ACROSS VEE	VEE CAPACITY (DIA.)		SQUARE, PARALLEL & CENTRAL	WT (#)	
SINGLE	PAIR					WITH CLAMPS	WITHOUT CLAMPS		SINGLE	PAIR
TYPE "A"										
--	VB-225-MCI	2"	5"	2-1/2"	2-1/2"	--	3-1/2"	0.0005"	--	12
--	VB-336-MCI	3"	6"	3-1/2"	3-1/2"	--	4-3/4"	0.0005"	--	25
--	VB-667-MCI	6"	7"	6"	4"	--	5-1/2"	0.0005"	--	90
--	VB-688-MCI	6"	8"	8"	5"	--	7"	0.0005"	--	123
--	VB-121212-MCI	12"	12"	12"	8-3/8"	--	11-3/4"	0.0005"	--	407
TYPE "B"										
VB-888-CI	VB-888-CIM	8"	8"	8"	6-1/4"	6-3/8"	8-1/2"	0.0005"	49	96
VB-101010-CI	VB-101010-CIM	10"	10"	10"	8-1/4"	8-3/8"	11-3/8"	0.0005"	83	186

STEEL STRAIGHT EDGES

- Provides extremely accurate reference line.
- Can be used for checking surfaces for straightness.
- Two working edges are precision ground and finely finished.
- Perfect for drawing or scribing straight lines.
- Graduated & non-graduated models available.
- Stainless steel models longer than 24" have a hang-up hole and all stainless models are flame hardened.
- Working edges are straight within 0.0005" per 12" T.I.R.



SE-24-SSHD & SE-24-SSBHD



SE-24-TS, SE-24-TSB & SE-24-TSBG

TOOL STEEL • 1/32 GRADUATIONS • BEVELED EDGE

MODEL #	LENGTH	WIDTH	THICKNESS	WT (#)
SE-24-TSBG	24"	1-15/32"	5/32"	4
SE-36-TSBG	36"	2-15/32"	7/32"	8
SE-48-TSBG	48"	2-15/32"	7/32"	11

TOOL STEEL • NON-GRADUATED • SQUARE EDGE

MODEL #	LENGTH	WIDTH	THICKNESS	WT (#)
SE-12-TS	12"	1-15/32"	5/32"	2
SE-24-TS	24"	1-15/32"	5/32"	4
SE-36-TS	36"	2-15/32"	7/32"	8
SE-48-TS	48"	2-15/32"	7/32"	11
SE-72-TS	72"	3-1/8"	9/32"	36
SE-96-TS	96"	3-7/32"	11/32"	42

TOOL STEEL • NON-GRADUATED • BEVELED EDGE

MODEL #	LENGTH	WIDTH	THICKNESS	WT (#)
SE-12-TSB	12"	1-15/32"	5/32"	2
SE-24-TSB	24"	1-15/32"	5/32"	4
SE-36-TSB	36"	2-15/32"	7/32"	8
SE-48-TSB	48"	2-15/32"	7/32"	11
SE-72-TSB	72"	3-5/32"	9/32"	36
SE-96-TSB	96"	3-17/64"	11/32"	42
SE-120-TSB	120"	3-17/64"	11/32"	64

STAINLESS STEEL • NON-GRADUATED • BEVELED EDGE

MODEL #	LENGTH	WIDTH	THICKNESS	WT (#)
SE-12-SSBHD	12"	1-9/16"	7/32"	2
SE-24-SSBHD	24"	2-1/16"	17/64"	4
SE-36-SSBHD	36"	2-1/16"	17/64"	12
SE-48-SSBHD	48"	2-9/16"	17/64"	18
SE-60-SSBHD	60"	3-1/16"	5/16"	23
SE-72-SSBHD	72"	3-1/64"	11/32"	27
SE-96-SSBHD	96"	3-17/64"	11/32"	51

STAINLESS STEEL • NON-GRADUATED • SQUARE EDGE

MODEL #	LENGTH	WIDTH	THICKNESS	WT (#)
SE-12-SSHD	12"	1-9/16"	7/32"	2
SE-24-SSHD	24"	2-1/16"	17/64"	4
SE-36-SSHD	36"	2-1/16"	17/64"	13
SE-48-SSHD	48"	2-9/16"	17/64"	19
SE-60-SSHD	60"	3-1/16"	5/16"	24
SE-72-SSHD	72"	3-1/64"	11/32"	28
SE-96-SSHD	96"	3-17/64"	11/32"	53

All sizes are nominal.

CAST IRON STRAIGHT EDGES



- Made of stress-relieved, cast iron for maximum stability.
- Cored and ribbed for increased rigidity and reduced weight.
- Top and bottom faces are precision ground parallel and flat within 0.0001 " per 12".
- Use for setting up and leveling machinery and equipment and for checking the flatness of surfaces or scribing.
- Also can be used for positioning work above and parallel to a surface.

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
SE-24-CI	24"	1"	2"	10
SE-36-CI	36"	1-1/2"	3"	27
SE-48-CI	48"	1-1/2"	3"	36
SE-6024-CI	60"	2"	4"	95
SE-72-CI	72"	2"	4"	110
SE-96-CI	96"	3"	8"	400



PRECISION TRI-BLOCKS

- Also known as 1-2-3 and setup blocks.
- Made of hardened steel, ground on all six sides.
- Available as single blocks or in matched pairs, per chart below.
- B-123-H1-M has one 1/2" through hole in 2" x 3" face.
- 11-hole models have 5/16-18 tapped holes.
- 23-hole models have 3/8-16 tapped holes.
- All models, except PB-123, furnished with a fitted wooden box.
- B-123-H11-M has drilled, counterbored & tapped holes to allow screw mounting and conversion into angle plates & other precision set-ups.
- B-123-H23M, B-234-H23-M & B-246-H23-M have tapped holes & matching clearance holes to allow screw mounting and conversion into angle plates & other precision set-ups.

MODEL #	PAIR or SINGLE	HOLES	SQUARE	FLAT & PARALLEL	SIZE	WT (#)
B-123-H1-M	PAIR	1	0.0001" per 1"	0.0002"	1" x 2" x 3" ±0.0002"	3
B-123-H11-M	PAIR	11	0.0001" per 1"	0.0002"	1" x 2" x 3" +0.0001" to +0.0003"	3
B-123-H23-M	PAIR	23	0.0001" per 1"	0.0002"	1" x 2" x 3" +0.0001" to +0.0003"	3
B-123-NH-M	PAIR	--	0.0001" per 1"	0.0002"	1" x 2" x 3" +0.0001" to +0.0003"	3
B-234-H23-M	PAIR	23	0.0001" per 1"	0.0003"	2" x 3" x 4" +0.0001" to +0.0004"	12
B-246-H23-M	PAIR	23	0.0001" per 1"	0.0003"	2" x 4" x 6" +0.0001" to +0.0004"	24
PB-123	SINGLE	--	0.0002"	0.0002"	1" x 2" x 3" ±0.0001"	2

MATCHED PAIRS OF 2-WAY STEEL PARALLELS



TWP-019

- Made of tool steel, hardened to Rc 58-62 and ground in matched pairs on two sides.
- Provides an economical alternative to 4-way ground parallels, when only two parallel sides are required.
- Size tolerance of the ground height is ± 0.001 ", while being held to a total of 0.0001" between the pieces of a matched pair.
- Total parallelism over the 6" length is 0.0001".

MODEL #	LENGTH	WIDTH	GROUND HEIGHT	WT (#)
TWP-001	6"	1/4"	3/8"	1
TWP-002	6"	1/4"	7/16"	1
TWP-003	6"	1/4"	1/2"	1
TWP-004	6"	1/4"	9/16"	1
TWP-005	6"	1/4"	5/8"	1
TWP-006	6"	1/4"	11/16"	1
TWP-007	6"	1/4"	3/4"	1
TWP-008	6"	1/4"	13/16"	1
TWP-009	6"	1/4"	7/8"	1
TWP-010	6"	1/4"	15/16"	2
TWP-011	6"	1/4"	1"	2
TWP-012	6"	1/4"	1-1/16"	2
TWP-013	6"	1/4"	1-1/8"	2
TWP-014	6"	1/4"	1-3/16"	2
TWP-015	6"	1/4"	1-1/4"	2
TWP-016	6"	1/4"	1-5/16"	2
TWP-017	6"	1/4"	1-3/8"	2
TWP-018	6"	1/4"	1-7/16"	2
TWP-019	6"	1/4"	1-1/2"	2
TWP-020	6"	1/4"	1-9/16"	2
TWP-021	6"	1/4"	1-5/8"	2
TWP-022	6"	1/4"	1-11/16"	2
TWP-023	6"	1/4"	1-3/4"	2
TWP-024	6"	1/4"	1-13/16"	2
TWP-025	6"	1/4"	1-7/8"	2
TWP-026	6"	1/4"	1-15/16"	2
TWP-027	6"	1/4"	2"	2

SETS OF MATCHED PAIRS OF 2-WAY STEEL PARALLELS



TWP9-SET-A



TWP22-SET

- Includes matched pairs 6" long x 1/4" wide, in 1/16" height increments.
- Furnished in a wooden holder, marked with sizes.

MODEL #	PAIRS PER SET	SIZE RANGE	WT (#)
TWP9-SET-A	9	3/8" through 7/8"	9
TWP9-SET-B	9	15/16" through 1-7/16"	13
TWP9-SET-C	9	1-1/2" through 2"	18
TWP22-SET	22	1/2" through 1-13/16"	32

4-WAY STEEL PARALLELS

MATCHED PAIRS



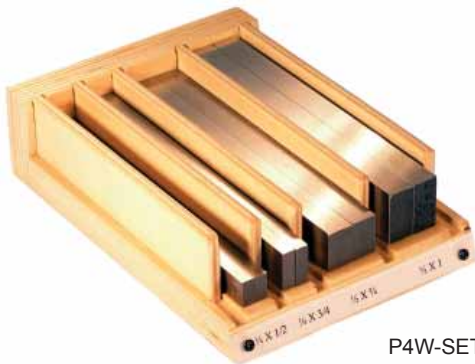
P-06050100-M

- Made of alloy steel, hardened to Rc 58-62 and ground in matched pairs on four sides for use where extra precision is required.
- Pairs are matched in size on the width and height to a tolerance of ± 0.0002 " on 6", 8" & 12" lengths and ± 0.0003 " for longer lengths.
- Total parallelism and straightness over the full length is 0.0001" on 6" & 8" lengths, 0.0002" on 12" lengths & 0.0003" on longer lengths.
- Adjacent ground sides are square with each other within 0.0004", except the 6" x 1/4" x 3/4", 6" x 1/4" x 3/8" and 6" x 1/4" x 1/2" sizes, which are square within 0.0005".

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
P-06025038-M	6"	1/4"	3/8"	1
P-06025050-M	6"	1/4"	1/2"	1
P-06025063-M	6"	1/4"	5/8"	1
P-06025075-M	6"	1/4"	3/4"	1
P-06038050-M	6"	3/8"	1/2"	1
P-06038075-M	6"	3/8"	3/4"	2
P-06050063-M	6"	1/2"	5/8"	2
P-06050075-M	6"	1/2"	3/4"	2
P-06050100-M	6"	1/2"	1"	2
P-06063100-M	6"	5/8"	1"	3
P-06075100-M	6"	3/4"	1"	3
P-06075150-M	6"	3/4"	1-1/2"	5
P-08050100-M	8"	1/2"	1"	3
P-08063150-M	8"	5/8"	1-1/2"	5
P-08075100-M	8"	3/4"	1"	4
P-08075125-M	8"	3/4"	1-1/4"	5
P-08075163-M	8"	3/4"	1-5/8"	6
P-12075100-M	12"	3/4"	1"	6
P-12100150-M	12"	1"	1-1/2"	11
P-12100200-M	12"	1"	2"	14
P-12150200-M	12"	1-1/2"	2"	21
P-12150300-M	12"	1-1/2"	3"	32
P-18100200-M	18"	1"	2"	22
P-24100200-M	24"	1"	2"	30
P-36100200-M	36"	1"	2"	46

SETS OF MATCHED PAIRS

- The same fine matched pairs of parallels as above are furnished in a wooden holder, marked with their sizes.
- Each set includes four pairs of parallels in the sizes shown.



P4W-SET-A

MODEL #	SET INCLUDES (1 PAIR EACH)	WT (#)
P4W-SET-A	6" x 1/4" x 1/2" 6" x 1/4" x 3/4" 6" x 1/2" x 3/4" 6" x 1/2" x 1"	6
P4W-SET-B	8" x 1/2" x 1" 8" x 3/4" x 1" 12" x 3/4" x 1" 12" x 1" x 2"	30

4-WAY STEEL PARALLELS

INDIVIDUAL



P-06050100, P-06050075, P-06025075 & P-06025050

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
P-06025038	6"	1/4"	3/8"	1
P-06025050	6"	1/4"	1/2"	1
P-06025063	6"	1/4"	5/8"	1
P-06025075	6"	1/4"	3/4"	1
P-06025100	6"	1/4"	1"	1
P-06038050	6"	3/8"	1/2"	1
P-06038063	6"	3/8"	5/8"	1
P-06038075	6"	3/8"	3/4"	1
P-06050063	6"	1/2"	5/8"	1
P-06050075	6"	1/2"	3/4"	1
P-06050100	6"	1/2"	1"	2
P-08050100	8"	1/2"	1"	2
P-08075100	8"	3/4"	1"	3
P-08075125	8"	3/4"	1-1/4"	3
P-12075100	12"	3/4"	1"	4
P-12100150	12"	1"	1-1/2"	6
P-12100200	12"	1"	2"	8
P-12150200	12"	1-1/2"	2"	11
P-12150300	12"	1-1/2"	3"	16

- These hardened steel parallels are ground to such close tolerances on four sides that there is no need to buy matched pairs for many common uses.
- Can be used individually or matched with any other **individual** 4-way parallel at any time.
- Different sizes can be used together. For example, a 6" x 1/2" x 1" can be used with an 8" x 3/4" x 1" on the 1" dimension.
- Held to size $\pm 0.00025"$ on four sides.
- Adjacent sides square within 0.0005" per inch.
- Opposite sides parallel within 0.0001" per 6 inches.

ANGLE BLOCK SET

MODEL #	DESCRIPTION	WT (#)
SETS		
AB-10-ST	Set of 10 Angle Blocks	4
AB-12-ST	AB-10-ST plus AB-QTR & AB-HLF	6
INDIVIDUAL REPLACEMENT BLOCKS		
AB-1	Individual 1° Block	1
AB-2	Individual 2° Block	1
AB-3	Individual 3° Block	1
AB-4	Individual 4° Block	1
AB-5	Individual 5° Block	1
AB-10	Individual 10° Block	1
AB-15	Individual 15° Block	1
AB-20	Individual 20° Block	1
AB-25	Individual 25° Block	1
AB-30	Individual 30° Block	1
AB-QTR	Individual 1/4° Block	1
AB-HLF	Individual 1/2° Block	1

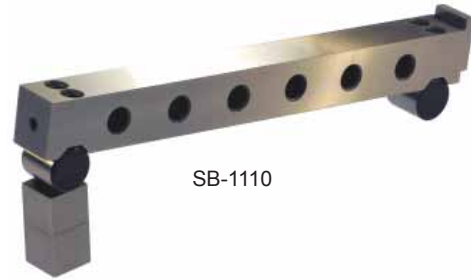
- Provides a quick, accurate and direct method of setting or checking angles.
- Eliminates calculations to help avoid errors.
- Blocks are furnished in 1° increments to 5°, then in 5° increments to 30°.
- With the addition of the optional 1/4° and 1/2° blocks, nearly any angle can be set in 1/4° increments.
- 3" long x 1/4" thick hardened steel.
- Precision ground to $\pm 0.0001"$ per inch (equates to 21 seconds at 1° & 16 seconds at 30°).
- Sets furnished in fitted wooden case.
- Individual replacement blocks available.



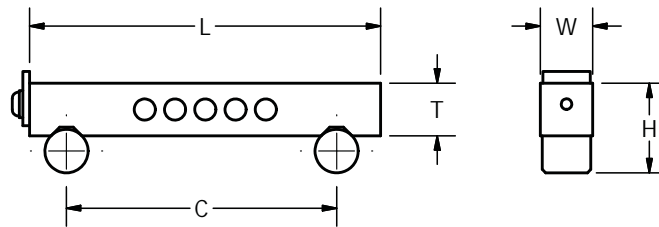
AB-10-ST

SINE BARS

- Effectively "cancels" the angle being measured to check its accuracy.
- Made of steel, hardened to Rc 58-62.
- Includes end rail, which can be mounted at either end.



SB-1110



MODEL #	L	W	H	T	C	FLAT, SQUARE & PARALLEL	WT (#)
SB-111	6-1/2"	1"	1-21/32"	1"	5" ±0.0001"	0.0002"	2
SB-1110	11-3/8"	1-1/8"	2-1/16"	1-1/4"	10" ±0.0003"	0.0002"	5

PLANER GAGE

- Body and slide are hardened and ground alloy steel castings.
- Wide body for stable operation.
- Beveled construction eliminates side play and provides accurate alignment and parallelism.
- Multiple tapped holes in the slide allow for attachment of extension nib or other accessories.
- 3" extension nib and fitted wooden case included.



PG-613

MODEL #	LENGTH	WIDTH	HEIGHT	RANGE	FLAT & PARALLEL	WT (#)
PG-613	6-3/16"	1-1/8"	3-1/2"	7/16"-10"	0.0002"	6

CYLINDER SQUARES

- Provides an excellent 90° reference angle.
- Solid, one-piece steel construction. Heat treated and precision ground.
- Ends of hardened cylinders are lapped square to outside diameters.
- Includes a fitted, wooden case.

MODEL #	DIAMETER	HEIGHT	SQUARE	WT (#)
CS-6	3"	6"	0.00010"	18
CS-12	4"	12"	0.00015"	50



CS-6

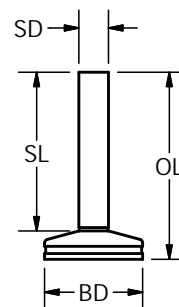
MAGNETIC CYLINDER SQUARES



MCS-6 & MCS-4

- Designed to easily check squareness on workpieces.
- Base is perpendicular to shaft within 0.0001" over the length of the square.
- Magnetic base eliminates clamping distortion and speeds setup.
- Made of steel, selected and normalized to insure stability and uniformity.
- Includes fitted wooden storage case.

MODEL #	OL	BD	SD	SL	WT (#)
MCS-4	4-1/4"	1-7/16"	1/2"	3-1/2"	3
MCS-6	6-1/2"	3-3/8"	1"	5-1/2"	7



LIFT-MASTER™ PERMANENT MAGNETIC LIFTS

- Allows one person to do the material loading and handling that once required two or more.
- Quick-release handle disengages the lift with a simple cam action.
- Uses max-C-mag™ ceramic magnets to ensure powerful holding force, with no chance for demagnetization.
- Grips and holds any ferrous material instantly.
- Designed for efficient, trouble-free, low maintenance service.



LM-800, LM-1600 & LM-3000

MODEL #	LENGTH	WIDTH	HEIGHT	MAXIMUM LIFTING CAPACITY (#) *	WT (#)
LM-800	6-5/8"	3-3/8"	2-1/2"	800	20
LM-1600	8-1/2"	4-7/8"	2-1/2"	1600	30
LM-3000	11-1/4"	6-3/8"	2-1/2"	3000	45

* See precautions and **derating factors** below.

MAGNETIC LIFT SAFETY

- ◆ Never lift round material.
- ◆ Never stand under a load being lifted.
- ◆ Always use extra caution.
- ◆ Only use magnetic lifts on material that doesn't flex or bend.
- ◆ The surface of the lift and the load need to be clean and free of chips, oil, slag, dirt, etc.
- ◆ Not recommended for painted or finish coated surfaces.
- ◆ Two or more lifts are required, when lifting sheets over 8 feet long.

DERATING FACTORS

Conditions other than those listed above will have a significant effect on the lifting capacity of permanent magnetic lift magnets, causing them to be **derated** as illustrated by the following:

- ◆ Thin work piece - **derate by 25%** at 3/4" and 65% at 1/4" material thickness.
- ◆ Rust or scale on surface of work piece - **derate by 25%**.
- ◆ Irregular or rough surface - **derate by 50%**.
- ◆ High carbon, high chromium or cast iron material - **derate by 50%**.

WOODEN STORAGE CASES



- Storage cases are made using the techniques of the finest cabinet makers.
- Natural wood cases provide a superior means of carrying & storing your precision tools.
- Keeps tools dry, and corrosion & dust-free.
- Helps eliminate unwanted nicks & scratches that can effect your tool's accuracy.
- Cases with carrying handles are provided for the larger, heavier tools.

MODEL #	FITS THESE TOOLS	WT (#)
BX-123	Pair of 1-2-3 Blocks	1
BX-66	MC-66-S1, MC-66-FP-S1, SP-66-S1 or SPC-66-S1	4
BX-AP333	AP-333	2
BX-AP334	AP-334-S0	2
BX-AP444	AP-444-S1	2
BX-AP446	AP-445, AP-446-S2 or CAP-46	2
BX-AP664	AP-664-S1	3
BX-MC44	MC-44-FP-S0	2
BX-MSP363	MSP-363-FP	2
BX-MSP44	MSP-44-S0 or MSPC-44-FP-S0	3
BX-MSP612	All MSP-126 or MSP-612 Models	6
BX-MSPC612	MSPC-612-S2 or MSPC-612-FP-S2	7
BX-MSPC66	All MSP-66 or MSPC-66 Models	5
BX-PG613	PG-613	2
BX-SB111	SB-111	1
BX-SB1110	SB-1110	2
BX-SP128	SP-128-S2 or SP-812-S2	6
BX-SP136	SP-136	1
BX-SPC1212	SPC-1212-S2 or SPC-1212-S2	9
BX-SPC612	SPC-612-S2	6
BX-SV337	SV-337 & SV-337-S1	3
BX-SV411	All SV-411 & V-411 Models	6
BX-V225	V-225 & V-225-S0	2
BX-V237	All V-237 Models	2
BX-VB222M	Pair of All VB-222 or VB-602 Models	1
BX-VB334	All VB-334 or VB-604 Models	1
BX-VB334M	Pair of all VB-334 or VB-604 Models	2
BX-VB466M	Pair of VB-466 or VB-466-S2	6
SS-0	Complete SineSet #0	11
SS-1	Complete SineSet #1	10

FLY CUTTER SETS



FCS-SET050711



FCS-SS-CAT40

- Cutter body fits shell mill arbor with 1" boss & 3/8" key.
- Body & bars coated with clear zinc for corrosion resistance.
- Body & bars are cryogenically treated for stability.
- Uses a standard TNMG-432 insert.
- Best for fine finishing surfaces with cut depths of up to 0.030" in steel and 0.080" in aluminum and plastics.



MODEL #	CONSISTS OF	APPROXIMATE CUTTING DIAMETER RANGE	WT (#)
FCS-SET05	Cutter Body with 5" Bar, (1) Carbide Insert & All Required Fasteners	5-7/8 to 7-3/4"	7
FCS-SET0507	Cutter Body with 5 & 7-1/2" Bars, (2) Carbide Inserts & All Required Fasteners	5-7/8 to 10-9/16"	9
FCS-SET050711	Cutter Body with 5, 7-1/2 & 11"Bars, (3) Carbide Inserts & All Required Fasteners	5-7/8 to 19"	12
FCS-SET07	Cutter Body with 7-1/2" Bar, (1) Carbide Insert & All Required Fasteners	7-3/4 to 10-9/16"	8
FCS-SET0711	Cutter Body with 7-1/2 & 11"Bars, (2) Carbide Inserts & All Required Fasteners	7-3/4 to 19"	10
FCS-SS-CAT40	Cutter Body with 5, 7-1/2 & 11"Bars, (13) Carbide Inserts, CAT40 Adapter, Storage Case & All Required Fasteners	5-7/8 to 19"	23
FCS-SS-R8	Cutter Body with 5, 7-1/2 & 11"Bars, (13) Carbide Inserts, R8 Adapter, Storage Case & All Required Fasteners	5-7/8 to 19"	22
FCS-05BAR	5" Bar Only with (1) Carbide Insert & All Required Fasteners	5-7/8 to 7-3/4"	2
FCS-07BAR	7" Bar Only with (1) Carbide Insert & All Required Fasteners	7-3/4 to 10-9/16"	3
FCS-11BAR	11" Bar Only with (1) Carbide Insert & All Required Fasteners	10-9/16 to 19"	4
FCS-BODY	Fly Cutter System Body & Required Fasteners Only	--	6

FLY CUTTER ACCESSORIES



FCS-TNMG432-TIN



FCS-SMA-R8



FCS-SMA-CAT40

MODEL #	DESCRIPTION	WT (#)
FCS-TNMG432-UNCOATED	10 Pack of TNMG-432 Uncoated Inserts	1
FCS-TNMG432-TIN	10 Pack of TNMG-432 TIN Coated Inserts	1
FCS-TNMG432-CERAMIC	10 Pack of TNMG-432 Ceramic Inserts	1
FCS-SMA-R8	R8 Shell Mill Adaptor for Fly Cutter System	3
FCS-SMA-CAT40	CAT40 Shell Mill Adaptor for Fly Cutter System	4
BX-FCS	Storage Case Only for Fly Cutter Sets	7

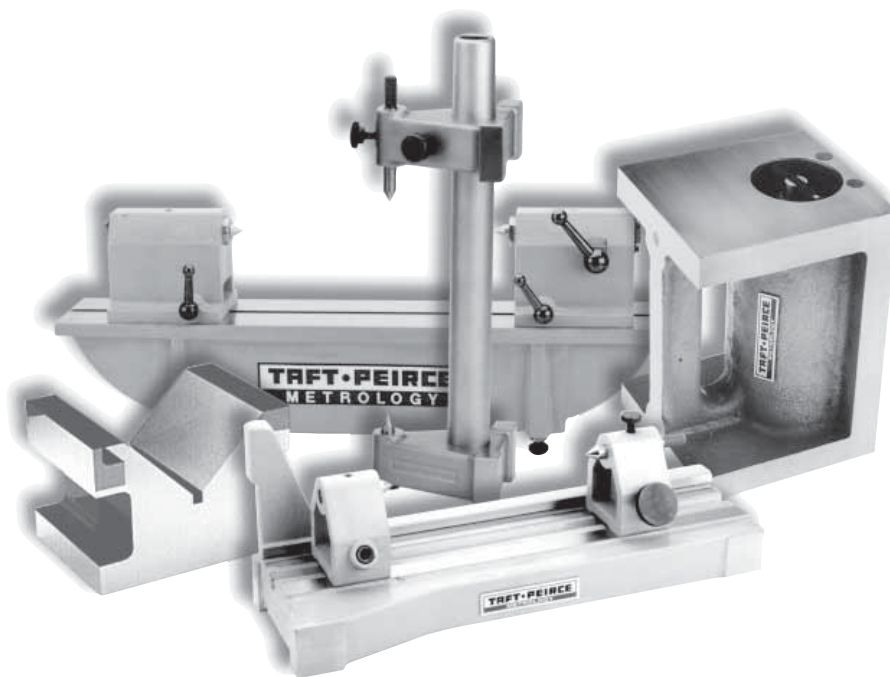
NOTES

TAFT • PEIRCE METROLOGY

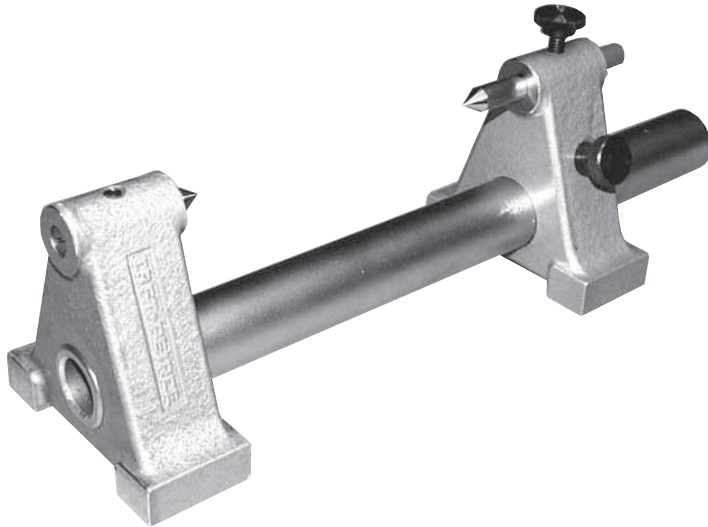
PRODUCTION & INSPECTION EQUIPMENT LINE

This premium line of precision tools is a result of its purchase from The Taft-Peirce Metrology Company by Suburban Tool, Inc. in 1988. We manufacture this fine line in our Auburn Hills facility to the same ageless quality, using the same blueprints and procedures followed by Taft-Peirce for decades. Minor changes have been made to improve quality, where possible.

In this section you will find bench centers and accessories, angle setting and checking tools, angle irons, magnetic angle irons, parallels, v-blocks, squares, cylinder squares, straight edges and more. All are built to the exacting standards of Taft-Peirce Metrology.



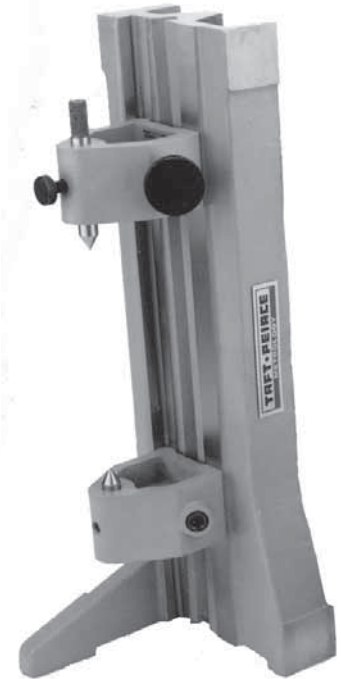
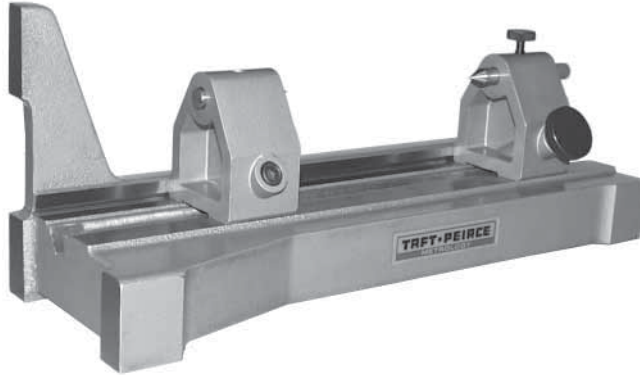
INSTRUMENT BENCH CENTER



- Can be used in either the vertical or horizontal position.
- Head and tailstock made from high-quality alloy steel and heat treated for maximum stability.
- Shaft made of chrome-plated 1-1/8" O.D. tubular steel.
- Center point of headstock can be rotated within $\pm.0015"$ eccentric range of adjustment bringing the piece perfectly parallel to surface.
- 3/8" x 60° hardened and ground tool steel centers are parallel to base within $\pm.0002"$ and square within $\pm.0003"$ per 6".
- Tailstock center is spring-loaded & lockable with knurled knob.
- A finished wooden case is available.

MODEL #	LENGTH	WIDTH	HEIGHT	WORK CAPACITY		WT (#)
				LENGTH	DIAMETER	
9203	12-1/4"	3-1/2"	3-5/8"	8"	3"	9

INTERMEDIATE BENCH CENTER



- Designed to bridge the capacity gap between the model number 9203 Instrument Bench Center and the model number 9205 Standard Bench Centers.
- Can be used in either the vertical or horizontal position.
- Headstock, tailstock and base made from close-grained, heat-treated cast iron.
- Center point of headstock can be rotated within $\pm .0015$ " eccentric range of adjustment, bringing the piece perfectly parallel to surface.
- $1/2$ " x 60° hardened and ground tool steel centers are parallel to base within $\pm .0002$ " and square within $\pm .0003$ " per 6".
- Tailstock center is spring-loaded & lockable with knurled knob.
- A finished wooden case is available.

MODEL #	LENGTH	WIDTH	HEIGHT	WORK CAPACITY		WT (#)
				LENGTH	DIAMETER	
9204	17-3/4"	5"	5-5/8"	12"	5"	38

STANDARD BENCH CENTERS



9205-18

- Taft-Peirce standard bench centers offer a fast, accurate method of inspecting work on arbors, mandrels or directly between centers.
- Heavy-duty, cast iron beds are ruggedly proportioned with internal ribbing for maximum strength.
- Head and tailstocks are also made from close-grained cast iron. Each is supplied with a 3/4" x 60° male center with a **modified #2** Morse taper.
- Head and tailstocks are machined in pairs with center axes held alike in height within 0.0005".
- Alignment of head and tailstocks is maintained by keys, which fit in an accurately located 1/2" t-slot in the bed.
- The center in the headstock is fixed.
- The tailstock center is in a spring-loaded, lockable sleeve.
- Beds have four adjustable leveling feet.
- Standard bench centers are supplied complete with ground bed, headstock, tailstock and centers.
- Optional sizes of head and tailstocks are available (see opposite page).
- Dial indicator and mounting brackets are also available (see page 89).

MODEL #	LENGTH	WIDTH	HEIGHT*	WORK CAPACITY		FLATNESS OF TOP SURFACE	WT (#)
				LENGTH	DIAMETER		
9205-18	30"	5-1/2"	11-1/2"	18"	8"	0.0005"	160
9205-36	48"	5-1/2"	12"	36"	8"	0.0010"	240
9205-80	80"	7"	17"	68"	16"	0.0015"	500

* Without leveling feet.

Female centers, bull-nose centers or other custom head and tailstock centers can be supplied to order, as required. Special centers may also be ordered singly or in pairs for Taft-Peirce bench centers already in use.

LARGE CAPACITY 9205 HEAD & TAILSTOCKS



9205-8

- These matching sets of head and tailstocks can be ordered as optional accessories for standard bench centers, or combined with standard or heavy duty beds.
- Head and tailstocks are made from close-grained cast iron.
- Each is equipped with a 3/4" x 60° male center with a **modified #2** Morse taper, 1/2" alignment keys, t-bolts and locking levers.

MODEL #	WORK CAPACITY				WEIGHT CAPACITY BETWEEN CENTERS (#)	WT (#)
	DIAMETER	LENGTH				
		30" BED	48" BED	80" BED		
9205-8	8"	18"	36"	68"	400	45
9205-12	12"	18"	36"	68"	375	56
9205-16	16"	18"	36"	68"	300	76
9205-20	20"	18"	36"	68"	250	97
9205-24	24"	18"	36"	68"	225	119
9205-28	28"	18"	36"	68"	200	140
9205-32	32"	18"	36"	68"	175	161

- The center in the headstock is fixed.
- The tailstock center is in a spring-loaded sleeve that retracts approximately **5/8"** and can be locked in the working position.
- When ordering, be sure that the work to be swung does not exceed the listed weight capacity.

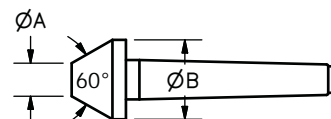
BULL-NOSE HEAD & TAILSTOCK CENTERS



9205-150BN

- Designed specifically to fit the 9205 head & tailstocks.
- Made of hardened 52100 steel.
- Head is concentric to #2 Morse taper within 0.0001".

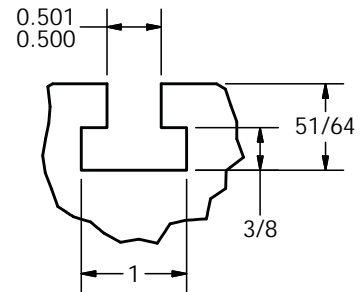
MODEL #	A	B	WT (#)
9205-150BN	5/8"	1-1/2"	2
9205-225BN	1-3/8"	2-1/4"	3
9205-300BN	2-1/8"	3"	4



STANDARD DUTY BENCH CENTER BEDS



9205-30G



9205 & 9209 T-SLOT DETAIL

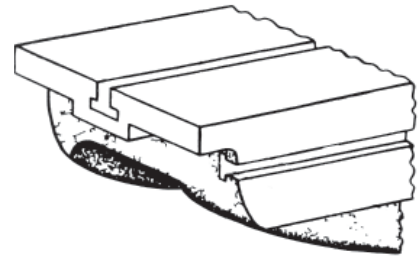
- Can be combined with large-capacity head and tailstocks to create a bench center to fit your needs (see page 87).
- Available with either a precision ground or hand scraped top surface.
- All sizes are provided with milled edges, a central t-slot and four leveling buttons.
- Special sizes available upon request.

MODEL #		LENGTH	WIDTH	HEIGHT*	FLATNESS OF TOP SURFACE	WT (#)
GROUND	SCRAPED					
9205-30G	9205-30S	30"	5-1/2"	5-5/8"	0.0005"	120
9205-48G	9205-48S	48"	5-1/2"	6"	0.0010"	190
9205-80G	9205-80S	80"	7"	7-1/2"	0.0015"	430

* Without leveling buttons.

HEAVY DUTY BENCH CENTER BED

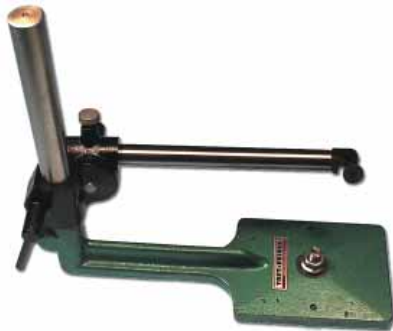
- Rigidly constructed with internal ribbing.
- Features a side pad for mounting accessory slides or special tooling.
- Both side pad and top have a t-slot for fast alignment and clamping of inspection equipment.
- Available with either a precision ground or hand scraped top surface.
- Scraped unit averages 18 bearing points per square inch.
- The top surface and side pad are square within 0.0003" per 6".



MODEL #		LENGTH	WIDTH	HEIGHT*	SIDE PAD WIDTH	FLATNESS OF TOP & SIDE PAD	WT (#)
GROUND	SCRAPED						
9209-G	9209-S	52"	10"	6-3/4"	4"	0.001"	250

* Without leveling buttons.

INDICATOR MOUNTING BRACKETS



- Designed to work with any 9205 or 9209 bench center bed.
- Integral clamp designed to accommodate any standard lug back dial indicator.
- Keyed to base t-slot and may be positioned anywhere between the centers and locked into place.
- The indicator bracket allows the indicator to be adjusted up or down, and swung 360° horizontally, vertically or axially.

MODEL #	WIDTH	POST TO KEYWAY DISTANCE	MAXIMUM DIAMETER CAPACITY	WT (#)
9205-8IM	3-1/4"	4-1/2"	8"	14
9205-12IM	3-3/4"	6-1/4"	12"	14
9205-16IM	4-1/4"	8-5/8"	16"	14
9205-20IM	4-1/4"	10-3/4"	20"	20
9205-24IM	4-1/4"	13"	24"	25
9205-28IM	4-1/4"	14-7/8"	28"	30
9205-32IM	4-1/4"	17"	32"	35

DIAL INDICATOR



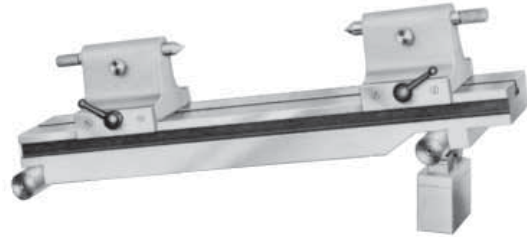
- Designed specifically for use with our 9205 and 9209 bench centers and indicator mounts.
- AGD Group 2 fitted with lug back.
- 2-3/16" diameter face.
- 0.0001" graduations.
- 0.025" range
- Revolution counter.



MODEL #	WT (#)
9320-212	2

SINE BLOCK TAPER TESTING FIXTURE

- Combines a 20" sine block with a pair of identical center heads that can be positioned anywhere along a t-slot that runs the length of the block.
- When mounted on the sine block, the centers are parallel to the sine rolls within 0.0002", and parallel to the sides of the sine block within 0.0005".
- Sine block can be used alone for general purpose angle checking.
- Center heads made from seasoned cast iron, machined in pairs for accurate alignment of centers.
- Sine blocks made from heat-treated alloy steel, and precision ground on all working surfaces.



MODEL #	LENGTH	WIDTH	HEIGHT	CENTER DISTANCE	WORK CAPACITY		WT (#)
					BETWEEN CENTERS	DIAMETER	
9122-20NSP	24-1/16"	4-3/4"	6-3/8"	20" ±0.0005"	15"	6"	70

SINE BLOCKS

- Made of high-quality, heat-treated alloy steel.
- Top surface precision-ground, flat and square with sides, and parallel to sine rolls.
- The rolls are ground and lapped alike for diameter, roundness and straightness, and parallel to each other within the limits specified below.
- Precision-ground end plate acts as a work positioning stop.
- Furnished in a finished wood case.
- Tapped holes in the top surface & sides allow a wide variety of work-clamping set-ups.



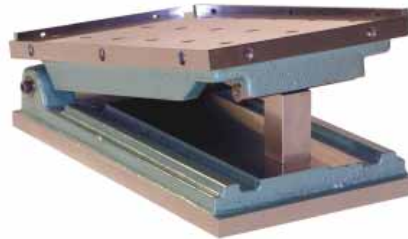
9118-5

MODEL #	LENGTH	WIDTH	HEIGHT	TAPPED HOLES	CENTER DISTANCE	SQUARE & PARALLEL	WT (#)
9118-5	6-13/16"	2-1/8"	2-1/8"	10-32	5" ±0.0002"	0.0001"	8
9118-10	11-5/8"	4"	2-5/8"	10-32	10" ±0.0003"	0.0002"	21

SINE ANGLE PLATES & SINE ANGLE MAGNETIC CHUCKS



9123-1



9228



9124-1



8866-1



8866-2

- Made from close-grained, heat-treated cast iron.
- Precision ground working surfaces.
- Sine rolls made from tool steel, hardened and lapped.
- Sine angle plate top plates are equipped with end stops for positioning work, and tapped holes for use in applying clamps.
- Sine angle magnetic chucks combine the principle of the sine angle plate construction, utilizing a permanent magnetic chuck. They are available in simple or compound styles.

SINE ANGLE PLATES

MODEL #	TYPE	LENGTH	WIDTH	HEIGHT	TAPPED HOLES	CENTER DISTANCE	SQUARE & PARALLEL	WT (#)
9123-1	Simple	6"	6"	2"	1/4-20	5" ±0.0002"	0.0002"	26
9124-1	Compound	6"	6"	3-3/8"	1/4-20	5" ±0.0002"	0.0002"	35
9228	Simple	12"	6-1/2"	2-7/8"	5/16-18	10" ±0.0003"	0.0003"	52
9229	Compound	12"	6-1/2"	4-3/4"	5/16-18	5" ±0.0002" & 10" ±0.0003"	0.0003"	97

SINE ANGLE MAGNETIC CHUCKS

MODEL #	TYPE	LENGTH	WIDTH	HEIGHT	CENTER DISTANCE	SQUARE & PARALLEL	WT (#)
8866-1	Simple	6"	6"	3-3/4"	5" ±0.0002"	0.0002"	37
8866-2	Compound	6"	6"	5"	5" ±0.0002"	0.0002"	45

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

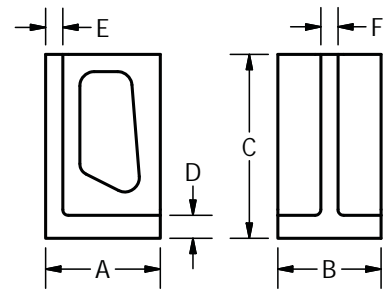
UNIVERSAL RIGHT ANGLE IRONS



9191-S

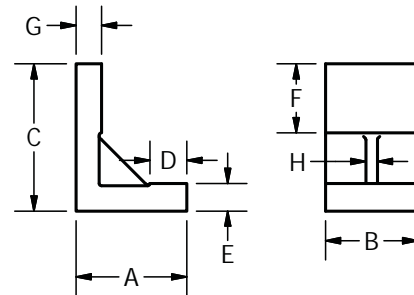
- Made from class 35-40 cast iron.
- This angle iron's squareness and parallelism makes it useful for clamping work in several different positions.
- Ideal for squaring operations.
- Available in either a ground or scraped finish.

MODEL #		A	B	C	D	E	F	SQUARE & PARALLEL	WT (#)
GROUND	SCRAPED								
9191-G	9191-S	4"	3-3/4"	5"	3/4"	5/8"	5/8"	0.0002"	8
9192-G	9192-S	5"	4-1/2"	8"	1"	3/4"	3/4"	0.0002"	20
9193-G	9193-S	7"	5-1/2"	10"	1-1/8"	1"	7/8"	0.0003"	37
9194-G	9194-S	9"	8"	16"	1-3/8"	1-1/8"	15/16"	0.0005"	102



9180-G

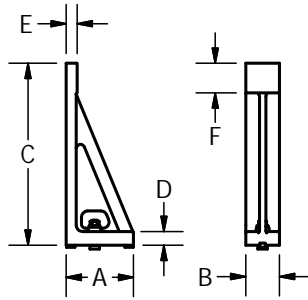
TOOLMAKER'S KNEES



- Made from class 35-40 cast iron.
- Pads on the back of each angle are finished for clamping and reference purposes.
- May be used on any face or edge for layout, inspection or machining.
- Available in either a ground or scraped finish.

MODEL #		A	B	C	D	E	F	G	H	SQUARE & PARALLEL	WT (#)
GROUND	SCRAPED										
9180-G	9180-S	3"	2-1/2"	4"	1"	3/4"	1-7/8"	11/16"	5/16"	0.0001"	4

MEASURING IRONS



- Made from class 35-40 cast iron.
- Furnished with two precision 11/16" aligning keys and one T-bolt with nut.
- Narrow width offers convenient means of clamping where table room is at a minimum.
- Available in either a ground or scraped finish.



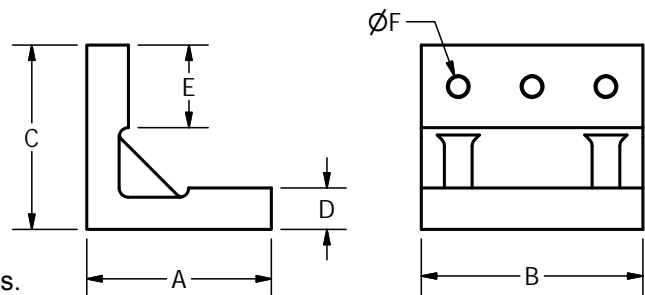
9202-G

MODEL #		A	B	C	D	E	F	VERTICAL FACE SQUARE TO BOTTOM	INSIDE FACE PARALLEL TO VERTICAL FACE	KEY SLOT SQUARE WITH VERTICAL FACE	WT (#)
GROUND	SCRAPED										
9201-G	9201-S	6"	2-1/2"	12-1/2"	7/8"	13/16"	1-1/2"	0.0002" / 12"	0.0002"	0.0002"	18
9202-G	9202-S	8"	4"	21-1/2"	1-5/8"	1-5/16"	3-1/2"	0.0002" / 12"	0.0003"	0.0002"	56



9181-20G

DUPLEX ANGLE IRONS

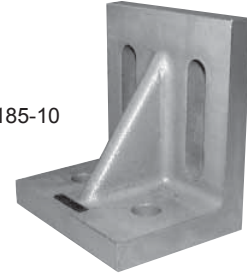


- Made from class 35-40 cast iron.
- Ground inner pads provide handy reference surfaces.
- Conveniently spaced holes in both faces may be used for clamping work to the angle iron, or bolting the angle iron to machine tables.
- Heavy ribbing in the inside corner of each size assures maximum strength and rigidity.
- Available in either a ground or scraped finish.

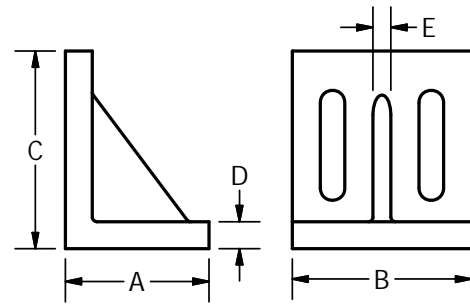
MODEL #		A	B	C	D	E	F	WORKING FACES SQUARE	INSIDE FACE PARALLEL TO VERTICAL FACE	WT (#)
GROUND	SCRAPED									
9181-10G	9181-10S	5"	6"	5"	1-1/8"	2-1/4"	(5) 17/32"	0.00025" / 6"	0.00025" / 6"	17
9181-20G	9181-20S	6"	12"	6"	1-1/8"	3"	(5) 21/32"	0.0005" / 6"	0.0005" / 6"	42

SLOTTED ANGLE IRONS

9185-10



- Made from class 35-40 cast iron.
- Heavily proportioned, ribbed for strength & rigidity.
- Faces and edges ground square and parallel within 0.0005" per 6".
- Table faces and angle faces have convenient clamping holes and slots for fast work mounting and setups.



MODEL #		A	B	C	D	E	HORIZONTAL FACE		VERTICAL FACE	WT (#)
GROUND	SCRAPED						HOLES	SLOTS	SLOTS	
9185-10G	9185-10S	4"	5"	5-1/2"	3/4"	(1) 1/2"	(2) 3/4"	--	(2) 3" X 11/16"	10
9185-12G	9185-12S	6"	6"	8"	7/8"	(1) 5/8"	(4) 3/4"	--	(2) 3/4" X 5"	23
9185-16G	9185-16S	8"	10"	12"	1-1/8"	(2) 3/4"	--	(3) 3/4" X 3-3/4"	(4) 3/4" X 3-1/2"	71
9185-18G	9185-18S	5"	12"	10"	1"	(2) 3/4"	--	(3) 3/4" X 2-7/8"	(2) 3/4" X 5-3/8"	36
9185-20G	9185-20S	9"	12"	10"	1-1/8"	(2) 51/64"	--	(4) 25/32" X 2-1/8" (2) 25/32" X 5-1/4"	(6) 25/32" X 1-3/4" (4) 25/32" X 3"	89
9185-22G	9185-22S	12"	16"	14"	1-1/8"	(2) 7/8"	--	(4) 1" X 3-1/2" (2) 1" X 8"	(2) 1" X 2-3/4" (3) 1" X 4-1/4"	173
9185-26G	9185-26S	16"	20"	18"	1-1/8"	(2) 1"	(12) 1"	--	(4) 1" X 4-7/8" (3) 1" X 11"	244

MAGNETIC ANGLE IRON



- Combines the advantages of a universal right angle iron with a permanent magnetic chuck.
- Magnetic face can be quickly energized by a simple turn of one of the recessed control bars located on each end face.



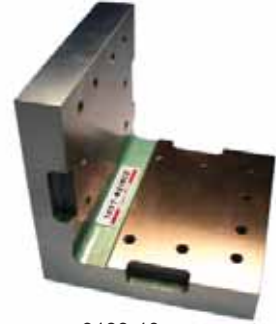
- Heavy supporting rib between the end faces gives great structural strength and acts as a convenient carrying handle.
- Body made from class 35-40 cast iron.

MODEL #	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	WT (#)
9195	4-3/4"	4-1/4"	6-1/2"	0.0002"	20

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

PALLET IRONS

- Made from class 35-40 cast iron.
- Tapped holes for convenient work holding and recessed ledges for clamping to machine tables.
- Intersection of the inside faces is relieved for convenience in mounting right angle work.
- Locating pins or stops, as well as keyways and work clamping devices, may be added to any working surface.
- Ideal for use on multi-station transfer lines.



9183-10

MODEL #	SIZE (±0.005")			TAPPED HOLES	INSIDE WORKING FACES			SQUARE	PARALLEL	WT (#)
	LENGTH	WIDTH	HEIGHT		LENGTH	WIDTH	THICKNESS (±0.0005")			
9183-8	8"	8"	8"	(16) 3/8-16	8"	5-1/2"	1-1/2"	0.0005" / 6"	0.0003"	30
9183-10	10"	10"	10"	(16) 3/8-16	10"	7"	1-3/4"	0.0005" / 6"	0.0004"	59

BOX ANGLE IRON

- Made from class 35-40 cast iron.
- Combines the advantages of a right angle iron and box parallel in a single unit.
- Can be converted into special fixtures by incorporating plain or tapped holes, key slots, locating pins and/or stops.
- Open sides simplify clamping and provide clearances for nesting work projections.

9166-6



MODEL #	SIZE (±0.0005")			SQUARE OPENINGS	RECTANGULAR OPENINGS	FINISHED SURFACES		WT (#)
	LENGTH	WIDTH	HEIGHT			SQUARE	PARALLEL	
9166-6	6"	6"	6"	4" x 4"	1-7/8" x 4"	0.0003"	0.0005"	28

STEEL V-BLOCKS



9129



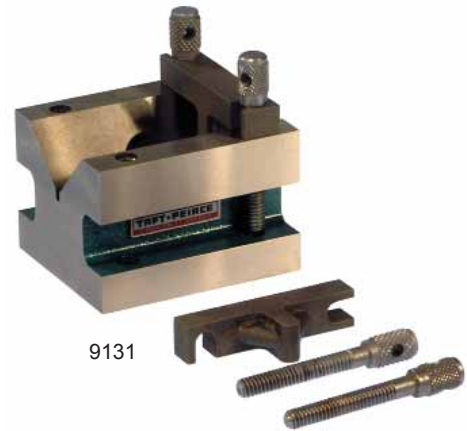
9130

- Made of high-quality, heat-treated alloy steel.
- All sizes available in pairs matched within 0.0003" and numbered for identification.
- Each block comes with a reversible steel clamp and two clamping screws.
- On model number 9129 and 9130 clamps can be swung aside or slipped off to speed insertion and removal of work.
- Designed so that blocks can lie on side or end without interference from clamp or screws.
- On model 9128 clamps have through holes only.

MODEL #		LENGTH	WIDTH	HEIGHT	VEE CAPACITY	VEE CENTRAL, SQUARE & PARALLEL	SIDES SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR							SINGLE	PAIR
9128	9128-M	1-3/8"	1-3/8"	1-1/8"	3/4"	0.0003"	0.0002"	2	3
9129	9129-M	2-1/8"	2-3/8"	1-7/8"	1-1/2"	0.0003"	0.0002"	3	5
9130	9130-M	2-7/8"	4"	2-7/8"	3"	0.0003"	0.0002"	8	15

UNIVERSAL V-BLOCKS

- Made of high-quality, heat-treated alloy steel.
- Sold as a single block or in pairs matched within the 0.0003" and numbered for identification.
- Each block has a 23/32" drilled hole in the center of the "V"-- useful for providing clearance for drilling and boring operations.
- Base ledge has four 5/16-18 tapped holes for convenient clamping to angle irons or face plates.
- Each block is provided with two clamps and four clamping screws.
- Clamps do not interfere when blocks are used on sides or ends and may be swung aside or removed entirely.
- Each pair furnished in wooden storage case.



9131

MODEL #		LENGTH	WIDTH	HEIGHT	VEE CAPACITY	VEE CENTRAL, SQUARE & PARALLEL	SIDES SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR							SINGLE	PAIR
9131	9131-M	2-3/4"	2-3/8"	1-7/8"	1-1/2"	0.0003"	0.0002"	4	7

SOLID BODY CAST IRON V-BLOCKS

- Made from class 35-40 cast iron.
- Extra-heavy body design combines a massive section for absolute rigidity and accuracy. An all-around base ledge allows C-clamps, parallel clamps and machine table straps to be applied in any position.
- Reversible work clamps do not interfere, when blocks are used on sides or ends, and may be swung aside or removed.
- Each block is provided with one clamp and two clamping screws.
- Sold as a single block or in pairs matched within the 0.0003" and numbered for identification.



9132

MODEL #		LENGTH	WIDTH	HEIGHT	VEE CAPACITY	VEE CENTRAL, SQUARE & PARALLEL	SIDES SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR							SINGLE	PAIR
9132	9132-M	4"	5"	4"	3-7/8"	0.0003"	0.0002"	17	34

OPEN BODY CAST IRON V-BLOCKS

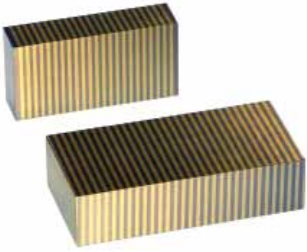
- Made from class 35-40 cast iron.
- Sides and ends of each block have a full outline bearing area.
- Convenient ledges allow for clamping in any position to machine tables and inspection plates.
- Features "open" body design to reduce weight, and heavy ribbing for added strength.
- Pairs are matched within 0.0005" and numbered for identification.
- Each block is provided with one clamp and two clamping screws.
- Clamps do not interfere, when blocks are used on sides or ends, and may be swung aside or removed entirely.



9133

MODEL #		LENGTH	WIDTH	HEIGHT	VEE CAPACITY	VEE CENTRAL, SQUARE & PARALLEL	SIDES SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR							SINGLE	PAIR
9133	9133-M	6"	6"	6"	4-1/2"	0.0005"	0.0005"	23	46
9134	9134-M	8"	8"	8"	6-3/8"	0.0005"	0.0005"	52	104

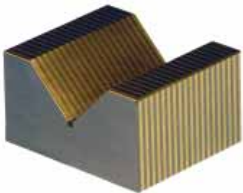
MAGNETIC TRANSFER PARALLELS



- Made of alternate laminations of brass and highly permeable, soft iron.
- Carries the magnetic holding force well above the working surface of practically any style or make of electromagnetic or permanent magnetic chuck.
- Sold singly or in pairs.
- Pairs matched within 0.0002".

MODEL #		LENGTH	WIDTH	HEIGHT	OPPOSITE SIDES PARALLEL	ADJACENT SIDES SQUARE	WT (#)	
SINGLE	PAIR						SINGLE	PAIR
9805-1	9805-1M	3"	1-1/2"	3/4"	0.0002"	0.0004"	2	3
9805-2	9805-2M	4"	2"	1"	0.0002"	0.0004"	3	6

MAGNETIC TRANSFER V-BLOCKS



- Made of alternate laminations of brass and highly permeable, soft iron.
- Sold as a single block or in pairs matched within ± 0.0001 " and numbered for identification.
- Used for building set-ups on magnetic chucks for work requiring surface grinding.
- Carries a magnetic chuck's holding power well above its working surface.
- 90° vee.
- Not intended for vertical use.

MODEL #		LENGTH	WIDTH	HEIGHT	VEE CAPACITY (DIA.)	ACROSS VEE	VEE CENTRAL & PARALLEL	ENDS SQUARE & PARALLEL	WT (#)	
SINGLE	PAIR								SINGLE	PAIR
9806-1	9806-1M	2-1/2"	2-1/2"	1-3/4"	2-3/4"	2-1/8"	0.0005"	0.002"	4	7

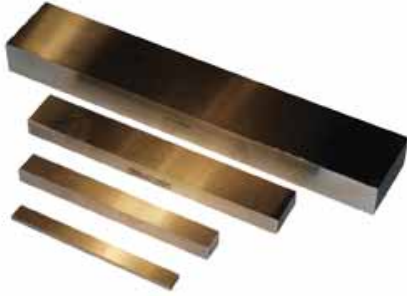
PRECISION TRI-BLOCKS



9151-1

- Made of high-quality, alloy steel, heat-treated to Rockwell "C" 63-65.
- Precision ground on all six sides to a uniform 8 micro inch finish or better.
- Because of the unusually close tolerances, you need only order Inspection Grade, where matched sets are required.

MODEL #	GRADE	LENGTH	WIDTH	HEIGHT	TOLERANCES			WT (#)
					SQUARE	PARALLEL	SIZE	
9151-1	TOOLROOM	3"	2"	1"	0.0002"	0.0002"	± 0.0001 "	3
9151-2	INSPECTION	3"	2"	1"	0.0002"	0.0001"	+0.0001" -0.0000"	3



STEEL PARALLELS

- Made of high-quality, heat-treated alloy steel.
- Precision ground on all four sides. Not made to be used as a square.
- Sold individually, but for convenience should be bought in pairs.
- Can be purchased in Tool Crib Sets.
- Metric sizes available.

MODEL #	LENGTH	WIDTH	HEIGHT	INCLUDED IN SET			WT (#)
				A	B	C	
9150-0001	5"	1/4"	5/16"	A	B	C	2
9150-0002	5"	1/4"	3/8"	A	--	--	2
9150-0003	5"	5/16"	3/8"	A	B	C	2
9150-0004	5"	1/4"	7/16"	A	--	--	2
9150-0005	5"	3/8"	7/16"	A	--	--	2
9150-0006	5"	1/4"	1/2"	A	B	C	2
9150-0008	5"	3/8"	1/2"	A	--	--	2
9150-0009	6"	1/4"	5/8"	A	--	--	2
9150-0010	6"	5/16"	5/8"	A	B	C	2
9150-0011	6"	9/16"	11/16"	A	--	--	3
9150-0012	6"	3/8"	3/4"	A	B	C	2
9150-0013	6"	7/16"	3/4"	A	--	--	3
9150-0014	6"	1/2"	3/4"	A	--	--	3
9150-0015	6"	1/4"	13/16"	A	--	--	2
9150-0016	6"	5/16"	13/16"	A	--	--	3
9150-0018	6"	1/4"	7/8"	A	--	--	2
9150-0019	6"	7/16"	7/8"	A	B	C	3

MODEL #	LENGTH	WIDTH	HEIGHT	INCLUDED IN SET			WT (#)
				A	B	C	
9150-0021	6"	1/4"	1"	A	--	--	2
9150-0022	6"	5/16"	1"	A	--	--	3
9150-0023	6"	1/2"	1"	A	B	C	3
9150-0025	6"	1/2"	1-1/8"	A	--	--	3
9150-0026	6"	5/8"	1-1/8"	A	B	C	3
9150-0027	6"	3/4"	1-1/8"	A	--	--	3
9150-0028	8"	3/8"	1-1/4"	A	B	C	3
9150-0030	8"	5/8"	1-1/4"	A	--	--	4
9150-0031	8"	5/8"	1-1/2"	A	--	--	4
9150-0032	8"	3/4"	1-1/2"	A	B	C	5
9150-0033	12"	1-1/4"	1-1/2"	A	--	--	8
9150-0034	12"	7/8"	1-3/4"	A	B	C	7
9150-0035	12"	1"	2"	A	B	C	9
9150-0036	12"	1-1/8"	2-1/4"	A	--	C	11
9150-0037	12"	1-1/4"	2-1/2"	A	--	C	13
9150-0038	12"	1-3/8"	2-3/4"	A	--	C	15
9150-0039	12"	1-1/2"	3"	A	--	C	17

SIZE RANGE	TOLERANCES (WIDTH & HEIGHT)	
	SIZE	PARALLEL
5" & 6" LENGTHS	±0.0002"	±0.00010"
8" LENGTHS	±0.0003"	±0.00015"
12" LENGTHS	±0.0004"	±0.00020"



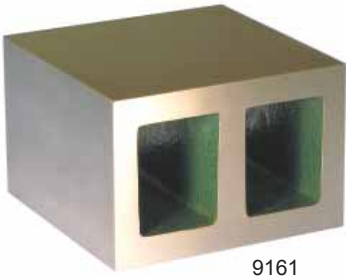
Wooden Cabinets for Tool Crib Sets

TOOL CRIB SETS

These sets are furnished in a sturdy, wooden cabinet designed to keep parallels of different lengths within easy reach.

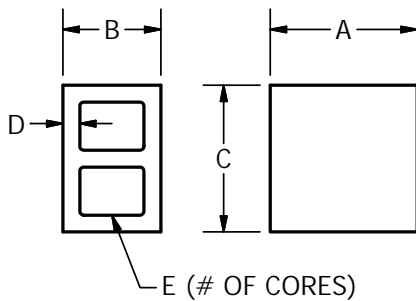
MODEL #	PARALLELS INCLUDED	WT (#)
9150-A	(2) EACH OF 34 SIZES MARKED "A" ABOVE	218
9150-B	(2) EACH OF 12 SIZES MARKED "B" ABOVE	49
9150-C	(2) EACH OF 16 SIZES MARKED "C" ABOVE	97

BOX PARALLELS



9161

- Made from class 35-40 cast iron.
- Cored to reduce weight and to provide convenient ledges for applying clamps.
- May be drilled, tapped, slotted or otherwise machined for making special fixtures.
- Two or more box parallels of a given size may be used as a set.
- Adjacent sides square within 0.0005" per 6".
- Opposite sides parallel within 0.0003" per 6".



MODEL #	SIZE (±0.0005")			D	E	WT (#)
	A	B	C			
9160	6"	4"	4"	11/16"	1	16
9161	6"	4"	6"	11/16"	2	25
9162	12"	5"	8"	11/16"	2	65
9163	16"	6"	14"	5/8"	2	110
9164-A	10"	10"	10"	3/4"	4	125
9164-B	12"	12"	12"	1"	4	184

PLANER & BORING MILL PARALLELS



9165-24

- Made from class 35-40 cast iron.
- Rigidly constructed with reinforced ribs.
- Cored holes at intervals throughout the length provide for easy clamping.
- Adjacent sides square within 0.0005" per 6".
- Opposite sides parallel within 0.0003" per 6".

MODEL #	LENGTH	WIDTH ±0.0005"	HEIGHT ±0.0005"	CORED HOLES	WT (#)
9165-24	24"	1-1/2"	3"	(3) 1"	17
9165-32	24"	2"	4"	(3) 1"	27
9165-40	24"	2-1/2"	5"	(5) 1"	51
9165-48	36"	3"	6"	(6) 1-1/4"	97
9165-64	36"	4"	8"	(6) 1-1/2"	135

STEEL STRAIGHT EDGES



9169-24

- Made of heat-treated alloy steel.
- Edges precision ground, parallel and straight.
- All sizes are proportioned for proper balance between rigidity and weight.
- Sizes 24" and longer have marked support points, which should be used to minimize deflection due to gravity.
- When not in use, these straight edges should be hung vertically by the hole provided in one end.

MODEL #	LENGTH	WIDTH	HEIGHT	STRAIGHT & PARALLEL	WT (#)
9169-12	12"	1/4"	1-1/2"	0.0001"	3
9169-24	24"	5/16"	2"	0.0002"	6
9169-36	36"	3/8"	2-1/2"	0.0003"	9
9169-48	48"	7/16"	3"	0.0004"	17
9169-60	60"	1/2"	3-1/2"	0.0005"	38
9169-72	72"	1/2"	4"	0.0006"	50

LEVELING STRAIGHT EDGES

- Designed for setting up & leveling machinery.
- I-beam construction for maximum strength.
- Cored & ribbed for balanced lightness & rigidity.
- Made from class 35-40 cast iron.
- Top and bottom surfaces are ground or hand scraped flat, straight, and parallel.



9168-36S

MODEL #		LENGTH	WIDTH	HEIGHT	STRAIGHT*	PARALLEL	WT (#)
GROUND	SCRAPED						
9168-36G	9168-36S	36"	2-1/2"	8"	0.0002"	0.0002"	90
9168-48G	9168-48S	48"	2-1/2"	8"	0.0003"	0.0002"	100
9168-60G	9168-60S	60"	2-1/2"	8"	0.0004"	0.0003"	126
--	9168-72S	72"	2-1/2"	8"	0.0005"	0.0003"	153
--	9168-96S	96"	3"	9-1/2"	0.0006"	0.0003"	440
--	9168-120S	120"	3-3/4"	11"	0.0006"	0.0003"	550

* Overall straightness is precisely checked at the factory to within the tolerance listed for each size. In use, however, straightness is a function of proper selection of support points. While this is not critical for the 36" and 48" sizes, the support points should be located 6" to 18" from the ends for the 60" size, 13" to 20" for the 72" size, & 20" to 26" for the 96" size.

CYLINDRICAL SQUARES

- Made of high-quality, heat-treated alloy steel.
- Provides one of the most reliable 90° reference standards available.
- Periphery is ground between centers, straight and round within the tolerance specified for each size with an extremely fine micro finish.
- Recessed ends, provided with self-cleaning dirt grooves, are ground and lapped square with the axis.
- Supplied in a finished wood case with hinged cover.



9143-12

MODEL #	DIAMETER	HEIGHT	ROUND WITHIN	SQUARE	WT (#)
9141	3"	4-1/2"	0.0001"	0.0001"	11
9143-12	5"	12"	0.0001"	0.0001"	71
9143-24	6"	24"	0.0002"	0.0002"	116
9143-36	7-7/8"	36"	0.0002"	0.0003"	250
9143-48	9-3/4"	48"	0.0002"	0.0004"	590

COMPARATOR SQUARE



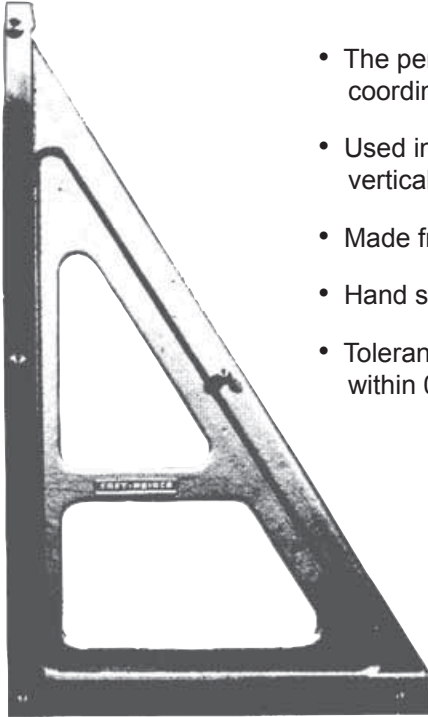
9146

(shown with optional cylindrical square)

- 5" x 3-1/2" x 1" thick base made of hardened stainless steel, serrated on the bottom for self-cleaning action and lapped flat for positive surface plate contact.
- 11-1/16" x 1-1/4" diameter column made of hardened stainless steel.
- Indicator bracket made of seasoned cast iron, with a slot that allows 1/8" horizontal adjustment of the indicator.
- 1-11/16" diameter AGD Group 1 dial indicator with adjustable bracket-type back, 0.0001" graduations & 0.025" range with 0-5-0 reading dial.
- Comes complete with indicator in a finished wooden case with hinged cover.

MODEL #	LENGTH	WIDTH	HEIGHT	USABLE HEIGHT RANGE	WT (#)
9146	5"	3-1/2"	12-1/16"	2-1/8" to 11-7/8"	17

3-AXIS REFERENCE SQUARE



- The perfect tool for checking all three axes of machining centers and coordinate measuring machines.
- Used in applications where there is a need to check horizontal and/or vertical alignment.
- Made from class 35-40 cast iron.
- Hand scraped finish.
- Tolerances of all working surfaces are held square to one another within 0.0003" overall.

MODEL #	LENGTH	WIDTH	EDGE THICKNESS	SQUARE	WT (#)
9314-S	40"	24"	2"	0.0003"	180

Six Quick Steps to Check X, Y & Z Alignment

1. Square measuring iron to table X axis, using t-slot.
2. Track X axis along reference iron with spindle/probe to determine squareness.
3. Adjust X travel to fall within established tolerance.
4. Track Y axis to determine squareness of X and Y positions.
5. Position measuring iron in vertical position on table.
6. Track vertical surface with a spindle/probe to determine squareness of Z to X and Y (table).

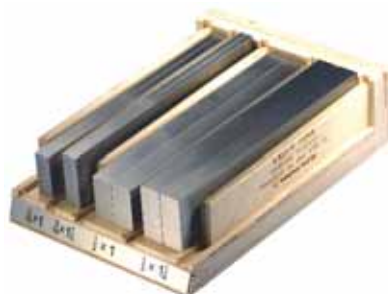
NOTES

VALUE LINE™

GLOBALLY SOURCED



BY SUBURBAN TOOL, INC.



VALUE LINE™ TRI-BLOCKS



VL-001-0001



VL-001-0002

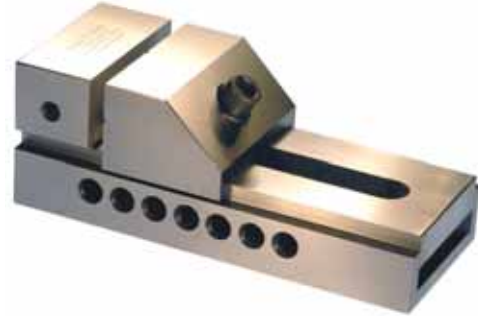
- Made of steel, hardened to Rc58-60.
- Square within ± 0.0002 ".
- Flat & parallel within 0.0002".
- Held to size within ± 0.0002 ".
- Supplied in pairs in a fitted wooden storage case.

MODEL #	LENGTH	WIDTH	HEIGHT	WT (#)
VL-001-0001	3"	2"	1"	3
VL-001-0002	4"	3"	2"	14

IMPORTED

VALUE LINE™ PRECISION VISES

- Made of hardened steel.
- Square & parallel within 0.0002".



VL-003-0001

MODEL #	LENGTH	WIDTH	HEIGHT	JAW OPENING	WT (#)
VL-003-0001	9-5/8"	4"	3-5/8"	4-7/8"	23

IMPORTED

VALUE LINE™ PRECISION ANGLE PLATES

- One-piece hardened steel construction.
- Parallel within 0.0005".
- All have tapped holes.



VL-005-0001



VL-005-0002

MODEL #	LENGTH	WIDTH	HEIGHT	HOLES	WT (#)
VL-005-0001	4"	4"	4"	(13) 1/4-20 (4) C'Bores for 3/8	12
VL-005-0002	4"	4"	6"	(14) 3/8-16 (4) C'Bores for 3/8	15

VALUE LINE™ INDEX FIXTURE

- 24 position index plate provides a hard stop every 15°.
- Wheel dresser arm included.



VL-014-0001

MODEL #	THROUGH HOLE	CENTERLINE HEIGHT	LENGTH	WIDTH	HEIGHT	SQUARE & PARALLEL	WT (#)
VL-014-0001	0.60"	3.14"	8.20"	4.20"	7.30"	0.0003"	18

IMPORTED

VALUE LINE™ SLOTTED WEBBED ANGLE PLATES



VL-006-0006

- One-piece cast iron.
- Machined finish - square & parallel within 0.005" per 6".
- Ground finish - parallel within 0.005" per 6" & square within 0.003" per 6".

MODEL #	FINISH	LENGTH	WIDTH	HEIGHT	# OF WEBS	WT (#)
VL-006-0007	MACHINED	2"	3"	3"	1	4
VL-006-0008	GROUND	2"	3"	3"	1	4
VL-006-0009	MACHINED	3"	4"	3"	1	5
VL-006-0002	GROUND	3"	4"	3"	1	5
VL-006-0010	MACHINED	4"	6"	5"	1	13
VL-006-0005	GROUND	4"	6"	5"	1	13
VL-006-0011	MACHINED	4"	7"	5"	1	14
VL-006-0012	GROUND	4"	7"	5"	1	14
VL-006-0013	MACHINED	5"	8"	6"	2	22
VL-006-0004	GROUND	5"	8"	6"	2	22
VL-006-0014	MACHINED	6"	9"	7"	2	28
VL-006-0003	GROUND	6"	9"	7"	2	28
VL-006-0015	MACHINED	6"	10"	8"	2	37
VL-006-0006	GROUND	6"	10"	8"	2	37
VL-006-0016	MACHINED	8"	12"	9"	2	63
VL-006-0001	GROUND	8"	12"	9"	2	63

IMPORTED

VALUE LINE™ PLAIN WEBBED ANGLE PLATES



VL-011-0014

- One-piece cast iron.
- Machined finish - parallel within 0.005" per 6" & square within 0.0036" per 6".
- Ground finish - parallel within 0.005" per 6" & square within 0.0018" per 6".

MODEL #	FINISH	LENGTH	WIDTH	HEIGHT	# OF WEBS	WT (#)
VL-011-0001	MACHINED	2"	2"	2"	1	1
VL-011-0002	GROUND	2"	2"	2"	1	1
VL-011-0003	MACHINED	3"	3"	3"	1	3
VL-011-0004	GROUND	3"	3"	3"	1	3
VL-011-0005	MACHINED	4"	4"	4"	1	7
VL-011-0006	GROUND	4"	4"	4"	1	7
VL-011-0007	MACHINED	5"	5"	5"	1	11
VL-011-0008	GROUND	5"	5"	5"	1	11
VL-011-0009	MACHINED	6"	6"	6"	1	18
VL-011-0010	GROUND	6"	6"	6"	1	18
VL-011-0011	MACHINED	8"	8"	8"	2	42
VL-011-0012	GROUND	8"	8"	8"	2	42
VL-011-0013	MACHINED	10"	10"	10"	2	70
VL-011-0014	GROUND	10"	10"	10"	2	70
VL-011-0015	MACHINED	12"	12"	12"	2	125
VL-011-0016	GROUND	12"	12"	12"	2	125

IMPORTED

VALUE LINE™ SLOTTED OPEN ANGLE PLATES



VL-012-0004

- One-piece cast iron.
- Machined finish - parallel within 0.005" per 6" & square within 0.0036" per 6".
- Ground finish - parallel within 0.005" per 6" & square within 0.0018" per 6".

MODEL #	FINISH	LENGTH	WIDTH	HEIGHT	WT (#)
VL-012-0001	MACHINED	3"	4"	3"	4
VL-012-0002	GROUND	3"	4"	3"	4
VL-012-0003	MACHINED	4"	6"	5"	12
VL-012-0004	GROUND	4"	6"	5"	12
VL-012-0005	MACHINED	4"	7"	5"	14
VL-012-0006	GROUND	4"	7"	5"	14
VL-012-0007	MACHINED	5"	8"	6"	20
VL-012-0008	GROUND	5"	8"	6"	20
VL-012-0009	MACHINED	6"	9"	7"	24
VL-012-0010	GROUND	6"	9"	7"	24
VL-012-0011	MACHINED	6"	10"	8"	33
VL-012-0012	GROUND	6"	10"	8"	33
VL-012-0013	MACHINED	8"	12"	9"	62
VL-012-0014	GROUND	8"	12"	9"	62

IMPORTED

VALUE LINE™ UNIVERSAL RIGHT ANGLE IRONS

- One-piece cast iron.
- Machined finish - square & parallel within 0.002" per 6".
- Ground finish - parallel within 0.0025" per 6" & square within 0.002" per 6".



VL-013-0004

MODEL #	FINISH	LENGTH	WIDTH	HEIGHT	WT (#)
VL-013-0001	MACHINED	5"	3"	4"	10
VL-013-0002	GROUND	5"	3"	4"	10
VL-013-0003	MACHINED	6"	4"	4"	12
VL-013-0004	GROUND	6"	4"	4"	12
VL-013-0005	MACHINED	6"	4"	5"	16
VL-013-0006	GROUND	6"	4"	5"	16
VL-013-0007	MACHINED	8"	4"	5"	21
VL-013-0008	GROUND	8"	4"	5"	21
VL-013-0009	MACHINED	10"	5"	7"	37
VL-013-0010	GROUND	10"	5"	7"	37
VL-013-0011	MACHINED	10"	5"	8"	40
VL-013-0012	GROUND	10"	5"	8"	40
VL-013-0013	MACHINED	12"	5"	8"	44
VL-013-0014	GROUND	12"	5"	8"	44
VL-013-0015	MACHINED	8"	6"	6"	32
VL-013-0016	GROUND	8"	6"	6"	32
VL-013-0017	MACHINED	16"	8"	9"	94
VL-013-0018	GROUND	16"	8"	9"	94
VL-013-0019	MACHINED	12"	8"	10"	94
VL-013-0020	GROUND	12"	8"	10"	94

IMPORTED

VALUE LINE™ COLLET SETS

5C COLLET SETS & ACCESSORIES



VL-015-0001



VL-015-0005

- Sets available in 1/16 or 1/32 inch increments.
- 30 hole collet rack is optional.

MODEL #	DESCRIPTION	# OF COLLETS	WT (#)
VL-015-0001	5C Round Collet Set - 1/16 to 1-1/8" by 1/16"	18	12
VL-015-0002	5C Round Collet Set - 1/16 to 1-1/8" by 1/32"	35	22
VL-015-0005	30 Hole 5C Collet Rack	--	3

ER25 COLLET SETS



VL-015-0004

- Sets available in 1/16 or 1/32 inch increments.
- Each set comes in a wooden storage case.

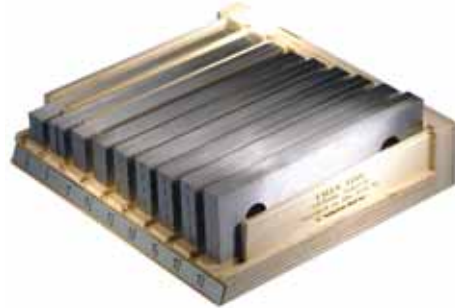
MODEL #	DESCRIPTION	# OF COLLETS	WT (#)
VL-015-0003	ER25 Round Collet Set - 1/16 to 5/8" by 1/16"	10	3
VL-015-0004	ER25 Round Collet Set - 1/16 to 5/8" by 1/32"	19	5

IMPORTED

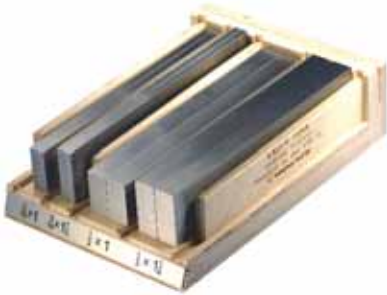
VALUE LINE™ 2-WAY STEEL PARALLEL SETS



VL-007-0001



VL-007-0002



VL-007-0003



VL-007-0004

- Includes matched pairs per the chart below.
- Furnished in a wooden holder, marked with sizes.

MODEL #	# OF PAIRS	SIZES INCLUDED (1 PAIR EACH)	WT (#)
VL-007-0001	10	6" long x 1/8" wide 1/2" to 1-5/8" high in 1/8" increments	8
VL-007-0002	9	6" long x 1/4" wide 3/4" to 1-3/4" high in 1/8" increments	12
VL-007-0003	4	6" x 3/16" x 1" 6" x 3/16" x 1-1/4" 6" x 1/2" x 1" 6" x 1/2" x 1-1/4"	7
VL-007-0004	4	6" x 3/16" x 1-1/2" 6" x 3/16" x 1-3/4" 6" x 1/2" x 1-1/2" 6" x 1/2" x 1-3/4"	9

IMPORTED

VALUE LINE™ COLLET SETS



VL-010-0001



VL-010-0002

- Center height: 2.5".
- 180° swing range.
- 8" maximum grinding wheel size.
- 5/8" maximum outside radius.
- 1" maximum inside radius.
- 1" spindle diameter.
- 3x optical lens allows a clear view of the dressing operation.
- Resulting radius & angle are perfectly tangent.
- Angle settings accomplished using vernier & adjustable stops.
- Comes in fitted wooden storage case.

- 7" overall height.
- 180° swing range.
- 8" maximum grinding wheel size.
- 5/8" maximum outside radius.
- 1" maximum inside radius.
- 1" spindle diameter.
- Can dress 2 tangent angles in one continuous motion within 0.0001".
- Base features 1" adjustments.
- Comes in fitted wooden storage case.

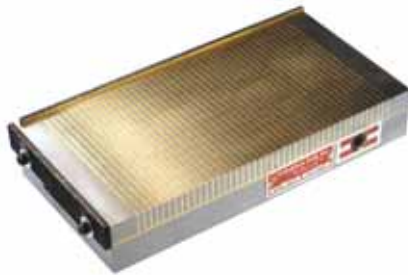
MODEL #	DESCRIPTION	WT (#)
VL-010-0001	Optical Radius & Angle Wheel Dresser	12
VL-010-0002	Radius & Angle Wheel Dresser	16

IMPORTED

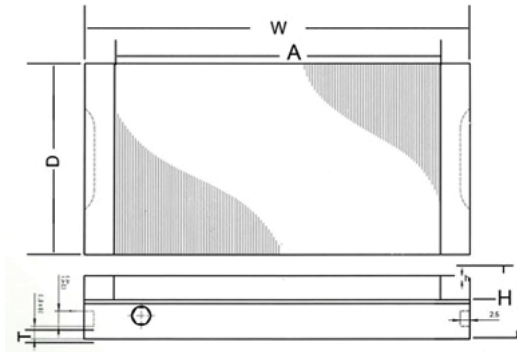
NOTES

QUALITY GLOBAL IMPORTS

RECTANGULAR RARE EARTH MAGNETIC CHUCKS STANDARD POLE



MRE-1530



- Made with neodymium iron boron type rare earth magnets for exceptional holding power.
- Flat, square & parallel within 0.005mm/100mm.
- Chucks are lubricated & sealed against dirt and liquids.
- Suitable for grinding & light milling.
- 80 N/cm² (116 psi) nominal holding power.
- Works best for holding larger & thicker workpieces.
- Has 4mm steel poles & 2mm brass spacers.
- Includes removable handle, side and back rails.

MODEL #	W	A	D	H	T	WT (#)
MRE-1018	180mm (7.09 in)	150mm (5.91 in)	104mm (4.09 in)	45mm (1.77 in)	10mm (0.39 in)	17
MRE-1325	250mm (9.84 in)	210mm (8.27 in)	130mm (5.12 in)	45mm (1.77 in)	10mm (0.39 in)	29
MRE-1530	300mm (11.81 in)	260mm (10.24 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	41
MRE-1535	350mm (13.78 in)	309mm (12.15 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	47
MRE-1545	450mm (17.72 in)	400mm (15.75 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	60
MRE-2045	450mm (17.72 in)	400mm (15.75 in)	200mm (7.87 in)	45mm (1.77 in)	10mm (0.39 in)	105
MRE-2060	600mm (23.62 in)	550mm (21.65 in)	200mm (7.87 in)	45mm (1.77 in)	10mm (0.39 in)	145
MRE-3045	450mm (17.72 in)	400mm (15.75 in)	300mm (11.81 in)	45mm (1.77 in)	10mm (0.39 in)	155
MRE-3060	600mm (23.62 in)	550mm (21.65 in)	300mm (11.81 in)	45mm (1.77 in)	10mm (0.39 in)	210

IMPORTED

RECTANGULAR RARE EARTH MAGNETIC CHUCKS FINE POLE



MRE-1325-FP

- Made with neodymium iron boron type rare earth magnets for exceptional holding power.
- Flat, square & parallel within 0.005mm/100mm.
- Chucks are lubricated & sealed against dirt and liquids.
- Suitable for grinding & EDM.
- 80 N/cm² (116 psi) nominal holding power.
- Works best for holding smaller & thinner workpieces.
- Has 1.5mm steel poles & 0.5mm brass spacers.
- Includes removable handle, side and back rails.

MODEL #	OVERALL LENGTH	ACTIVE POLE LENGTH	WIDTH	HEIGHT	BOTTOM TO HOLD-DOWN SLOT	WT (#)
MRE-1018-FP	180mm (7.09 in)	150mm (5.91 in)	104mm (4.09 in)	45mm (1.77 in)	10mm (0.39 in)	17
MRE-1325-FP	250mm (9.84 in)	210mm (8.27 in)	130mm (5.12 in)	45mm (1.77 in)	10mm (0.39 in)	29
MRE-1530-FP	300mm (11.81 in)	260mm (10.24 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	41
MRE-1535-FP	350mm (13.78 in)	309mm (12.15 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	47
MRE-1545-FP	450mm (17.72 in)	400mm (15.75 in)	150mm (5.91 in)	45mm (1.77 in)	10mm (0.39 in)	60
MRE-2045-FP	450mm (17.72 in)	400mm (15.75 in)	200mm (7.87 in)	45mm (1.77 in)	10mm (0.39 in)	105
MRE-2060-FP	600mm (23.62 in)	550mm (21.65 in)	200mm (7.87 in)	45mm (1.77 in)	10mm (0.39 in)	145
MRE-3045-FP	450mm (17.72 in)	400mm (15.75 in)	300mm (11.81 in)	45mm (1.77 in)	10mm (0.39 in)	155
MRE-3060-FP	600mm (23.62 in)	550mm (21.65 in)	300mm (11.81 in)	45mm (1.77 in)	10mm (0.39 in)	210

IMPORTED

ROUND RARE EARTH MAGNETIC CHUCKS STANDARD POLE



MRRE-13

- Flat, square & parallel within 0.005mm/100mm.
- Chucks are lubricated & sealed against dirt and liquids.
- Suitable for grinding & light milling.
- 80 N/cm² (116 psi) nominal holding power.
- Works best for holding larger & thicker workpieces.
- Has 4mm steel poles & 2mm brass spacers.
- Includes removable handle, side and back rails.

MODEL #	OUTSIDE DIAMETER	THICKNESS	WT (#)
MRRE-10	100mm (3.94 in)	51mm (2.0 in)	17
MRRE-13	130mm (5.12 in)	51mm (2.0 in)	29
MRRE-16	160mm (6.30 in)	51mm (2.0 in)	41
MRRE-20	200mm (7.87 in)	51mm (2.0 in)	47
MR2E-25	250mm (9.84 in)	61mm (2.4 in)	60
MRRE-30	300mm (11.81 in)	61mm (2.4 in)	105
MRRE-40	400mm (15.75 in)	61mm (2.4 in)	145

IMPORTED

ROUND RARE EARTH MAGNETIC CHUCKS FINE POLE



MRRE-30-FP

- Made with neodymium iron boron type rare earth magnets for exceptional holding power.
- 80 N/cm² (116 psi) nominal holding power.
- Suitable for grinding & EDM.
- Works best for holding smaller & thinner workpieces.
- Has 1.5mm steel poles & 0.5mm brass spacers.

MODEL #	OUTSIDE DIAMETER	THICKNESS	WT (#)
MRRE-10-FP	100mm (3.94 in)	51mm (2.0 in)	17
MRRE-13-FP	130mm (5.12 in)	51mm (2.0 in)	29
MRRE-16-FP	160mm (6.30 in)	51mm (2.0 in)	41
MRRE-20-FP	200mm (7.87 in)	51mm (2.0 in)	47
MR2E-25-FP	250mm (9.84 in)	61mm (2.4 in)	60
MRRE-30-FP	300mm (11.81 in)	61mm (2.4 in)	105
MRRE-40-FP	400mm (15.75 in)	61mm (2.4 in)	145

IMPORTED

NOTES

TABLES & FORMULAS

**The tables, charts and formulas
in this section
are provided
for your convenience only.**

**Their accuracy
is not in any way
guaranteed by
Suburban Tool, Inc.**

SEE PAGE 129 FOR IMPORTANT HOLDING POWER INFORMATION.

NOTES

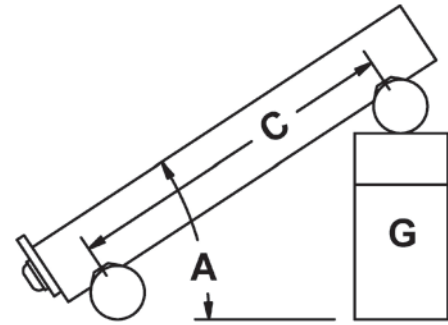
HOW TO USE A SINE BAR / PLATE

1. To set an angle on any sine device, whether it is a sine bar, sine plate, compound sine plate, or other sine tool, you must first determine the center distance of the device (C) and the angle you wish to set (A).
2. Next, you must look up the 'setting constant' in the appropriate table.

The sine tables provided in this booklet are the basic sizes needed to set an angle on most sine products. For center distances other than those sizes listed, use the appropriate multiple of the constant determined from the basic chart.

For example: to obtain the constant needed to set a 15 degree 12 minute angle on a 10" sine plate, look up the constant in the 5" chart and find 1.310946". Multiply this by 2 and the result is 2.621892".

3. After determining the appropriate constant, assemble a stack of gage blocks (G) equal in size to that constant.
4. Place these gage blocks under the gage block roll of the sine device, and the desired angle is set.
5. Tighten the locking mechanism on those devices that have one, and you're ready to go.



COMPOUND ANGLE COMPENSATION

When setting compound angles, it is necessary to compensate for the first angle set in order to correctly set the second angle. To obtain this compensation, refer to the following drawings and procedures.

Where:

Angle A = First desired angle.

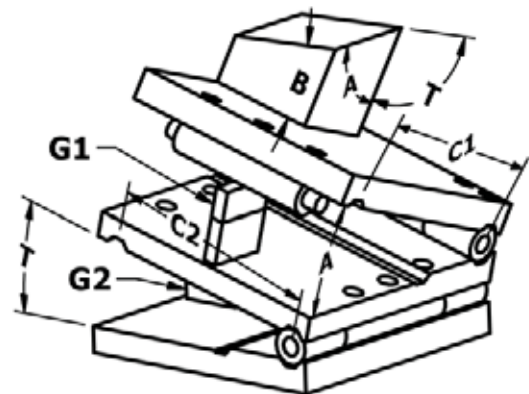
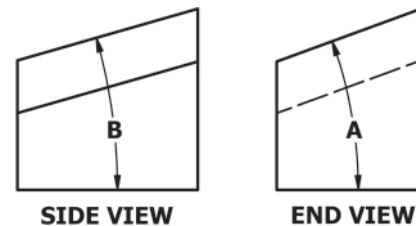
Angle B = Second desired angle.

Angle C = True angle setting required to get angle B.

1. Set the first of the desired angles (Angle A) on the top section of your compound sine plate.
2. Calculate the tangent of the True Angle (Angle C) using the formula:

$$\text{Tan (True Angle C)} = \text{Tan (Angle B)} \times \text{Cos (Angle A)}$$

3. Lookup the True Angle (Angle C) in a table of tangents (or use the inverse tangent function on your calculator).
4. Set the lower section of your compound sine plate, using the proper sine table and the True Angle (Angle C).
5. Results: The compound sine plate is now set to obtain the desired angles (Angles A & B) in their respective planes.



VIEW OF PART

3" SINE BAR CONSTANTS

MIN	0°	1°	2°	3°	4°	5°	6°	7°	8°
0	0.000000	0.052357	0.104698	0.157008	0.209269	0.261467	0.313585	0.365608	0.417519
1	0.000873	0.053230	0.105571	0.157879	0.210140	0.262337	0.314453	0.366474	0.418383
2	0.001745	0.054102	0.106443	0.158751	0.211010	0.263206	0.315321	0.367340	0.419248
3	0.002618	0.054975	0.107315	0.159622	0.211881	0.264075	0.316189	0.368206	0.420110
4	0.003491	0.055847	0.108187	0.160494	0.212751	0.264944	0.317057	0.369072	0.420976
5	0.004363	0.056720	0.109059	0.161365	0.213622	0.265814	0.317924	0.369938	0.421840
6	0.005236	0.057592	0.109931	0.162236	0.214492	0.266683	0.318792	0.370804	0.422704
7	0.006109	0.058465	0.110803	0.163108	0.215363	0.267552	0.319660	0.371670	0.423568
8	0.006981	0.059337	0.111675	0.163979	0.216233	0.268421	0.320528	0.372536	0.424432
9	0.007854	0.060210	0.112547	0.164851	0.217104	0.269290	0.321395	0.373402	0.425295
10	0.008727	0.061082	0.113419	0.165722	0.217974	0.270160	0.322263	0.374268	0.426159
11	0.009599	0.061955	0.114291	0.166593	0.218844	0.271029	0.323130	0.375134	0.427023
12	0.010472	0.062827	0.115163	0.167465	0.219715	0.271898	0.323998	0.376000	0.427887
13	0.011345	0.063700	0.116035	0.168336	0.220585	0.272767	0.324866	0.376865	0.428751
14	0.012217	0.064572	0.116907	0.169207	0.221455	0.273636	0.325733	0.377731	0.429614
15	0.013090	0.065445	0.117779	0.170078	0.222325	0.274505	0.326601	0.378597	0.430478
16	0.013963	0.066317	0.118651	0.170950	0.223196	0.275374	0.327468	0.379463	0.431341
17	0.014835	0.067190	0.119523	0.171821	0.224066	0.276243	0.328336	0.380328	0.432205
18	0.015708	0.068062	0.120395	0.172692	0.224936	0.277112	0.329203	0.381194	0.433069
19	0.016581	0.068934	0.121267	0.173563	0.225806	0.277981	0.330070	0.382059	0.433932
20	0.017453	0.069807	0.122139	0.174434	0.226677	0.278850	0.330938	0.382925	0.434796
21	0.018326	0.070679	0.123011	0.175306	0.227547	0.279718	0.331805	0.383790	0.435659
22	0.019198	0.071552	0.123883	0.176177	0.228417	0.280587	0.332672	0.384656	0.436522
23	0.020071	0.072424	0.124755	0.177048	0.229287	0.281456	0.333540	0.385521	0.437386
24	0.020944	0.073297	0.125627	0.177919	0.230157	0.282325	0.334407	0.386387	0.438249
25	0.021816	0.074169	0.126499	0.178790	0.231027	0.283194	0.335274	0.387252	0.439112
26	0.022689	0.075041	0.127371	0.179661	0.231897	0.284062	0.336141	0.388118	0.439976
27	0.023562	0.075914	0.128243	0.180532	0.232767	0.284931	0.337008	0.388983	0.440839
28	0.024434	0.076786	0.129114	0.181404	0.233637	0.285800	0.337875	0.389848	0.441702
29	0.025307	0.077658	0.129986	0.182275	0.234507	0.286669	0.338743	0.390713	0.442565
30	0.026180	0.078531	0.130858	0.183146	0.235377	0.287537	0.339610	0.391579	0.443428
31	0.027052	0.079403	0.131730	0.184017	0.236247	0.288406	0.340477	0.392444	0.444291
32	0.027925	0.080276	0.132602	0.184888	0.237117	0.289275	0.341344	0.393309	0.445154
33	0.028797	0.081148	0.133474	0.185759	0.237987	0.290143	0.342211	0.394174	0.446017
34	0.029670	0.082020	0.134345	0.186630	0.238857	0.291012	0.343078	0.395039	0.446880
35	0.030543	0.082893	0.135217	0.187501	0.239727	0.291880	0.343945	0.395904	0.447743
36	0.031415	0.083765	0.136089	0.188372	0.240597	0.292749	0.344811	0.396769	0.448606
37	0.032288	0.084637	0.136961	0.189242	0.241467	0.293617	0.345678	0.397634	0.449469
38	0.033161	0.085510	0.137832	0.190113	0.242336	0.294486	0.346545	0.398499	0.450332
39	0.034033	0.086382	0.138704	0.190984	0.243206	0.295354	0.347412	0.399364	0.451194
40	0.034906	0.087254	0.139576	0.191855	0.244076	0.296222	0.348279	0.400229	0.452057
41	0.035778	0.088126	0.140448	0.192726	0.244946	0.297091	0.349145	0.401094	0.452920
42	0.036651	0.088999	0.141319	0.193597	0.245816	0.297959	0.350012	0.401959	0.453782
43	0.037524	0.089871	0.142191	0.194468	0.246685	0.298828	0.350879	0.402823	0.454645
44	0.038396	0.090743	0.143063	0.195339	0.247555	0.299696	0.351746	0.403688	0.455508
45	0.039269	0.091616	0.143934	0.196209	0.248425	0.300564	0.352612	0.404553	0.456370
46	0.040141	0.092488	0.144806	0.197080	0.249294	0.301432	0.353479	0.405417	0.457233
47	0.041014	0.093360	0.145678	0.197951	0.250164	0.302301	0.354345	0.406282	0.458095
48	0.041887	0.094232	0.146549	0.198822	0.251034	0.303169	0.355212	0.407147	0.458958
49	0.042759	0.095105	0.147421	0.199692	0.251903	0.304037	0.356078	0.408011	0.459820
50	0.043632	0.095977	0.148293	0.200563	0.252773	0.304905	0.356945	0.408876	0.460682
51	0.044504	0.096849	0.149164	0.201434	0.253642	0.305773	0.357811	0.409740	0.461545
52	0.045377	0.097721	0.150036	0.202305	0.254512	0.306641	0.358678	0.410605	0.462407
53	0.046249	0.098593	0.150907	0.203175	0.255381	0.307510	0.359544	0.411469	0.463269
54	0.047122	0.099466	0.151779	0.204046	0.256251	0.308378	0.360411	0.412334	0.464131
55	0.047995	0.100338	0.152650	0.204917	0.257120	0.309246	0.361277	0.413198	0.464993
56	0.048867	0.101210	0.153522	0.205787	0.257990	0.310114	0.362143	0.414062	0.465855
57	0.049740	0.102082	0.154393	0.206658	0.258859	0.310982	0.363009	0.414927	0.466717
58	0.050612	0.102954	0.155265	0.207528	0.259728	0.311850	0.363876	0.415791	0.467579
59	0.051485	0.103826	0.156136	0.208399	0.260598	0.312717	0.364742	0.416655	0.468441

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3" SINE BAR CONSTANTS

MIN	9°	10°	11°	12°	13°	14°	15°	16°	17°
0	0.469303	0.520945	0.572427	0.623735	0.674853	0.725766	0.776457	0.826912	0.877115
1	0.470165	0.521804	0.573284	0.624589	0.675703	0.726612	0.777300	0.827751	0.877950
2	0.471027	0.522663	0.57414	0.625442	0.676554	0.727459	0.778143	0.828590	0.878784
3	0.471889	0.523523	0.574997	0.626296	0.677404	0.728306	0.778986	0.829428	0.879618
4	0.472751	0.524382	0.575853	0.627149	0.678254	0.729152	0.779828	0.830267	0.880453
5	0.473613	0.525241	0.576710	0.628002	0.679104	0.729999	0.780671	0.831105	0.881287
6	0.474474	0.526100	0.577566	0.628856	0.679954	0.730845	0.781514	0.831944	0.882121
7	0.475336	0.526959	0.578422	0.629709	0.680804	0.731691	0.782356	0.832782	0.882955
8	0.476197	0.527818	0.579278	0.630562	0.681654	0.732538	0.783198	0.833621	0.883789
9	0.477059	0.528677	0.580135	0.631415	0.682504	0.733380	0.784041	0.834459	0.884623
10	0.477921	0.529536	0.580991	0.632268	0.683353	0.734230	0.784883	0.835297	0.885457
11	0.478782	0.530395	0.581847	0.633121	0.684203	0.735076	0.785725	0.836135	0.886290
12	0.479644	0.531254	0.582703	0.633974	0.685053	0.735922	0.786568	0.836973	0.887124
13	0.480505	0.532113	0.583559	0.634827	0.685902	0.736768	0.787410	0.837811	0.887958
14	0.481366	0.532972	0.584415	0.635680	0.686752	0.737614	0.788252	0.838649	0.888791
15	0.482228	0.533831	0.585271	0.636533	0.687601	0.738460	0.789094	0.839487	0.889625
16	0.483089	0.534689	0.586127	0.637386	0.688451	0.739306	0.789936	0.840325	0.890458
17	0.483950	0.535548	0.586983	0.638238	0.689300	0.740151	0.790777	0.841163	0.891291
18	0.484811	0.536407	0.587838	0.639091	0.690149	0.740997	0.791619	0.842000	0.892125
19	0.485673	0.537265	0.588694	0.639944	0.690998	0.741843	0.792461	0.842838	0.892958
20	0.486534	0.538124	0.589550	0.640796	0.691848	0.742688	0.793302	0.843675	0.893791
21	0.487395	0.538982	0.590405	0.641649	0.692697	0.743534	0.794144	0.844513	0.894624
22	0.488256	0.539841	0.591261	0.642501	0.693546	0.744379	0.794986	0.845350	0.895457
23	0.489117	0.540699	0.592117	0.643354	0.694395	0.745224	0.795827	0.846187	0.896290
24	0.489978	0.541557	0.592972	0.644206	0.695244	0.746070	0.796668	0.847024	0.897122
25	0.490839	0.542416	0.593827	0.645058	0.696093	0.746915	0.797510	0.847861	0.897955
26	0.491700	0.543274	0.594683	0.645910	0.696941	0.747760	0.798351	0.848699	0.898788
27	0.492561	0.544132	0.595538	0.646763	0.697790	0.748605	0.799192	0.849536	0.899620
28	0.493421	0.544990	0.596393	0.647615	0.698639	0.749450	0.800033	0.850372	0.900453
29	0.494282	0.545849	0.597249	0.648467	0.699488	0.750295	0.800874	0.851209	0.901285
30	0.495143	0.546707	0.598104	0.649319	0.700336	0.751140	0.801715	0.852046	0.902117
31	0.496003	0.547565	0.598959	0.650171	0.701185	0.751985	0.802556	0.852883	0.902950
32	0.496864	0.548423	0.599814	0.651023	0.702033	0.752830	0.803397	0.853719	0.903782
33	0.497725	0.549281	0.600669	0.651875	0.702881	0.753674	0.804238	0.854556	0.904614
34	0.498585	0.550138	0.601524	0.652726	0.703730	0.754519	0.805078	0.855392	0.905446
35	0.499446	0.550996	0.602379	0.653578	0.704578	0.755364	0.805919	0.856229	0.906278
36	0.500306	0.551854	0.603234	0.654430	0.705426	0.756208	0.806759	0.857065	0.907110
37	0.501167	0.552712	0.604089	0.655281	0.706275	0.757053	0.807600	0.857901	0.907941
38	0.502027	0.553570	0.604943	0.656133	0.707123	0.757897	0.808440	0.858738	0.908773
39	0.502887	0.554427	0.605798	0.656984	0.707971	0.758741	0.809281	0.859574	0.909605
40	0.503748	0.555285	0.606653	0.657836	0.708819	0.759586	0.810121	0.860410	0.910436
41	0.504608	0.556142	0.607507	0.658687	0.709667	0.760430	0.810961	0.861246	0.911268
42	0.505468	0.557000	0.608362	0.659539	0.710514	0.761274	0.811801	0.862082	0.912099
43	0.506328	0.557857	0.609216	0.660390	0.711362	0.762118	0.812641	0.862917	0.912930
44	0.507188	0.558715	0.610071	0.661241	0.712210	0.762962	0.813481	0.863753	0.913762
45	0.508049	0.559572	0.610925	0.662092	0.713058	0.763806	0.814321	0.864589	0.914593
46	0.508909	0.560429	0.611780	0.662943	0.713905	0.764650	0.815161	0.865424	0.915424
47	0.509769	0.561287	0.612634	0.663794	0.714753	0.765494	0.816001	0.866260	0.916255
48	0.510628	0.562144	0.613488	0.664645	0.715600	0.766337	0.816841	0.867095	0.917086
49	0.511488	0.563001	0.614342	0.665496	0.716448	0.767181	0.817680	0.867931	0.917917
50	0.512348	0.563858	0.615196	0.666347	0.717295	0.768025	0.818520	0.868766	0.918748
51	0.513208	0.564715	0.616051	0.667198	0.718143	0.768868	0.819360	0.869601	0.919578
52	0.514068	0.565572	0.616905	0.668049	0.718990	0.769712	0.820199	0.870436	0.920409
53	0.514928	0.566429	0.617759	0.668900	0.719837	0.770555	0.821038	0.871272	0.921239
54	0.515787	0.567286	0.618613	0.669750	0.720684	0.771398	0.821878	0.872107	0.922070
55	0.516647	0.568143	0.619466	0.670601	0.721531	0.772242	0.822717	0.872942	0.922900
56	0.517507	0.569000	0.620320	0.671452	0.722378	0.773085	0.823556	0.873776	0.923731
57	0.518366	0.569857	0.621174	0.672302	0.723225	0.773928	0.824395	0.874611	0.924561
58	0.519226	0.570714	0.622028	0.673152	0.724072	0.774771	0.825234	0.875446	0.925391
59	0.520085	0.571570	0.622881	0.674003	0.724919	0.775614	0.826073	0.876281	0.926221

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3" SINE BAR CONSTANTS

MIN	18°	19°	20°	21°	22°	23°	24°	25°	26°
0	0.927051	0.976704	1.026060	1.075104	1.123820	1.172193	1.220210	1.267855	1.315113
1	0.927881	0.977530	1.026880	1.075919	1.124629	1.172997	1.221007	1.268646	1.315898
2	0.928711	0.978355	1.027700	1.076733	1.125438	1.173800	1.221804	1.269436	1.316682
3	0.929540	0.979179	1.028520	1.077548	1.126247	1.174603	1.222601	1.270227	1.317466
4	0.930370	0.980004	1.029340	1.078362	1.127056	1.175406	1.223398	1.271018	1.318250
5	0.931200	0.980829	1.030160	1.079176	1.127864	1.176209	1.224195	1.271808	1.319034
6	0.932029	0.981654	1.030979	1.079990	1.128673	1.177011	1.224991	1.272598	1.319818
7	0.932859	0.982478	1.031799	1.080805	1.129481	1.177814	1.225788	1.273388	1.320601
8	0.933688	0.983303	1.032618	1.081619	1.130290	1.178617	1.226584	1.274179	1.321385
9	0.934517	0.984127	1.033437	1.082432	1.131098	1.179419	1.227381	1.274969	1.322168
10	0.935347	0.984952	1.034256	1.083246	1.131906	1.180221	1.228177	1.275758	1.322951
11	0.936176	0.985776	1.035076	1.084060	1.132714	1.181024	1.228973	1.276548	1.323734
12	0.937005	0.986600	1.035895	1.084874	1.133522	1.181826	1.229769	1.277338	1.324518
13	0.937834	0.987424	1.036714	1.085687	1.134330	1.182628	1.230565	1.278127	1.325301
14	0.938663	0.988248	1.037532	1.086501	1.135138	1.183430	1.231361	1.278917	1.326083
15	0.939491	0.989072	1.038351	1.087314	1.135946	1.184232	1.232157	1.279706	1.326866
16	0.940320	0.989896	1.039170	1.088127	1.136753	1.185033	1.232952	1.280495	1.327649
17	0.941149	0.990720	1.039988	1.088941	1.137561	1.185835	1.233748	1.281285	1.328431
18	0.941977	0.991543	1.040807	1.089754	1.138368	1.186637	1.234543	1.282074	1.329214
19	0.942806	0.992367	1.041625	1.090567	1.139176	1.187438	1.235338	1.282862	1.329996
20	0.943634	0.993190	1.042444	1.091380	1.139983	1.188239	1.236134	1.283651	1.330778
21	0.944463	0.994014	1.043262	1.092192	1.140790	1.189041	1.236929	1.284440	1.331560
22	0.945291	0.994837	1.044080	1.093005	1.141597	1.189842	1.237724	1.285229	1.332342
23	0.946119	0.995660	1.044898	1.093818	1.142404	1.190643	1.238519	1.286017	1.333124
24	0.946947	0.996483	1.045716	1.094630	1.143211	1.191444	1.239313	1.286805	1.333906
25	0.947775	0.997306	1.046534	1.095443	1.144018	1.192245	1.240108	1.287594	1.334687
26	0.948603	0.998129	1.047352	1.096255	1.144825	1.193045	1.240903	1.288382	1.335469
27	0.949431	0.998952	1.048170	1.097067	1.145631	1.193846	1.241697	1.289170	1.336250
28	0.950259	0.999775	1.048987	1.097880	1.146438	1.194646	1.242491	1.289958	1.337031
29	0.951086	1.000598	1.049805	1.098692	1.147244	1.195447	1.243286	1.290746	1.337812
30	0.951914	1.001421	1.050622	1.099504	1.148050	1.196247	1.244080	1.291533	1.338593
31	0.952741	1.002243	1.051439	1.100316	1.148856	1.197047	1.244874	1.292321	1.339374
32	0.953569	1.003066	1.052257	1.101127	1.149663	1.197848	1.245668	1.293108	1.340155
33	0.954396	1.003888	1.053074	1.101939	1.150469	1.198648	1.246462	1.293896	1.340936
34	0.955224	1.004710	1.053891	1.102751	1.151274	1.199448	1.247255	1.294683	1.341716
35	0.956051	1.005533	1.054708	1.103562	1.152080	1.200247	1.248049	1.295470	1.342497
36	0.956878	1.006355	1.055525	1.104374	1.152886	1.201047	1.248842	1.296257	1.343277
37	0.957705	1.007177	1.056342	1.105185	1.153692	1.201847	1.249636	1.297044	1.344058
38	0.958532	1.007999	1.057158	1.105996	1.154497	1.202646	1.250429	1.297831	1.344838
39	0.959359	1.008821	1.057975	1.106807	1.155302	1.203446	1.251222	1.298618	1.345618
40	0.960186	1.009642	1.058792	1.107618	1.156108	1.204245	1.252015	1.299404	1.346398
41	0.961012	1.010464	1.059608	1.108429	1.156913	1.205044	1.252808	1.300191	1.347177
42	0.961839	1.011286	1.060425	1.109240	1.157718	1.205843	1.253601	1.300977	1.347957
43	0.962666	1.012107	1.061241	1.110051	1.158523	1.206642	1.254394	1.301764	1.348737
44	0.963492	1.012929	1.062057	1.110862	1.159328	1.207441	1.255187	1.302550	1.349516
45	0.964318	1.013750	1.062873	1.111672	1.160133	1.208240	1.255979	1.303336	1.350295
46	0.965145	1.014571	1.063689	1.112483	1.160938	1.209039	1.256772	1.304122	1.351075
47	0.965971	1.015393	1.064505	1.113293	1.161742	1.209837	1.257564	1.304908	1.351854
48	0.966797	1.016214	1.065321	1.114104	1.162547	1.210636	1.258356	1.305693	1.352633
49	0.967623	1.017035	1.066137	1.114914	1.163351	1.211434	1.259148	1.306479	1.353411
50	0.968449	1.017856	1.066952	1.115724	1.164156	1.212233	1.259940	1.307264	1.354190
51	0.969275	1.018677	1.067768	1.116534	1.164960	1.213031	1.260732	1.308050	1.354969
52	0.970101	1.019497	1.068583	1.117344	1.165764	1.213829	1.261524	1.308835	1.355747
53	0.970927	1.020318	1.069399	1.118154	1.166568	1.214627	1.262316	1.309620	1.356526
54	0.971752	1.021139	1.070214	1.118963	1.167372	1.215425	1.263107	1.310405	1.357304
55	0.972578	1.021959	1.071029	1.119773	1.168176	1.216223	1.263899	1.311190	1.358082
56	0.973403	1.022780	1.071844	1.120583	1.168979	1.217020	1.264690	1.311975	1.358860
57	0.974229	1.023600	1.072659	1.121392	1.169783	1.217818	1.265482	1.312760	1.359638
58	0.975054	1.024420	1.073474	1.122201	1.170587	1.218615	1.266273	1.313545	1.360416
59	0.975879	1.025240	1.074289	1.123011	1.171390	1.219413	1.267064	1.314329	1.361194

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3" SINE BAR CONSTANTS

MIN	27°	28°	29°	30°	31°	32°	33°	34°	35°
0	1.361971	1.408415	1.454429	1.500000	1.545114	1.589758	1.633917	1.677579	1.720729
1	1.362749	1.409185	1.455192	1.500756	1.545862	1.590498	1.634649	1.678302	1.721444
2	1.363526	1.409955	1.455955	1.501511	1.546610	1.591238	1.635381	1.679025	1.722159
3	1.364304	1.410726	1.456718	1.502267	1.547358	1.591977	1.636112	1.679748	1.722873
4	1.365081	1.411496	1.457481	1.503022	1.548105	1.592717	1.636844	1.680471	1.723588
5	1.365858	1.412266	1.458244	1.503777	1.548853	1.593456	1.637575	1.681194	1.724302
6	1.366635	1.413036	1.459006	1.504532	1.549600	1.594196	1.638306	1.681917	1.725016
7	1.367412	1.413805	1.459769	1.505287	1.550347	1.594935	1.639037	1.682640	1.725730
8	1.368188	1.414575	1.460531	1.506042	1.551094	1.595674	1.639768	1.683362	1.726443
9	1.368965	1.415345	1.461293	1.506797	1.551841	1.596413	1.640498	1.684084	1.727157
10	1.369741	1.416114	1.462055	1.507551	1.552588	1.597152	1.641229	1.684806	1.727870
11	1.370518	1.416883	1.462817	1.508306	1.553335	1.597890	1.641959	1.685528	1.728584
12	1.371294	1.417652	1.463579	1.509060	1.554081	1.598629	1.642690	1.686250	1.729297
13	1.372070	1.418421	1.464341	1.509814	1.554827	1.599367	1.643420	1.686972	1.730010
14	1.372846	1.419190	1.465102	1.510568	1.555574	1.600105	1.644150	1.687693	1.730723
15	1.373622	1.419959	1.465864	1.511322	1.556320	1.600844	1.644880	1.688415	1.731436
16	1.374398	1.420728	1.466625	1.512076	1.557066	1.601582	1.645609	1.689136	1.732148
17	1.375173	1.421496	1.467386	1.512829	1.557812	1.602319	1.646339	1.689857	1.732861
18	1.375949	1.422265	1.468147	1.513583	1.558557	1.603057	1.647068	1.690578	1.733573
19	1.376724	1.423033	1.468908	1.514336	1.559303	1.603795	1.647798	1.691299	1.734285
20	1.377499	1.423801	1.469669	1.515090	1.560048	1.604532	1.648527	1.692020	1.734997
21	1.378275	1.424569	1.470430	1.515843	1.560794	1.605269	1.649256	1.692740	1.735709
22	1.379050	1.425337	1.471190	1.516596	1.561539	1.606006	1.649985	1.693461	1.736421
23	1.379825	1.426105	1.471951	1.517349	1.562284	1.606744	1.650714	1.694181	1.737132
24	1.380599	1.426873	1.472711	1.518101	1.563029	1.607480	1.651442	1.694901	1.737844
25	1.381374	1.427640	1.473471	1.518854	1.563774	1.608217	1.652171	1.695621	1.738555
26	1.382149	1.428408	1.474232	1.519606	1.564518	1.608954	1.652899	1.696341	1.739266
27	1.382923	1.429175	1.474992	1.520359	1.565263	1.609690	1.653627	1.697061	1.739977
28	1.383697	1.429942	1.475751	1.521111	1.566007	1.610427	1.654355	1.697780	1.740688
29	1.384472	1.430709	1.476511	1.521863	1.566752	1.611163	1.655083	1.698499	1.741398
30	1.385246	1.431476	1.477271	1.522615	1.567496	1.611899	1.655811	1.699219	1.742109
31	1.386020	1.432243	1.478030	1.523367	1.568240	1.612635	1.656539	1.699938	1.742819
32	1.386794	1.433010	1.478789	1.524119	1.568984	1.613371	1.657266	1.700657	1.743529
33	1.387567	1.433776	1.479549	1.524870	1.569727	1.614106	1.657993	1.701376	1.744240
34	1.388341	1.434543	1.480308	1.525622	1.570471	1.614842	1.658721	1.702094	1.744949
35	1.389115	1.435309	1.481067	1.526373	1.571214	1.615577	1.659448	1.702813	1.745659
36	1.389888	1.436076	1.481826	1.527124	1.571958	1.616312	1.660175	1.703531	1.746369
37	1.390661	1.436842	1.482584	1.527875	1.572701	1.617047	1.660901	1.704249	1.747078
38	1.391435	1.437608	1.483343	1.528626	1.573444	1.617782	1.661628	1.704968	1.747788
39	1.392208	1.438374	1.484101	1.529377	1.574187	1.618517	1.662355	1.705686	1.748497
40	1.392981	1.439139	1.484860	1.530128	1.574930	1.619252	1.663081	1.706403	1.749206
41	1.393753	1.439905	1.485618	1.530878	1.575672	1.619987	1.663807	1.707121	1.749915
42	1.394526	1.440670	1.486376	1.531629	1.576415	1.620721	1.664533	1.707839	1.750624
43	1.395299	1.441436	1.487134	1.532379	1.577157	1.621455	1.665259	1.708556	1.751332
44	1.396071	1.442201	1.487892	1.533129	1.577900	1.622189	1.665985	1.709273	1.752041
45	1.396844	1.442966	1.488650	1.533879	1.578642	1.622923	1.666711	1.709990	1.752749
46	1.397616	1.443731	1.489407	1.534629	1.579384	1.623657	1.667436	1.710707	1.753457
47	1.398388	1.444496	1.490165	1.535379	1.580126	1.624391	1.668162	1.711424	1.754165
48	1.399160	1.445261	1.490922	1.536129	1.580867	1.625125	1.668887	1.712141	1.754873
49	1.399932	1.446026	1.491679	1.536878	1.581609	1.625858	1.669612	1.712857	1.755581
50	1.400704	1.446790	1.492436	1.537628	1.582350	1.626591	1.670337	1.713574	1.756288
51	1.401475	1.447555	1.493193	1.538377	1.583092	1.627325	1.671062	1.714290	1.756996
52	1.402247	1.448319	1.493950	1.539126	1.583833	1.628058	1.671786	1.715006	1.757703
53	1.403018	1.449083	1.494707	1.539875	1.584574	1.628791	1.672511	1.715722	1.758410
54	1.403789	1.449847	1.495463	1.540624	1.585315	1.629523	1.673235	1.716438	1.759117
55	1.404561	1.450611	1.496220	1.541372	1.586056	1.630256	1.673960	1.717153	1.759824
56	1.405332	1.451375	1.496976	1.542121	1.586796	1.630988	1.674684	1.717869	1.760531
57	1.406103	1.452139	1.497732	1.542870	1.587537	1.631721	1.675408	1.718584	1.761237
58	1.406873	1.452902	1.498488	1.543618	1.588277	1.632453	1.676131	1.719299	1.761943
59	1.407644	1.453666	1.499244	1.544366	1.589018	1.633185	1.676855	1.720014	1.762650

3"

3" SINE BAR CONSTANTS

MIN	36°	37°	38°	39°	40°	41°	42°	43°	44°
0	1.763356	1.805445	1.846984	1.887961	1.928363	1.968177	2.007392	2.045995	2.083975
1	1.764062	1.806142	1.847672	1.888639	1.929031	1.968836	2.008040	2.046633	2.084603
2	1.764767	1.806839	1.848359	1.889317	1.929700	1.969494	2.008689	2.047271	2.085230
3	1.765473	1.807535	1.849047	1.889995	1.930368	1.970152	2.009337	2.047909	2.085858
4	1.766179	1.808232	1.849734	1.890673	1.931036	1.970810	2.009985	2.048547	2.086485
5	1.766884	1.808928	1.850421	1.891350	1.931703	1.971468	2.010632	2.049184	2.087112
6	1.767589	1.809624	1.851108	1.892027	1.932371	1.972126	2.011280	2.049821	2.087738
7	1.768294	1.810320	1.851794	1.892705	1.933038	1.972783	2.011927	2.050458	2.088365
8	1.768999	1.811016	1.852481	1.893382	1.933706	1.973441	2.012575	2.051095	2.088991
9	1.769704	1.811711	1.853167	1.894058	1.934373	1.974098	2.013222	2.051732	2.089618
10	1.770408	1.812407	1.853853	1.894735	1.935040	1.974755	2.013868	2.052369	2.090244
11	1.771113	1.813102	1.854539	1.895412	1.935706	1.975412	2.014515	2.053005	2.090870
12	1.771817	1.813797	1.855225	1.896088	1.936373	1.976068	2.015162	2.053641	2.091495
13	1.772521	1.814492	1.855911	1.896764	1.937040	1.976725	2.015808	2.054277	2.092121
14	1.773225	1.815187	1.856596	1.897440	1.937706	1.977381	2.016454	2.054913	2.092746
15	1.773929	1.815882	1.857282	1.898116	1.938372	1.978037	2.017100	2.055549	2.093371
16	1.774633	1.816577	1.857967	1.898792	1.939038	1.978693	2.017746	2.056185	2.093996
17	1.775336	1.817271	1.858652	1.899467	1.939704	1.979349	2.018392	2.05682	2.094621
18	1.776040	1.817965	1.859337	1.900143	1.940369	1.980005	2.019038	2.057455	2.095246
19	1.776743	1.818659	1.860022	1.900818	1.941035	1.980661	2.019683	2.058090	2.095870
20	1.777446	1.819353	1.860706	1.901493	1.941700	1.981316	2.020328	2.058725	2.096495
21	1.778149	1.820047	1.861391	1.902168	1.942365	1.981971	2.020973	2.059360	2.097119
22	1.778852	1.820741	1.862075	1.902843	1.943030	1.982626	2.021618	2.059994	2.097743
23	1.779554	1.821434	1.862759	1.903517	1.943695	1.983281	2.022263	2.060628	2.098366
24	1.780257	1.822128	1.863443	1.904192	1.944360	1.983936	2.022907	2.061263	2.098990
25	1.780959	1.822821	1.864127	1.904866	1.945024	1.984590	2.023551	2.061896	2.099613
26	1.781661	1.823514	1.864811	1.905540	1.945689	1.985244	2.024196	2.062530	2.100237
27	1.782363	1.824207	1.865494	1.906214	1.946353	1.985899	2.024840	2.063164	2.100860
28	1.783065	1.824899	1.866178	1.906888	1.947017	1.986553	2.025483	2.063797	2.101483
29	1.783767	1.825592	1.866861	1.907561	1.947680	1.987206	2.026127	2.064431	2.102105
30	1.784468	1.826284	1.867544	1.908235	1.948344	1.987860	2.026771	2.065064	2.102728
31	1.785170	1.826977	1.868227	1.908908	1.949008	1.988514	2.027414	2.065697	2.103350
32	1.785871	1.827669	1.868910	1.909581	1.949671	1.989167	2.028057	2.066329	2.103972
33	1.786572	1.828361	1.869592	1.910254	1.950334	1.989820	2.028700	2.066962	2.104594
34	1.787273	1.829052	1.870274	1.910927	1.950997	1.990473	2.029343	2.067594	2.105216
35	1.787974	1.829744	1.870957	1.911599	1.951660	1.991126	2.029985	2.068227	2.105838
36	1.788675	1.830435	1.871639	1.912272	1.952323	1.991779	2.030628	2.068859	2.106459
37	1.789375	1.831127	1.872321	1.912944	1.952985	1.992431	2.031270	2.069491	2.107080
38	1.790076	1.831818	1.873002	1.913616	1.953647	1.993083	2.031912	2.070122	2.107702
39	1.790776	1.832509	1.873684	1.914288	1.954310	1.993736	2.032554	2.070754	2.108322
40	1.791476	1.833200	1.874366	1.914960	1.954972	1.994388	2.033196	2.071385	2.108943
41	1.792176	1.833891	1.875047	1.915632	1.955634	1.995039	2.033838	2.072016	2.109564
42	1.792875	1.834581	1.875728	1.916303	1.956295	1.995691	2.034479	2.072647	2.110184
43	1.793575	1.835272	1.876409	1.916975	1.956957	1.996343	2.035120	2.073278	2.110804
44	1.794274	1.835962	1.877090	1.917646	1.957618	1.996994	2.035761	2.073909	2.111424
45	1.794974	1.836652	1.877770	1.918317	1.958279	1.997645	2.036402	2.074539	2.112044
46	1.795673	1.837342	1.878451	1.918988	1.958940	1.998296	2.037043	2.075169	2.112664
47	1.796372	1.838032	1.879131	1.919659	1.959601	1.998947	2.037684	2.075800	2.113283
48	1.797071	1.838721	1.879811	1.920329	1.960262	1.999597	2.038324	2.076430	2.113903
49	1.797769	1.839411	1.880491	1.920999	1.960922	2.000248	2.038964	2.077059	2.114522
50	1.798468	1.840100	1.881171	1.921670	1.961583	2.000898	2.039604	2.077689	2.115141
51	1.799166	1.840789	1.881851	1.922340	1.962243	2.001548	2.040244	2.078318	2.115759
52	1.799865	1.841478	1.882531	1.923010	1.962903	2.002198	2.040884	2.078948	2.116378
53	1.800563	1.842167	1.883210	1.923679	1.963563	2.002848	2.041523	2.079577	2.116996
54	1.801261	1.842856	1.883889	1.924349	1.964222	2.003498	2.042163	2.080205	2.117615
55	1.801958	1.843544	1.884568	1.925018	1.964882	2.004147	2.042802	2.080834	2.118233
56	1.802656	1.844232	1.885247	1.925688	1.965541	2.004796	2.043441	2.081463	2.118851
57	1.803354	1.844921	1.885926	1.926357	1.966201	2.005446	2.044080	2.082091	2.119468
58	1.804051	1.845609	1.886604	1.927026	1.966860	2.006094	2.044718	2.082719	2.120086
59	1.804748	1.846297	1.887283	1.927694	1.967518	2.006743	2.045357	2.083347	2.120703

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5" SINE BAR CONSTANTS

MIN	0°	1°	2°	3°	4°	5°	6°	7°	8°
0	0.000000	0.087262	0.174497	0.261680	0.348782	0.435779	0.522642	0.609347	0.695866
1	0.001454	0.088716	0.175951	0.263132	0.350233	0.437228	0.524089	0.610790	0.697306
2	0.002909	0.090170	0.177405	0.264585	0.351684	0.438676	0.525535	0.612234	0.698746
3	0.004363	0.091625	0.178858	0.266037	0.353135	0.440125	0.526982	0.613677	0.700186
4	0.005818	0.093079	0.180312	0.267489	0.354586	0.441574	0.528428	0.615121	0.701626
5	0.007272	0.094533	0.181765	0.268942	0.356036	0.443023	0.529874	0.616564	0.703066
6	0.008727	0.095987	0.183219	0.270394	0.357487	0.444471	0.531320	0.618007	0.704506
7	0.010181	0.097441	0.184672	0.271846	0.358938	0.445920	0.532767	0.619451	0.705946
8	0.011636	0.098896	0.186125	0.273299	0.360389	0.447369	0.534213	0.620894	0.707386
9	0.013090	0.100350	0.187579	0.274751	0.361839	0.448817	0.535659	0.622337	0.708826
10	0.014544	0.101804	0.189032	0.276203	0.363290	0.450266	0.537105	0.623780	0.710265
11	0.015999	0.103258	0.190486	0.277655	0.364740	0.451714	0.538551	0.625223	0.711705
12	0.017453	0.104712	0.191939	0.279108	0.366191	0.453163	0.539997	0.626666	0.713145
13	0.018908	0.106166	0.193392	0.280560	0.367642	0.454611	0.541443	0.628109	0.714584
14	0.020362	0.107620	0.194846	0.282012	0.369092	0.456060	0.542889	0.629552	0.716024
15	0.021817	0.109074	0.196299	0.283464	0.370542	0.457508	0.544334	0.630995	0.717463
16	0.023271	0.110529	0.197752	0.284916	0.371993	0.458956	0.545780	0.632438	0.718902
17	0.024725	0.111983	0.199206	0.286368	0.373443	0.460405	0.547226	0.633880	0.720342
18	0.026180	0.113437	0.200659	0.287820	0.374894	0.461853	0.548672	0.635323	0.721781
19	0.027634	0.114891	0.202112	0.289272	0.376344	0.463301	0.550117	0.636766	0.723220
20	0.029089	0.116345	0.203565	0.290724	0.377794	0.464749	0.551563	0.638208	0.724659
21	0.030543	0.117799	0.205019	0.292176	0.379245	0.466197	0.553008	0.639651	0.726098
22	0.031997	0.119253	0.206472	0.293628	0.380695	0.467646	0.554454	0.641093	0.727537
23	0.033452	0.120707	0.207925	0.295080	0.382145	0.469094	0.555899	0.642536	0.728976
24	0.034906	0.122161	0.209378	0.296532	0.383595	0.470542	0.557345	0.643978	0.730415
25	0.036361	0.123615	0.210831	0.297984	0.385045	0.471990	0.558790	0.645420	0.731854
26	0.037815	0.125069	0.212285	0.299436	0.386495	0.473437	0.560235	0.646863	0.733293
27	0.039270	0.126523	0.213738	0.300887	0.387945	0.474885	0.561681	0.648305	0.734731
28	0.040724	0.127977	0.215191	0.302339	0.389395	0.476333	0.563126	0.649747	0.736170
29	0.042178	0.129431	0.216644	0.303791	0.390846	0.477781	0.564571	0.651189	0.737609
30	0.043633	0.130885	0.218097	0.305243	0.392295	0.479229	0.566016	0.652631	0.739047
31	0.045087	0.132339	0.219550	0.306694	0.393745	0.480676	0.567461	0.654073	0.740485
32	0.046541	0.133793	0.221003	0.308146	0.395195	0.482124	0.568906	0.655515	0.741924
33	0.047996	0.135247	0.222456	0.309598	0.396645	0.483572	0.570351	0.656957	0.743362
34	0.049450	0.136700	0.223909	0.311049	0.398095	0.485019	0.571796	0.658399	0.744800
35	0.050905	0.138154	0.225362	0.312501	0.399545	0.486467	0.573241	0.659840	0.746239
36	0.052359	0.139608	0.226815	0.313953	0.400995	0.487914	0.574686	0.661282	0.747677
37	0.053813	0.141062	0.228268	0.315404	0.402444	0.489362	0.576131	0.662724	0.749115
38	0.055268	0.142516	0.229721	0.316856	0.403894	0.490809	0.577575	0.664165	0.750553
39	0.056722	0.143970	0.231174	0.318307	0.405344	0.492257	0.579020	0.665607	0.751991
40	0.058176	0.145424	0.232627	0.319759	0.406793	0.493704	0.580465	0.667048	0.753429
41	0.059631	0.146877	0.234079	0.321210	0.408243	0.495151	0.581909	0.668490	0.754866
42	0.061085	0.148331	0.235532	0.322662	0.409693	0.496599	0.583354	0.669931	0.756304
43	0.062539	0.149785	0.236985	0.324113	0.411142	0.498046	0.584798	0.671372	0.757742
44	0.063994	0.151239	0.238438	0.325564	0.412592	0.499493	0.586243	0.672813	0.759179
45	0.065448	0.152693	0.239891	0.327016	0.414041	0.500940	0.587687	0.674255	0.760617
46	0.066902	0.154146	0.241343	0.328467	0.415490	0.502387	0.589131	0.675696	0.762054
47	0.068357	0.155600	0.242796	0.329918	0.416940	0.503834	0.590576	0.677137	0.763492
48	0.069811	0.157054	0.244249	0.331370	0.418389	0.505281	0.592020	0.678578	0.764929
49	0.071265	0.158508	0.245702	0.332821	0.419839	0.506728	0.593464	0.680019	0.766366
50	0.072719	0.159961	0.247154	0.334272	0.421288	0.508175	0.594908	0.681460	0.767804
51	0.074174	0.161415	0.248607	0.335723	0.422737	0.509622	0.596352	0.682901	0.769241
52	0.075628	0.162869	0.250060	0.337174	0.424186	0.511069	0.597796	0.684341	0.770678
53	0.077082	0.164322	0.251512	0.338625	0.425635	0.512516	0.599240	0.685782	0.772115
54	0.078537	0.165776	0.252965	0.340076	0.427085	0.513963	0.600684	0.687223	0.773552
55	0.079991	0.167230	0.254417	0.341528	0.428534	0.515409	0.602128	0.688663	0.774989
56	0.081445	0.168683	0.255870	0.342979	0.429983	0.516856	0.603572	0.690104	0.776426
57	0.082899	0.170137	0.257322	0.344430	0.431432	0.518303	0.605016	0.691544	0.777862
58	0.084354	0.171590	0.258775	0.345881	0.432881	0.519749	0.606459	0.692985	0.779299
59	0.085808	0.173044	0.260227	0.347331	0.434330	0.521196	0.607903	0.694425	0.780736

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5" SINE BAR CONSTANTS

MIN	9°	10°	11°	12°	13°	14°	15°	16°	17°
0	0.782172	0.868241	0.954045	1.039558	1.124755	1.209609	1.294095	1.378187	1.461859
1	0.783609	0.869673	0.955473	1.040981	1.126172	1.211021	1.295500	1.379585	1.463249
2	0.785045	0.871105	0.956900	1.042404	1.127589	1.212432	1.296905	1.380983	1.464640
3	0.786482	0.872538	0.958328	1.043826	1.129006	1.213843	1.298309	1.382381	1.466031
4	0.787918	0.873970	0.959755	1.045248	1.130423	1.215254	1.299714	1.383778	1.467421
5	0.789354	0.875402	0.961183	1.046671	1.131840	1.216664	1.301118	1.385176	1.468811
6	0.790790	0.876834	0.962610	1.048093	1.133257	1.218075	1.302523	1.386573	1.470202
7	0.792226	0.878265	0.964037	1.049515	1.134673	1.219486	1.303927	1.387971	1.471592
8	0.793662	0.879697	0.965464	1.050937	1.136090	1.220896	1.305331	1.389368	1.472982
9	0.795098	0.881129	0.966891	1.052359	1.137506	1.222306	1.306735	1.390765	1.474371
10	0.796534	0.882561	0.968318	1.053781	1.138922	1.223717	1.308139	1.392162	1.475761
11	0.797970	0.883992	0.969745	1.055202	1.140338	1.225127	1.309542	1.393559	1.477151
12	0.799406	0.885424	0.971172	1.056624	1.141754	1.226537	1.310946	1.394956	1.478540
13	0.800842	0.886855	0.972598	1.058046	1.143170	1.227947	1.312349	1.396352	1.479930
14	0.802277	0.888286	0.974025	1.059467	1.144586	1.229357	1.313753	1.397749	1.481319
15	0.803713	0.889718	0.975452	1.060888	1.146002	1.230766	1.315156	1.399145	1.482708
16	0.805148	0.891149	0.976878	1.062310	1.147418	1.232176	1.316559	1.400541	1.484097
17	0.806584	0.892580	0.978304	1.063731	1.148833	1.233586	1.317962	1.401938	1.485486
18	0.808019	0.894011	0.979731	1.065152	1.150249	1.234995	1.319365	1.403334	1.486874
19	0.809454	0.895442	0.981157	1.066573	1.151664	1.236404	1.320768	1.404729	1.488263
20	0.810890	0.896873	0.982583	1.067994	1.153079	1.237814	1.322171	1.406125	1.489651
21	0.812325	0.898304	0.984009	1.069415	1.154495	1.239223	1.323573	1.407521	1.491040
22	0.813760	0.899734	0.985435	1.070835	1.155910	1.240632	1.324976	1.408917	1.492428
23	0.815195	0.901165	0.986861	1.072256	1.157325	1.242041	1.326378	1.410312	1.493816
24	0.816630	0.902596	0.988287	1.073677	1.158740	1.243449	1.327781	1.411707	1.495204
25	0.818065	0.904026	0.989712	1.075097	1.160154	1.244858	1.329183	1.413102	1.496592
26	0.819499	0.905457	0.991138	1.076517	1.161569	1.246267	1.330585	1.414498	1.497979
27	0.820934	0.906887	0.992564	1.077938	1.162984	1.247675	1.331987	1.415893	1.499367
28	0.822369	0.908317	0.993989	1.079358	1.164398	1.249084	1.333389	1.417287	1.500754
29	0.823803	0.909748	0.995414	1.080778	1.165813	1.250492	1.334790	1.418682	1.502142
30	0.825238	0.911178	0.996840	1.082198	1.167227	1.251900	1.336192	1.420077	1.503529
31	0.826672	0.912608	0.998265	1.083618	1.168641	1.253308	1.337593	1.421471	1.504916
32	0.828107	0.914038	0.999690	1.085038	1.170055	1.254716	1.338995	1.422866	1.506303
33	0.829541	0.915468	1.001115	1.086458	1.171469	1.256124	1.340396	1.424260	1.507690
34	0.830975	0.916897	1.002540	1.087877	1.172883	1.257532	1.341797	1.425654	1.509076
35	0.832410	0.918327	1.003965	1.089297	1.174297	1.258939	1.343198	1.427048	1.510463
36	0.833844	0.919757	1.005390	1.090716	1.175711	1.260347	1.344599	1.428442	1.511849
37	0.835278	0.921186	1.006814	1.092136	1.177124	1.261754	1.346000	1.429836	1.513236
38	0.836712	0.922616	1.008239	1.093555	1.178538	1.263162	1.347401	1.431229	1.514622
39	0.838146	0.924045	1.009663	1.094974	1.179951	1.264569	1.348801	1.432623	1.516008
40	0.839579	0.925475	1.011088	1.096393	1.181364	1.265976	1.350202	1.434016	1.517394
41	0.841013	0.926904	1.012512	1.097812	1.182778	1.267383	1.351602	1.435409	1.518780
42	0.842447	0.928333	1.013936	1.099231	1.184191	1.268790	1.353002	1.436803	1.520165
43	0.843881	0.929762	1.015361	1.100650	1.185604	1.270197	1.354402	1.438196	1.521551
44	0.845314	0.931191	1.016785	1.102069	1.187017	1.271603	1.355802	1.439589	1.522936
45	0.846748	0.932620	1.018209	1.103487	1.188429	1.273010	1.357202	1.440981	1.524321
46	0.848181	0.934049	1.019633	1.104906	1.189842	1.274416	1.358602	1.442374	1.525707
47	0.849614	0.935478	1.021057	1.106324	1.191255	1.275823	1.360002	1.443767	1.527092
48	0.851047	0.936907	1.022480	1.107742	1.192667	1.277229	1.361401	1.445159	1.528477
49	0.852481	0.938335	1.023904	1.109161	1.194080	1.278635	1.362801	1.446551	1.529861
50	0.853914	0.939764	1.025327	1.110579	1.195492	1.280041	1.364200	1.447943	1.531246
51	0.855347	0.941192	1.026751	1.111997	1.196904	1.281447	1.365599	1.449336	1.532630
52	0.856780	0.942621	1.028174	1.113415	1.198316	1.282853	1.366998	1.450727	1.534015
53	0.858213	0.944049	1.029598	1.114833	1.199728	1.284258	1.368397	1.452119	1.535399
54	0.859646	0.945477	1.031021	1.116251	1.201140	1.285664	1.369796	1.453511	1.536783
55	0.861078	0.946905	1.032444	1.117668	1.202552	1.287069	1.371195	1.454903	1.538167
56	0.862511	0.948333	1.033867	1.119086	1.203964	1.288475	1.372593	1.456294	1.539551
57	0.863944	0.949761	1.035290	1.120503	1.205375	1.289880	1.373992	1.457685	1.540935
58	0.865376	0.951189	1.036713	1.121921	1.206787	1.291285	1.375390	1.459076	1.542318
59	0.866809	0.952617	1.038136	1.123338	1.208198	1.292690	1.376789	1.460468	1.543702

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5" SINE BAR CONSTANTS

MIN	18°	19°	20°	21°	22°	23°	24°	25°	26°
0	1.545085	1.627841	1.710101	1.791840	1.873033	1.953656	2.033683	2.113091	2.191856
1	1.546468	1.629216	1.711467	1.793198	1.874381	1.954994	2.035012	2.114409	2.193163
2	1.547851	1.630591	1.712834	1.794555	1.875730	1.956333	2.036340	2.115727	2.194470
3	1.549234	1.631966	1.714200	1.795913	1.877078	1.957671	2.037669	2.117045	2.195777
4	1.550617	1.633340	1.715566	1.797270	1.878426	1.959010	2.038997	2.118363	2.197083
5	1.552000	1.634715	1.716933	1.798627	1.879774	1.960348	2.040325	2.119680	2.198390
6	1.553382	1.636089	1.718298	1.799984	1.881121	1.961686	2.041652	2.120997	2.199696
7	1.554765	1.637464	1.719664	1.801341	1.882469	1.963023	2.042980	2.122314	2.201002
8	1.556147	1.638838	1.721030	1.802698	1.883816	1.964361	2.044307	2.123631	2.202308
9	1.557529	1.640212	1.722395	1.804054	1.885163	1.965698	2.045635	2.124948	2.203613
10	1.558911	1.641586	1.723761	1.805411	1.886510	1.967036	2.046962	2.126264	2.204919
11	1.560293	1.642960	1.725126	1.806767	1.887857	1.968373	2.048288	2.127580	2.206224
12	1.561675	1.644333	1.726491	1.808123	1.889204	1.969710	2.049615	2.128896	2.207529
13	1.563056	1.645707	1.727856	1.809479	1.890550	1.971046	2.050942	2.130212	2.208834
14	1.564438	1.647080	1.729221	1.810835	1.891897	1.972383	2.052268	2.131528	2.210139
15	1.565819	1.648453	1.730585	1.812190	1.893243	1.973719	2.053594	2.132844	2.211443
16	1.567200	1.649826	1.731950	1.813546	1.894589	1.975056	2.054920	2.134159	2.212748
17	1.568581	1.651199	1.733314	1.814901	1.895935	1.976392	2.056246	2.135474	2.214052
18	1.569962	1.652572	1.734678	1.816256	1.897281	1.977728	2.057572	2.136789	2.215356
19	1.571343	1.653945	1.736042	1.817611	1.898626	1.979063	2.058897	2.138104	2.216660
20	1.572724	1.655317	1.737406	1.818966	1.899972	1.980399	2.060223	2.139419	2.217963
21	1.574104	1.656689	1.738770	1.820321	1.901317	1.981734	2.061548	2.140733	2.219267
22	1.575485	1.658062	1.740133	1.821675	1.902662	1.983069	2.062873	2.142048	2.220570
23	1.576865	1.659434	1.741497	1.823030	1.904007	1.984405	2.064198	2.143362	2.221873
24	1.578245	1.660806	1.742860	1.824384	1.905352	1.985739	2.065522	2.144676	2.223176
25	1.579625	1.662177	1.744223	1.825738	1.906696	1.987074	2.066847	2.145989	2.224479
26	1.581005	1.663549	1.745586	1.827092	1.908041	1.988409	2.068171	2.147303	2.225781
27	1.582385	1.664921	1.746949	1.828446	1.909385	1.989743	2.069495	2.148616	2.227083
28	1.583764	1.666292	1.748312	1.829799	1.910729	1.991077	2.070819	2.149930	2.228385
29	1.585144	1.667663	1.749674	1.831153	1.912073	1.992411	2.072143	2.151243	2.229687
30	1.586523	1.669034	1.751037	1.832506	1.913417	1.993745	2.073466	2.152555	2.230989
31	1.587902	1.670405	1.752399	1.833859	1.914761	1.995079	2.074790	2.153868	2.232291
32	1.589282	1.671776	1.753761	1.835212	1.916104	1.996413	2.076113	2.155181	2.233592
33	1.590661	1.673147	1.755123	1.836565	1.917448	1.997746	2.077436	2.156493	2.234893
34	1.592039	1.674517	1.756485	1.837918	1.918791	1.999079	2.078759	2.157805	2.236194
35	1.593418	1.675888	1.757847	1.839270	1.920134	2.000412	2.080081	2.159117	2.237495
36	1.594797	1.677258	1.759208	1.840623	1.921477	2.001745	2.081404	2.160429	2.238795
37	1.596175	1.678628	1.760570	1.841975	1.922819	2.003078	2.082726	2.161740	2.240096
38	1.597553	1.679998	1.761931	1.843327	1.924162	2.004410	2.084048	2.163052	2.241396
39	1.598931	1.681368	1.763292	1.844679	1.925504	2.005743	2.085370	2.164363	2.242696
40	1.600309	1.682737	1.764653	1.846031	1.926846	2.007075	2.086692	2.165674	2.243996
41	1.601687	1.684107	1.766014	1.847382	1.928188	2.008407	2.088014	2.166985	2.245296
42	1.603065	1.685476	1.767374	1.848734	1.929530	2.009739	2.089335	2.168295	2.246595
43	1.604443	1.686846	1.768735	1.850085	1.930872	2.011071	2.090657	2.169606	2.247894
44	1.605820	1.688215	1.770095	1.851436	1.932213	2.012402	2.091978	2.170916	2.249193
45	1.607197	1.689584	1.771455	1.852787	1.933555	2.013733	2.093299	2.172226	2.250492
46	1.608575	1.690952	1.772815	1.854138	1.934896	2.015065	2.094619	2.173536	2.251791
47	1.609952	1.692321	1.774175	1.855489	1.936237	2.016396	2.095940	2.174846	2.253089
48	1.611328	1.693690	1.775535	1.856839	1.937578	2.017726	2.097260	2.176155	2.254388
49	1.612705	1.695058	1.776894	1.858190	1.938919	2.019057	2.098581	2.177465	2.255686
50	1.614082	1.696426	1.778254	1.859540	1.940259	2.020388	2.099901	2.178774	2.256984
51	1.615458	1.697794	1.779613	1.860890	1.941600	2.021718	2.101221	2.180083	2.258281
52	1.616835	1.699162	1.780972	1.862240	1.942940	2.023048	2.102540	2.181392	2.259579
53	1.618211	1.700530	1.782331	1.863589	1.944280	2.024378	2.103860	2.182700	2.260876
54	1.619587	1.701898	1.783690	1.864939	1.945620	2.025708	2.105179	2.184009	2.262174
55	1.620963	1.703265	1.785049	1.866288	1.946959	2.027038	2.106498	2.185317	2.263471
56	1.622339	1.704633	1.786407	1.867638	1.948299	2.028367	2.107817	2.186625	2.264767
57	1.623715	1.706000	1.787766	1.868987	1.949638	2.029696	2.109136	2.187933	2.266064
58	1.625090	1.707367	1.789124	1.870336	1.950978	2.031025	2.110455	2.189241	2.267360
59	1.626466	1.708734	1.790482	1.871684	1.952317	2.032354	2.111773	2.190548	2.268656

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5" SINE BAR CONSTANTS

MIN	27°	28°	29°	30°	31°	32°	33°	34°	35°
0	2.269952	2.347358	2.424048	2.500000	2.57519	2.649596	2.723195	2.795965	2.867882
1	2.271248	2.348642	2.425320	2.501259	2.576437	2.650830	2.724415	2.797170	2.869073
2	2.272544	2.349926	2.426592	2.502519	2.577683	2.652063	2.725634	2.798376	2.870265
3	2.273839	2.351210	2.427863	2.503778	2.578929	2.653296	2.726854	2.799581	2.871455
4	2.275135	2.352493	2.429135	2.505037	2.580175	2.654528	2.728073	2.800786	2.872646
5	2.276430	2.353776	2.430406	2.506295	2.581421	2.655761	2.729291	2.801990	2.873836
6	2.277725	2.355059	2.431677	2.507554	2.582667	2.656993	2.730510	2.803195	2.875026
7	2.279019	2.356342	2.432948	2.508812	2.583912	2.658225	2.731728	2.804399	2.876216
8	2.280314	2.357625	2.434218	2.510070	2.585157	2.659457	2.732946	2.805603	2.877406
9	2.281608	2.358908	2.435489	2.511328	2.586402	2.660688	2.734164	2.806807	2.878595
10	2.282902	2.360190	2.436759	2.512585	2.587646	2.661919	2.735382	2.808011	2.879784
11	2.284196	2.361472	2.438029	2.513843	2.588891	2.663151	2.736599	2.809214	2.880973
12	2.285490	2.362754	2.439298	2.515100	2.590135	2.664381	2.737816	2.810417	2.882162
13	2.286783	2.364036	2.440568	2.516357	2.591379	2.665612	2.739033	2.811620	2.883350
14	2.288076	2.365317	2.441837	2.517613	2.592623	2.666842	2.740250	2.812822	2.884538
15	2.289370	2.366598	2.443106	2.518870	2.593866	2.668073	2.741466	2.814025	2.885726
16	2.290662	2.367879	2.444375	2.520126	2.595110	2.669303	2.742682	2.815227	2.886914
17	2.291955	2.369160	2.445644	2.521382	2.596353	2.670532	2.743898	2.816429	2.888101
18	2.293248	2.370441	2.446912	2.522638	2.597596	2.671762	2.745114	2.817630	2.889288
19	2.294540	2.371722	2.448181	2.523894	2.598838	2.672991	2.746330	2.818832	2.890475
20	2.295832	2.373002	2.449449	2.525149	2.600081	2.674220	2.747545	2.820033	2.891662
21	2.297124	2.374282	2.450716	2.526404	2.601323	2.675449	2.748760	2.821234	2.892848
22	2.298416	2.375562	2.451984	2.527659	2.602565	2.676677	2.749975	2.822434	2.894034
23	2.299708	2.376842	2.453252	2.528914	2.603807	2.677906	2.751189	2.823635	2.895220
24	2.300999	2.378121	2.454519	2.530169	2.605048	2.679134	2.752404	2.824835	2.896406
25	2.302290	2.379400	2.455786	2.531423	2.606289	2.680362	2.753618	2.826035	2.897591
26	2.303581	2.380679	2.457053	2.532677	2.607531	2.681590	2.754832	2.827235	2.898776
27	2.304872	2.381958	2.458319	2.533931	2.608771	2.682817	2.756045	2.828434	2.899961
28	2.306162	2.383237	2.459586	2.535185	2.610012	2.684044	2.757259	2.829633	2.901146
29	2.307453	2.384516	2.460852	2.536439	2.611253	2.685271	2.758472	2.830832	2.902331
30	2.308743	2.385794	2.462118	2.537692	2.612493	2.686498	2.759685	2.832031	2.903515
31	2.310033	2.387072	2.463384	2.538945	2.613733	2.687725	2.760898	2.833230	2.904699
32	2.311323	2.388350	2.464649	2.540198	2.614973	2.688951	2.762110	2.834428	2.905882
33	2.312612	2.389627	2.465915	2.541450	2.616212	2.690177	2.763322	2.835626	2.907066
34	2.313902	2.390905	2.467180	2.542703	2.617452	2.691403	2.764534	2.836824	2.908249
35	2.315191	2.392182	2.468445	2.543955	2.618691	2.692629	2.765746	2.838021	2.909432
36	2.316480	2.393459	2.469709	2.545207	2.619930	2.693854	2.766958	2.839219	2.910615
37	2.317769	2.394736	2.470974	2.546459	2.621168	2.695079	2.768169	2.840416	2.911797
38	2.319058	2.396013	2.472238	2.547710	2.622407	2.696304	2.769380	2.841613	2.912980
39	2.320346	2.397289	2.473502	2.548962	2.623645	2.697529	2.770591	2.842800	2.914162
40	2.321634	2.398566	2.474766	2.550213	2.624883	2.698753	2.771802	2.844006	2.915343
41	2.322922	2.399842	2.476030	2.551464	2.626121	2.699978	2.773012	2.845202	2.916525
42	2.324210	2.401117	2.477293	2.552715	2.627358	2.701202	2.774222	2.846398	2.917706
43	2.325498	2.402393	2.478557	2.553965	2.628596	2.702425	2.775432	2.847593	2.918887
44	2.326785	2.403669	2.479820	2.555215	2.629833	2.703649	2.776642	2.848789	2.920068
45	2.328073	2.404944	2.481083	2.556465	2.631070	2.704872	2.777851	2.849984	2.921248
46	2.329360	2.406219	2.482345	2.557715	2.632306	2.706095	2.779060	2.851179	2.922429
47	2.330647	2.407490	2.483608	2.558965	2.633543	2.707318	2.780269	2.852373	2.923609
48	2.331933	2.408768	2.484870	2.560214	2.634779	2.708541	2.781478	2.853568	2.924788
49	2.333220	2.410043	2.486132	2.561464	2.636015	2.709763	2.782687	2.854762	2.925968
50	2.334506	2.411317	2.487394	2.562713	2.637251	2.710986	2.783895	2.855956	2.927147
51	2.335792	2.412591	2.488655	2.563961	2.638486	2.712208	2.785103	2.857150	2.928326
52	2.337078	2.413865	2.489917	2.565210	2.639722	2.713429	2.786311	2.858343	2.929505
53	2.338364	2.415139	2.491178	2.566458	2.640957	2.714651	2.787518	2.859536	2.930683
54	2.339649	2.416412	2.492439	2.567706	2.642192	2.715872	2.788726	2.860729	2.931862
55	2.340934	2.417685	2.493699	2.568954	2.643426	2.717093	2.789933	2.861922	2.933040
56	2.342219	2.418958	2.494960	2.570202	2.644661	2.718314	2.791139	2.863115	2.934218
57	2.343504	2.420231	2.496220	2.571449	2.645895	2.719535	2.792346	2.864307	2.935395
58	2.344789	2.421504	2.497480	2.572697	2.647129	2.720755	2.793552	2.865499	2.936572
59	2.346074	2.422776	2.498740	2.573944	2.648363	2.721975	2.794759	2.866691	2.937749

5"

5" SINE BAR CONSTANTS

MIN	36°	37°	38°	39°	40°	41°	42°	43°	44°
0	2.938926	3.009075	3.078307	3.146602	3.213938	3.280295	3.345653	3.409992	3.473292
1	2.940103	3.010237	3.079453	3.147732	3.215052	3.281393	3.346734	3.411055	3.474338
2	2.941279	3.011398	3.080599	3.148862	3.216166	3.282490	3.347814	3.412119	3.475384
3	2.942455	3.012559	3.081745	3.149992	3.217279	3.283587	3.348894	3.413182	3.476429
4	2.943631	3.013719	3.082890	3.151121	3.218393	3.284684	3.349974	3.414244	3.477474
5	2.944806	3.014880	3.084035	3.152250	3.219505	3.285780	3.351054	3.415307	3.478519
6	2.945980	3.016040	3.085179	3.153379	3.220618	3.286876	3.352133	3.416360	3.479564
7	2.947157	3.017200	3.086324	3.154508	3.221731	3.287972	3.353212	3.417431	3.480608
8	2.948332	3.018360	3.087468	3.155636	3.222843	3.289068	3.354291	3.418492	3.481652
9	2.949506	3.019519	3.088612	3.156764	3.223955	3.290163	3.355369	3.419553	3.482696
10	2.950680	3.020678	3.089755	3.157892	3.225066	3.291258	3.356447	3.420614	3.483740
11	2.951855	3.021837	3.090899	3.159019	3.226177	3.292353	3.357525	3.421675	3.484783
12	2.953028	3.022996	3.092042	3.160147	3.227288	3.293447	3.358603	3.422736	3.485826
13	2.954202	3.024154	3.093185	3.161273	3.228399	3.294542	3.359680	3.423796	3.486868
14	2.955375	3.025312	3.094327	3.162400	3.229510	3.295635	3.360757	3.424855	3.487910
15	2.956548	3.026470	3.095470	3.163527	3.230620	3.296729	3.361834	3.425915	3.488952
16	2.957720	3.027628	3.096612	3.164653	3.231730	3.297822	3.362910	3.426974	3.489994
17	2.958894	3.028785	3.097754	3.165779	3.232840	3.298916	3.363987	3.428033	3.491035
18	2.960066	3.029942	3.098895	3.166904	3.233949	3.300008	3.365063	3.429092	3.492076
19	2.961238	3.031099	3.100036	3.168030	3.235058	3.301101	3.366138	3.430150	3.493117
20	2.962410	3.032255	3.101177	3.169155	3.236167	3.302193	3.367213	3.431208	3.494158
21	2.963581	3.033412	3.102318	3.170280	3.237275	3.303285	3.368289	3.432266	3.495198
22	2.964753	3.034568	3.103459	3.171404	3.238384	3.304377	3.369363	3.433323	3.496238
23	2.965924	3.035724	3.104599	3.172529	3.239492	3.305468	3.370438	3.434381	3.497277
24	2.967094	3.036879	3.105739	3.173653	3.240600	3.306559	3.371512	3.435438	3.498317
25	2.968265	3.038034	3.106879	3.174776	3.241707	3.307650	3.372586	3.436494	3.499356
26	2.969435	3.039190	3.108018	3.175900	3.242814	3.308741	3.373659	3.437550	3.500394
27	2.970605	3.040344	3.109157	3.177023	3.243921	3.309831	3.374733	3.438607	3.501433
28	2.971775	3.041499	3.110296	3.178146	3.245028	3.310921	3.375806	3.439662	3.502471
29	2.972945	3.042653	3.111435	3.179269	3.246134	3.312011	3.376879	3.440718	3.503509
30	2.974114	3.043807	3.112573	3.180391	3.247240	3.313100	3.377951	3.441773	3.504546
31	2.975283	3.044961	3.113711	3.181513	3.248346	3.314189	3.379023	3.442828	3.505584
32	2.976452	3.046114	3.114849	3.182635	3.249452	3.315278	3.380095	3.443882	3.506620
33	2.977620	3.047268	3.115987	3.183757	3.250557	3.316367	3.381167	3.444937	3.507657
34	2.978789	3.048421	3.117124	3.184878	3.251662	3.317455	3.382238	3.445991	3.508693
35	2.979957	3.049573	3.118261	3.185999	3.252767	3.318543	3.383309	3.447044	3.509730
36	2.981124	3.050726	3.119398	3.187120	3.253871	3.319631	3.384380	3.448098	3.510765
37	2.982292	3.051878	3.120533	3.188240	3.254975	3.320719	3.385450	3.449151	3.511801
38	2.983459	3.053030	3.121671	3.189361	3.256079	3.321806	3.386520	3.450204	3.512836
39	2.984626	3.054182	3.122807	3.190481	3.257183	3.322893	3.387590	3.451256	3.513871
40	2.985793	3.055333	3.123943	3.191600	3.258286	3.323979	3.388660	3.452308	3.514905
41	2.986959	3.056484	3.125078	3.192720	3.259389	3.325066	3.389729	3.453360	3.515940
42	2.988126	3.057635	3.126213	3.193839	3.260492	3.326152	3.390798	3.454412	3.516974
43	2.989292	3.058786	3.127348	3.194958	3.261595	3.327238	3.391867	3.455463	3.518007
44	2.990457	3.059936	3.128483	3.196077	3.262697	3.328323	3.392936	3.456514	3.519041
45	2.991623	3.061086	3.129617	3.197195	3.263799	3.329408	3.394004	3.457565	3.520074
46	2.992788	3.062236	3.130752	3.198313	3.264900	3.330493	3.395072	3.458616	3.521106
47	2.993953	3.063386	3.131885	3.199431	3.266002	3.331578	3.396139	3.459666	3.522139
48	2.995118	3.064535	3.133019	3.200548	3.267103	3.332662	3.397207	3.460716	3.523171
49	2.996282	3.065684	3.134152	3.201666	3.268204	3.333746	3.398274	3.461765	3.524203
50	2.997447	3.066833	3.135286	3.202783	3.269304	3.334830	3.399340	3.462815	3.525235
51	2.998611	3.067982	3.136418	3.203900	3.270405	3.335914	3.400407	3.463864	3.526266
52	2.999774	3.069130	3.137551	3.205016	3.271505	3.336997	3.401473	3.464913	3.527297
53	3.000938	3.070278	3.138683	3.206132	3.272605	3.338080	3.402539	3.465961	3.528327
54	3.002100	3.071426	3.139815	3.207248	3.273704	3.339163	3.403604	3.467009	3.529358
55	3.003264	3.072574	3.140947	3.208364	3.274803	3.340245	3.404670	3.468057	3.530388
56	3.004427	3.073721	3.142079	3.209479	3.275902	3.341327	3.405735	3.469105	3.531418
57	3.005589	3.074868	3.143210	3.210594	3.277001	3.342409	3.406799	3.470152	3.532447
58	3.006751	3.076015	3.144341	3.211709	3.278099	3.343491	3.407864	3.471199	3.533476
59	3.007913	3.077161	3.145572	3.212824	3.279197	3.344572	3.408928	3.472245	3.534505

5"

75mm SINE BAR CONSTANTS

MIN	0°	1°	2°	3°	4°	5°	6°	7°	8°
0	0.00000	1.30893	2.61746	3.92520	5.23174	6.53668	7.83963	9.14020	10.43798
1	0.02182	1.33074	2.63927	3.94698	5.25350	6.55841	7.86133	9.16185	10.45959
2	0.04363	1.35256	2.66107	3.96877	5.27526	6.58015	7.88303	9.18351	10.48119
3	0.06545	1.37437	2.68287	3.99056	5.29702	6.60188	7.90472	9.20516	10.50279
4	0.08727	1.39618	2.70467	4.01234	5.31879	6.62361	7.92642	9.22681	10.52439
5	0.10908	1.41800	2.72648	4.03413	5.34055	6.64534	7.94811	9.24846	10.54599
6	0.13090	1.43981	2.74828	4.05591	5.36231	6.66707	7.96981	9.27011	10.56700
7	0.15272	1.46162	2.77008	4.07770	5.38407	6.68880	7.99150	9.29176	10.58919
8	0.17453	1.48343	2.79188	4.09948	5.40583	6.71053	8.01319	9.31341	10.61079
9	0.19635	1.50525	2.81368	4.12126	5.42759	6.73226	8.03488	9.33506	10.63239
10	0.21817	1.52706	2.83548	4.14305	5.44935	6.75399	8.05657	9.35670	10.65398
11	0.23998	1.54887	2.85729	4.16483	5.47111	6.77572	8.07826	9.37835	10.67558
12	0.26180	1.57068	2.87909	4.18661	5.49286	6.79744	8.09995	9.39999	10.69717
13	0.28362	1.59249	2.90089	4.20840	5.51462	6.81917	8.12164	9.42164	10.71876
14	0.30543	1.61430	2.92269	4.23018	5.53638	6.84090	8.14333	9.44328	10.74036
15	0.32725	1.63612	2.94449	4.25196	5.55814	6.86262	8.16502	9.46492	10.76195
16	0.34906	1.65793	2.96629	4.27374	5.57989	6.88435	8.18670	9.48656	10.78354
17	0.37088	1.67974	2.98809	4.29552	5.60165	6.90607	8.20839	9.50821	10.80513
18	0.39270	1.70155	3.00988	4.31730	5.62340	6.92779	8.23007	9.52985	10.82672
19	0.41451	1.72336	3.03168	4.33908	5.64516	6.94952	8.25176	9.55149	10.84830
20	0.43633	1.74517	3.05348	4.36086	5.66691	6.97124	8.27344	9.57312	10.86989
21	0.45815	1.76698	3.07528	4.38264	5.68867	6.99296	8.29512	9.59476	10.89148
22	0.47996	1.78879	3.09708	4.40442	5.71042	7.01468	8.31681	9.61640	10.91306
23	0.50178	1.81060	3.11888	4.42620	5.73217	7.03640	8.33849	9.63803	10.93464
24	0.52359	1.83241	3.14067	4.44798	5.75393	7.05812	8.36017	9.65967	10.95623
25	0.54541	1.85422	3.16247	4.46976	5.77568	7.07984	8.38185	9.68130	10.97781
26	0.56723	1.87603	3.18427	4.49153	5.79743	7.10156	8.40353	9.70294	10.99939
27	0.58904	1.89784	3.20607	4.51331	5.81918	7.12328	8.42521	9.72457	11.02097
28	0.61086	1.91965	3.22786	4.53509	5.84093	7.14500	8.44689	9.74620	11.04255
29	0.63267	1.94146	3.24966	4.55686	5.86268	7.16671	8.46856	9.76783	11.06413
30	0.65449	1.96327	3.27145	4.57864	5.88443	7.18843	8.49024	9.78946	11.08571
31	0.67631	1.98508	3.29325	4.60042	5.90618	7.21015	8.51192	9.81109	11.10728
32	0.69812	2.00689	3.31505	4.62219	5.92793	7.23186	8.53359	9.83272	11.12886
33	0.71994	2.02870	3.33684	4.64397	5.94968	7.25358	8.55527	9.85435	11.15043
34	0.74175	2.05051	3.35864	4.66574	5.97143	7.27529	8.57694	9.87598	11.17201
35	0.76357	2.07231	3.38043	4.68752	5.99317	7.29700	8.59861	9.89760	11.19358
36	0.78538	2.09412	3.40222	4.70929	6.01492	7.31872	8.62029	9.91923	11.21515
37	0.80720	2.11593	3.42402	4.73106	6.03667	7.34043	8.64196	9.94085	11.23672
38	0.82901	2.13774	3.44581	4.75284	6.05841	7.36214	8.66363	9.96248	11.25829
39	0.85083	2.15955	3.46761	4.77461	6.08016	7.38385	8.68530	9.98410	11.27986
40	0.87264	2.18135	3.48940	4.79638	6.10190	7.40556	8.70697	10.00572	11.30143
41	0.89446	2.20316	3.51119	4.81815	6.12364	7.42727	8.72864	10.02734	11.32300
42	0.91628	2.22497	3.53298	4.83992	6.14539	7.44898	8.75031	10.04896	11.34456
43	0.93809	2.24678	3.55478	4.86169	6.16713	7.47069	8.77197	10.07058	11.36613
44	0.95990	2.26858	3.57657	4.88346	6.18887	7.49240	8.79364	10.09220	11.38769
45	0.98172	2.29039	3.59836	4.90523	6.21062	7.51410	8.81530	10.11382	11.40925
46	1.00353	2.31219	3.62015	4.92700	6.23236	7.53581	8.83697	10.13544	11.43082
47	1.02535	2.33400	3.64194	4.94877	6.25410	7.55752	8.85863	10.15705	11.45238
48	1.04716	2.35581	3.66373	4.97054	6.27584	7.57922	8.88030	10.17867	11.47394
49	1.06898	2.37761	3.68552	4.99231	6.29758	7.60093	8.90196	10.20028	11.49550
50	1.09079	2.39942	3.70731	5.01408	6.31932	7.62263	8.92362	10.22190	11.51706
51	1.11261	2.42122	3.72910	5.03585	6.34106	7.64433	8.94528	10.24351	11.53861
52	1.13442	2.44303	3.75089	5.05761	6.36279	7.66604	8.96694	10.26512	11.56017
53	1.15623	2.46483	3.77268	5.07938	6.38453	7.68774	8.98860	10.28673	11.58172
54	1.17805	2.48664	3.79447	5.10115	6.40627	7.70944	9.01026	10.30834	11.60328
55	1.19986	2.50844	3.81626	5.12291	6.42801	7.73114	9.03192	10.32995	11.62483
56	1.22168	2.53025	3.83805	5.14468	6.44974	7.75284	9.05358	10.35156	11.64638
57	1.24349	2.55205	3.85984	5.16644	6.47148	7.77454	9.07524	10.37317	11.66794
58	1.26530	2.57386	3.88162	5.18821	6.49321	7.79624	9.09689	10.39477	11.68949
59	1.28712	2.59566	3.90341	5.20997	6.51495	7.81794	9.11855	10.41638	11.71104

7
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3
m

75mm SINE BAR CONSTANTS

MIN	9°	10°	11°	12°	13°	14°	15°	16°	17°
0	11.73258	13.02361	14.31067	15.59338	16.87133	18.14414	19.41143	20.67280	21.92788
1	11.75413	13.04510	14.33209	15.61472	16.89259	18.16531	19.43250	20.69377	21.94874
2	11.77568	13.06658	14.35350	15.63605	16.91384	18.18648	19.45357	20.71474	21.96960
3	11.79722	13.08806	14.37492	15.65739	16.93510	18.20764	19.47464	20.73571	21.99046
4	11.81877	13.10955	14.39633	15.67873	16.95635	18.22880	19.49571	20.75667	22.01132
5	11.84031	13.13103	14.41774	15.70006	16.97760	18.24997	19.51677	20.77764	22.03217
6	11.86186	13.15250	14.43915	15.72139	16.99885	18.27113	19.53784	20.79860	22.05302
7	11.88340	13.17398	14.46056	15.74272	17.02010	18.29228	19.55890	20.81956	22.07388
8	11.90494	13.19546	14.48196	15.76405	17.04134	18.31344	19.57996	20.84052	22.09472
9	11.92648	13.21694	14.50337	15.78538	17.06259	18.33460	19.60102	20.86147	22.11557
10	11.94802	13.23841	14.52477	15.80671	17.08383	18.35575	19.62208	20.88243	22.13642
11	11.96955	13.25988	14.54617	15.82804	17.10507	18.37690	19.64313	20.90338	22.15726
12	11.99109	13.28136	14.56758	15.84936	17.12632	18.39805	19.66419	20.92433	22.17810
13	12.01262	13.30283	14.58898	15.87068	17.14755	18.41920	19.68524	20.94528	22.19894
14	12.03416	13.32430	14.61038	15.89200	17.16879	18.44035	19.70629	20.96623	22.21978
15	12.05569	13.34577	14.63177	15.91333	17.19003	18.46150	19.72734	20.98718	22.24062
16	12.07722	13.36723	14.65317	15.93464	17.21126	18.48264	19.74839	21.00812	22.26145
17	12.09876	13.38870	14.67457	15.95596	17.23250	18.50378	19.76943	21.02906	22.28228
18	12.12029	13.41017	14.69596	15.97728	17.25373	18.52493	19.79048	21.05000	22.30312
19	12.14182	13.43163	14.71735	15.99859	17.27496	18.54607	10.81152	21.07094	22.32394
20	12.16334	13.45309	14.73875	16.01991	17.29619	18.56720	19.83256	21.09188	22.34477
21	12.18487	13.47456	14.76014	16.04122	17.31742	18.58834	19.85360	21.11281	22.36560
22	12.20640	13.49602	14.78153	16.06253	17.33864	18.60948	19.87464	21.13375	22.38642
23	12.22792	13.51748	14.80291	16.08384	17.35987	18.63061	19.89567	21.15468	22.40724
24	12.24945	13.53894	14.82430	16.10515	17.38109	18.65174	19.91671	21.17561	22.42806
25	12.27097	13.56039	14.84569	16.12646	17.40231	18.67287	19.93774	21.19654	22.44888
26	12.29249	13.58185	14.86707	16.14776	17.42354	18.69400	19.95877	21.21746	22.46969
27	12.31401	13.60331	14.88845	16.16907	17.44475	18.71513	19.97980	21.23839	22.49051
28	12.33553	13.62476	14.90984	16.19037	17.46597	18.73620	20.00083	21.25931	22.51132
29	12.35705	13.64621	14.93122	16.21167	17.48719	18.75738	20.02185	21.28023	22.53213
30	12.37857	13.66766	14.95260	16.23297	17.50840	18.77850	20.04288	21.30115	22.55293
31	12.40009	13.68912	14.97397	16.25427	17.52962	18.79962	20.06390	21.32207	22.57374
32	12.42160	13.71056	14.99535	16.27557	17.55083	18.82074	20.08492	21.34298	22.59454
33	12.44312	13.73201	15.01673	16.29686	17.57204	18.84186	20.10594	21.36390	22.61535
34	12.46463	13.75346	15.03810	16.31816	17.59325	18.86297	20.12696	21.38481	22.63615
35	12.48614	13.77491	15.05947	16.33945	17.61445	18.88409	20.14797	21.40572	22.65695
36	12.50766	13.79635	15.08084	16.36074	17.63566	18.90520	20.16899	21.42663	22.67774
37	12.52917	13.81780	15.10221	16.38203	17.65686	18.92631	20.19000	21.44753	22.69854
38	12.55068	13.83924	15.12358	16.40332	17.67807	18.94742	20.21101	21.46844	22.71933
39	12.57218	13.86068	15.14495	16.42461	17.69927	18.96853	20.23202	21.48934	22.74012
40	12.59369	13.88212	15.16632	16.44590	17.72047	18.98964	20.25302	21.51024	22.76091
41	12.61520	13.90356	15.18768	16.46718	17.74166	19.01074	20.27403	21.53114	22.78169
42	12.63670	13.92500	15.20905	16.48847	17.76286	19.03185	20.29503	21.55204	22.80248
43	12.65821	13.94643	15.23041	16.50975	17.78406	19.05295	20.31604	21.57293	22.82326
44	12.67971	13.96787	15.25177	16.53103	17.80525	19.07405	20.33704	21.59383	22.84404
45	12.70121	13.98930	15.27313	16.55231	17.82644	19.09515	20.35803	21.61472	22.86482
46	12.72271	14.01074	15.29449	16.57359	17.84763	19.11624	20.37903	21.63561	22.88560
47	12.74421	14.03217	15.31585	16.59486	17.86882	19.13734	20.40003	21.65650	22.90637
48	12.76571	14.05360	15.33720	16.61614	17.89001	19.15843	20.42102	21.67738	22.92710
49	12.78721	14.07503	15.35856	16.63741	17.91120	19.17952	20.44201	21.69827	22.94792
50	12.80871	14.09646	15.37991	16.65868	17.93238	19.20061	20.46300	21.71915	22.96869
51	12.83020	14.11788	15.40126	16.67995	17.95356	19.22170	20.48399	21.74003	22.98946
52	12.85170	14.13931	15.42262	16.70122	17.97474	19.24279	20.50497	21.76091	23.01022
53	12.87319	14.16073	15.44397	16.72249	17.99592	19.26388	20.52596	21.78179	23.03098
54	12.89468	14.18216	15.46531	16.74376	18.01710	19.28496	20.54694	21.80266	23.05170
55	12.91617	14.20358	15.48666	16.76502	18.03828	19.30604	20.56792	21.82354	23.07251
56	12.93766	14.22500	15.50801	16.78629	17.05946	19.32712	20.58890	21.84441	23.09326
57	12.95915	14.24642	15.52935	16.80755	17.08063	19.34820	20.60988	21.86528	23.11402
58	12.98064	14.26784	15.55069	16.82881	17.10180	19.36928	20.63086	21.88615	23.13477
59	13.00213	14.28926	15.57204	16.85007	17.12297	19.39035	20.65183	21.90701	23.15552

75mm

75mm SINE BAR CONSTANTS

MIN	18°	19°	20°	21°	22°	23°	24°	25°	26°
0	23.17627	24.41761	25.65151	26.87760	28.09549	29.30483	30.50525	31.69637	32.87784
1	23.19702	24.43824	25.67201	26.89796	28.11572	29.32492	30.52518	31.71614	32.89744
2	23.21777	24.45886	25.69251	26.91833	28.13595	29.34499	30.54510	31.73591	32.91705
3	23.23851	24.47949	25.71300	26.93869	28.15617	29.36507	30.56503	31.75568	32.93665
4	23.25925	24.50011	25.73350	26.95905	28.17639	29.38514	30.58495	31.77544	32.95625
5	23.27999	24.52073	25.75399	26.97941	28.19660	29.40522	30.60487	31.79520	32.97584
6	23.30073	24.54134	25.77448	26.99976	28.21682	29.42528	30.62478	31.81496	32.99544
7	23.32147	24.56196	25.79496	27.02011	28.23703	29.44535	30.64470	31.83471	33.01503
8	23.34220	24.58257	25.81545	27.04046	28.25724	29.46541	30.66461	31.85446	33.03462
9	23.36293	24.60318	25.83593	27.06081	28.27745	29.48547	30.68452	31.87421	33.05420
10	23.38366	24.62379	25.85641	27.08116	28.29766	29.50553	30.70442	31.89396	33.07378
11	23.40439	24.64439	25.87689	27.10150	28.31786	29.52559	30.72433	31.91371	33.09336
12	23.42512	24.66500	25.89736	27.12184	28.33806	29.54564	30.74423	31.93345	33.11294
13	23.44584	24.68560	25.91784	27.14218	28.35826	29.56569	30.76413	31.95319	33.13251
14	23.46657	24.70620	25.93831	27.16252	28.37845	29.58574	30.78402	31.97292	33.15208
15	23.48729	24.72680	25.95878	27.18285	28.39865	29.60579	30.80391	31.99266	33.17165
16	23.50800	24.74739	25.97925	27.20318	28.41884	29.62583	30.82380	31.01239	33.19122
17	23.52872	24.76799	25.99971	27.22351	28.43903	29.64587	30.84369	31.03211	33.21078
18	23.54943	24.78858	26.02017	27.24384	28.45921	29.66591	30.86358	31.05184	33.23034
19	23.57015	24.80917	26.04063	27.26417	28.47940	29.68595	30.88346	31.07156	33.24990
20	23.59086	24.82976	26.06109	27.28449	28.49958	29.70598	30.90334	32.09128	33.26945
21	23.61156	24.85034	26.08155	27.30481	28.51976	29.72601	30.92322	32.11100	33.28900
22	23.63227	24.87092	26.10200	27.32513	28.53993	29.74604	30.94309	32.13071	33.30855
23	23.65298	24.89151	26.12245	27.34545	28.56011	29.76607	30.96296	32.15043	33.32810
24	23.67368	24.91208	26.14290	27.36576	28.58028	29.78609	30.98283	32.17013	33.34764
25	23.69438	24.93266	26.16335	27.38607	28.60045	29.80611	31.00270	32.18984	33.36718
26	23.71508	24.95324	26.18380	27.40638	28.62061	29.82613	31.02256	32.20954	33.38672
27	23.73577	24.97381	26.20424	27.42669	28.64078	29.84615	31.04242	32.22925	33.40625
28	23.75647	24.99438	26.22468	27.44699	28.66094	29.86616	31.06228	32.24894	33.42578
29	23.77716	25.01495	26.24512	27.46729	28.68110	29.88617	31.08214	32.26864	33.44531
30	23.79785	25.03551	26.26555	27.48759	28.70126	29.90618	31.10199	32.28833	33.46484
31	23.81854	25.05608	26.28599	27.50789	28.72141	29.92619	31.12184	32.30802	33.48436
32	23.83922	25.07664	26.30642	27.52818	28.74156	29.94619	31.14169	32.32771	33.50388
33	23.85991	25.09720	26.32685	27.54848	28.76171	29.96619	31.16154	32.34739	33.52340
34	23.88059	25.11776	26.34728	27.56877	28.78186	29.98619	31.18138	32.36708	33.54291
35	23.90127	25.13831	26.36770	27.58906	28.80201	30.00618	31.20122	32.38675	33.56242
36	23.92195	25.15887	26.38812	27.60934	28.82215	30.02618	31.22106	32.40643	33.58193
37	23.94262	25.17942	26.40854	27.62962	28.84229	30.04617	31.24089	32.42610	33.60144
38	23.96330	25.19997	26.42896	27.64991	28.86243	30.06616	31.26073	32.44578	33.62094
39	23.98397	25.22052	26.44938	27.67018	28.88256	30.08614	31.28056	32.46544	33.64044
40	24.00464	25.24106	26.46979	27.69046	28.90269	30.10612	31.30038	32.48511	33.65994
41	24.02531	25.26160	26.49020	27.71074	28.92283	30.12611	31.32021	32.50477	33.67943
42	24.04597	25.28214	26.51061	27.73101	28.94295	30.14608	31.34003	32.52443	33.69892
43	24.06664	25.30268	26.53102	27.75128	28.96308	30.16606	31.35985	32.54409	33.71841
44	24.08730	25.32322	26.55143	27.77154	28.98320	30.18603	31.37967	32.56374	33.73790
45	24.10796	25.34375	26.57183	27.79181	29.00332	30.20600	31.39948	32.58339	33.75738
46	24.12862	25.36429	26.59223	27.81207	29.02344	30.22597	31.41929	32.60304	33.77686
47	24.14927	25.38482	26.61263	27.83233	29.04356	30.24593	31.43910	32.62269	33.79634
48	24.16993	25.40534	26.63302	27.85259	29.06367	30.26590	31.45891	32.64233	33.81582
49	24.19058	25.42587	26.65342	27.87284	29.08378	30.28586	31.47871	32.66197	33.83529
50	24.21123	25.44639	26.67381	27.89310	29.10389	30.30581	31.49851	32.68161	33.85476
51	24.23188	25.46691	26.69420	27.91335	29.12399	30.32577	31.51831	32.70125	33.87422
52	24.25252	25.48743	26.71458	27.93359	29.14410	30.34572	31.53810	32.72088	33.89369
53	24.27316	25.50795	26.73497	27.95384	29.16420	30.36567	31.55790	32.74051	33.91315
54	24.29381	25.52847	26.75535	27.97408	29.18430	30.38562	31.57769	32.76013	33.93260
55	24.31445	25.54898	26.77573	27.99432	29.20439	30.40556	31.59747	32.77976	33.95206
56	24.33508	25.56949	26.79611	28.01456	29.22449	30.42551	31.61726	32.79938	33.97151
57	24.35572	25.59000	26.81648	28.03480	29.24458	30.44545	31.63704	32.81900	33.99096
58	24.37635	25.61050	26.83686	28.05503	29.26467	30.46538	31.65682	32.83861	34.01040
59	24.39698	25.63101	26.85723	28.07527	29.28475	30.48532	31.67660	32.85823	34.02985

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mm

75mm SINE BAR CONSTANTS

MIN	27°	28°	29°	30°	31°	32°	33°	34°	35°
0	34.04929	35.21037	36.36072	37.50000	38.62786	39.74394	40.84793	41.93947	43.01823
1	34.06872	35.22963	36.37980	37.51889	38.64655	39.76244	40.86622	41.95755	43.03610
2	34.08816	35.24889	36.39888	37.53778	38.66525	39.78094	40.88451	41.97563	43.05397
3	34.10759	35.26814	36.41795	37.55667	38.68394	39.79943	40.90280	41.99371	43.07183
4	34.12702	35.28740	36.43702	37.57555	38.70263	39.81792	40.92109	42.01179	43.08969
5	34.14645	35.30664	36.45609	37.59443	38.72132	39.83641	40.93937	42.02986	43.10754
6	34.16587	35.32589	36.47515	37.61331	38.74000	39.85489	40.95765	42.04792	43.12539
7	34.18529	35.34513	36.49421	37.63218	38.75868	39.87337	40.97592	42.06599	43.14324
8	34.20471	35.36438	36.51327	37.65105	38.77735	39.89185	40.99419	42.08405	43.16109
9	34.22412	35.38361	36.53233	37.66991	38.79603	39.91032	41.01246	42.10210	43.17893
10	34.24353	35.40285	36.55138	37.68878	38.81470	39.92879	41.03072	42.12016	43.19676
11	34.26294	35.42208	36.57043	37.70764	38.83336	39.94726	41.04898	42.13821	43.21459
12	34.28234	35.44131	36.58947	37.72650	38.85203	39.96572	41.06724	42.15625	43.23242
13	34.30175	35.46053	36.60852	37.74535	38.87069	39.98418	41.08550	42.1743	43.25025
14	34.32115	35.47976	36.62756	37.76420	38.88934	40.00264	41.10375	42.19233	43.26807
15	34.34054	35.49898	36.64659	37.78305	38.90799	40.02109	41.12199	42.21037	43.28589
16	34.35994	35.51819	36.66563	37.80189	38.92664	40.03954	41.14024	42.22840	43.30370
17	34.37933	35.53741	36.68466	37.82073	38.94529	40.05798	41.15848	42.24643	43.32151
18	34.39872	35.55662	36.70368	37.83957	38.96393	40.07643	41.17671	42.26445	43.33932
19	34.41810	35.57582	36.72271	37.85841	38.98257	40.09487	41.19494	42.28247	43.35713
20	34.43748	35.59503	36.74173	37.87724	39.00121	40.11330	41.21317	42.30049	43.37493
21	34.45686	35.61423	36.76075	37.89607	39.01984	40.13173	41.23140	42.31851	43.39272
22	34.47624	35.63343	36.77976	37.91489	39.03847	40.15016	41.24962	42.33652	43.41051
23	34.49561	35.65262	36.79877	37.93371	39.05710	40.16859	41.26784	42.35452	43.42830
24	34.51498	35.67182	36.81778	37.95253	39.07572	40.18701	41.28606	42.37253	43.44609
25	34.53435	35.69101	36.83679	37.97135	39.09434	40.20543	41.30427	42.39052	43.46387
26	34.55372	35.71019	36.85579	37.99016	39.11296	40.22384	41.32248	42.40852	43.48165
27	34.57308	35.72937	36.87479	38.00897	39.13157	40.24226	41.34068	42.42651	43.49942
28	34.59244	35.74856	36.89378	38.02778	39.15018	40.26066	41.35888	42.44450	43.51719
29	34.61179	35.76773	36.91278	38.04658	39.16879	40.27907	41.37708	42.46249	43.53496
30	34.63115	35.78691	36.93177	38.06538	39.18739	40.29747	41.39527	42.48047	43.55272
31	34.65050	35.80608	36.95075	38.08417	39.20599	40.31587	41.41346	42.49845	43.57048
32	34.66984	35.82525	36.96974	38.10297	39.22459	40.33426	41.43165	42.51642	43.58824
33	34.68919	35.84441	36.98872	38.12176	39.24318	40.35266	41.44984	42.53439	43.60599
34	34.70853	35.86357	37.00769	38.14054	39.26177	40.37104	41.46802	42.55236	43.62374
35	34.72787	35.88273	37.02667	38.15933	39.28036	40.38943	41.48619	42.57032	43.64148
36	34.74720	35.90189	37.04564	38.17811	39.29894	40.40781	41.50437	42.58828	43.65922
37	34.76654	35.92104	37.06461	38.19688	39.31752	40.42619	41.52254	42.60624	43.67696
38	34.78586	35.94019	37.08357	38.21566	39.33610	40.44456	41.5407	42.62419	43.69469
39	34.80519	35.95934	37.10253	38.23443	39.35467	40.46293	41.55886	42.64214	43.71242
40	34.82451	35.97848	37.12149	38.25319	39.37324	40.48130	41.57702	42.66008	43.73015
41	34.84384	35.99762	37.14045	38.27196	39.39181	40.49966	41.59518	42.67803	43.74787
42	34.86315	36.01676	37.15940	38.29072	39.41037	40.51802	41.61333	42.69596	43.76559
43	34.88247	36.03590	37.17835	38.30948	39.42893	40.53638	41.63148	42.71390	43.78331
44	34.90178	36.05503	37.19730	38.32823	39.44749	40.55473	41.64963	42.73183	43.80102
45	34.92109	36.07416	37.21624	38.34698	39.46604	40.57309	41.66777	42.74976	43.81872
46	34.94039	36.09328	37.23518	38.36573	39.48459	40.59143	41.68591	42.76768	43.83643
47	34.95970	36.11241	37.25411	38.38447	39.50314	40.60978	41.70404	42.7856	43.85413
48	34.97900	36.13153	37.27305	38.40321	39.52168	40.62812	41.72217	42.80352	43.87183
49	34.99830	36.15064	37.29198	38.42195	39.54022	40.64645	41.74030	42.82143	43.88952
50	35.01759	36.16976	37.31090	38.44069	39.55876	40.66479	41.75842	42.83934	43.90721
51	35.03688	36.18887	37.32983	38.45942	39.57729	40.68312	41.77654	42.85725	43.92489
52	35.05617	36.20797	37.34875	38.47815	39.59582	40.70144	41.79466	42.87515	43.94257
53	35.07545	36.22708	37.36767	38.49687	39.61435	40.71976	41.81277	42.89305	43.96025
54	35.09474	36.24618	37.38658	38.51559	39.63288	40.73808	41.83088	42.91094	43.97793
55	35.11402	36.26528	37.40549	38.53431	39.65140	40.75640	41.84899	42.92883	43.99560
56	35.13329	36.28437	37.42440	38.55303	39.66991	40.77471	41.86709	42.94672	44.01326
57	35.15256	36.30346	37.44330	38.57174	39.68843	40.79302	41.88519	42.96460	44.03093
58	35.17184	36.32255	37.46221	38.59045	39.70693	40.81133	41.90329	42.98248	44.04859
59	35.19110	36.34164	37.48110	38.60915	39.72544	40.82963	41.92138	43.00036	44.06624

75mm

75mm SINE BAR CONSTANTS

MIN	36°	37°	38°	39°	40°	41°	42°	43°	44°
0	44.08389	45.13613	46.17461	47.19903	48.20907	49.20443	50.18480	51.14988	52.09938
1	44.10154	45.15355	46.19180	47.21598	48.22578	49.22089	50.20101	51.16583	52.11507
2	44.11919	45.17097	46.20899	47.23293	48.24249	49.23735	50.21721	51.18178	52.13076
3	44.13683	45.18838	46.22617	47.24988	48.25919	49.25380	50.23342	51.19772	52.14644
4	44.15446	45.20579	46.24335	47.26682	48.27589	49.27025	50.24961	51.21366	52.16212
5	44.17210	45.22320	46.26052	47.28375	48.29258	49.28670	50.26581	51.22960	52.17779
6	44.18973	45.24060	46.27769	47.30069	48.30927	49.30314	50.28200	51.24553	52.19346
7	44.20735	45.25800	46.29486	47.31761	48.32596	49.31958	50.29818	51.26146	52.20912
8	44.22497	45.27539	46.31202	47.33454	48.34264	49.33602	50.31436	51.27738	52.22479
9	44.24259	45.29278	46.32918	47.35146	48.35932	49.35245	50.33054	51.29330	52.24044
10	44.26021	45.31017	46.34633	47.36838	48.37599	49.36887	50.34671	51.30922	52.25609
11	44.27782	45.32755	46.36348	47.38529	48.39266	49.38529	50.36288	51.32513	52.27174
12	44.29543	45.34493	46.38063	47.40220	48.40933	49.40171	50.37904	51.34103	52.28738
13	44.31303	45.36231	46.39777	47.41910	48.42599	49.41812	50.39520	51.35693	52.30302
14	44.33063	45.37968	46.41491	47.43600	48.44265	49.43453	50.41136	51.37283	52.31865
15	44.34822	45.39705	46.43205	47.45290	48.45930	49.45094	50.42751	51.38872	52.33428
16	44.36582	45.41441	46.44918	47.46979	48.47595	49.46734	50.44366	51.40461	52.34991
17	44.38340	45.43177	46.46630	47.48668	48.49259	49.48373	50.45980	51.42050	52.36553
18	44.40099	45.44913	46.48343	47.50357	48.50923	49.50013	50.47594	51.43638	52.38115
19	44.41857	45.46648	46.50055	47.52045	48.52587	49.51651	50.49207	51.45225	52.39676
20	44.43615	45.48383	46.51766	47.53732	48.54250	49.53290	50.50820	51.46812	52.41237
21	44.45372	45.50118	46.53477	47.55420	48.55913	49.54928	50.52433	51.48399	52.42797
22	44.47129	45.51852	46.55188	47.57106	48.57576	49.56565	50.54045	51.49985	52.44357
23	44.48885	45.53585	46.56898	47.58793	48.59238	49.58202	50.55657	51.51571	52.45916
24	44.50642	45.55319	46.58608	47.60479	48.60899	49.59839	50.57268	51.53156	52.47475
25	44.52397	45.57052	46.60318	47.62164	48.62560	49.61475	50.58879	51.54741	52.49034
26	44.54153	45.58784	46.62027	47.63850	48.64221	49.63111	50.60489	51.56326	52.50592
27	44.55908	45.60516	46.63736	47.65535	48.65882	49.64747	50.62099	51.57910	52.52149
28	44.57663	45.62248	46.65444	47.67219	48.67542	49.66382	50.63709	51.59493	52.53706
29	44.59417	45.63980	46.67152	47.68903	48.69201	49.68016	50.65318	51.61077	52.55263
30	44.61171	45.65711	46.68860	47.70587	48.70860	49.69650	50.66927	51.62659	52.56819
31	44.62924	45.67441	46.70567	47.72270	48.72519	49.71284	50.68535	51.64242	52.58375
32	44.64678	45.69172	46.72274	47.73953	48.74177	49.72917	50.70143	51.65823	52.59931
33	44.66430	45.746901	46.73980	47.75635	48.75835	49.74550	50.71750	51.67405	52.61486
34	44.68183	45.72631	46.75686	47.77317	48.77493	49.76183	50.73357	51.68986	52.63040
35	44.69935	45.74360	46.77392	47.78999	48.79150	49.77815	50.74964	51.70566	52.64594
36	44.71687	45.76089	46.79097	47.80680	48.80807	49.79447	50.76570	51.72147	52.66148
37	44.73438	45.77817	46.80802	47.82361	48.82463	49.81078	50.78175	51.73726	52.67701
38	44.75189	45.79545	46.82506	47.84041	48.84119	49.82709	50.79781	51.75305	52.69254
39	44.76939	45.81273	46.84210	47.85721	48.85774	49.84339	50.81386	51.76884	52.70806
40	44.78689	45.83000	46.85914	47.87401	48.87429	49.85969	50.82990	51.78463	52.72358
41	44.80439	45.84726	46.87617	47.89080	48.89084	49.87599	50.84594	51.80041	52.73909
42	44.82189	45.86453	46.89320	47.90759	48.90738	49.89228	50.86198	51.81618	52.75460
43	44.83938	45.88179	46.91022	47.92437	48.92392	49.90856	50.87801	51.83195	52.77011
44	44.85686	45.89904	46.92724	47.94115	48.94045	49.92485	50.89403	51.84772	52.78561
45	44.87435	45.91630	46.94426	47.95793	48.95698	49.94112	50.91006	51.86348	52.80110
46	44.89182	45.93354	46.96127	47.97470	48.97351	49.95740	50.92607	51.87924	52.81660
47	44.90930	45.95079	46.97828	47.99146	48.99003	49.97367	50.94209	51.89499	52.83208
48	44.92677	45.96803	46.99529	48.00823	49.00655	49.98994	50.95810	51.91074	52.84757
49	44.94424	45.98527	47.01229	48.02499	49.02306	50.00620	50.97410	51.92648	52.86304
50	44.96170	46.00250	47.02928	48.04174	49.03957	50.02245	50.99010	51.94222	52.87852
51	44.97916	46.01973	47.04628	48.05849	49.05607	50.03871	51.00610	51.95796	52.89399
52	44.99662	46.03695	47.06326	48.07524	49.07257	50.05496	51.02209	51.97369	52.90945
53	45.01407	46.05417	47.08025	48.09198	49.08907	50.07120	51.03808	51.98941	52.92491
54	45.03152	46.07139	47.09723	48.10872	49.10556	50.08744	51.05407	52.00514	52.94037
55	45.04896	46.08860	47.11421	48.12546	49.12205	50.10368	51.07004	52.02085	52.95582
56	45.06640	46.10581	47.13118	48.14219	49.13853	50.11991	51.08602	52.03657	52.97127
57	45.08384	46.12302	47.14815	48.15891	49.15501	50.13614	51.10199	52.05228	52.98671
58	45.10127	46.14022	47.16511	48.17564	49.17149	50.15236	51.11796	52.06798	53.00215
59	45.11870	46.15742	47.18207	48.19236	49.18796	50.16858	51.13392	52.08368	53.01758

7
5
3
m

100mm SINE BAR CONSTANTS

MIN	0°	1°	2°	3°	4°	5°	6°	7°	8°
0	0.00000	1.74524	3.48995	5.23360	6.97565	8.71557	10.45285	12.18693	13.91731
1	0.02909	1.77432	3.51902	5.26264	7.00467	8.74455	10.48178	12.21581	13.94612
2	0.05818	1.80341	3.54809	5.29169	7.03368	8.77353	10.51070	12.24468	13.97492
3	0.08727	1.83249	3.57716	5.32074	7.06270	8.80251	10.53963	12.27355	14.00372
4	0.11636	1.86158	3.60623	5.34979	7.09171	8.83148	10.56856	12.30241	14.03252
5	0.14544	1.89066	3.63530	5.37883	7.12073	8.86046	10.59748	12.33128	14.06132
6	0.17453	1.91974	3.66437	5.40788	7.14974	8.88943	10.62641	12.36015	14.09012
7	0.20362	1.94883	3.69344	5.43693	7.17876	8.91840	10.65533	12.38901	14.11892
8	0.23271	1.97791	3.72251	5.46597	7.20777	8.94738	10.68425	12.41788	14.14772
9	0.26180	2.00699	3.75158	5.49502	7.23678	8.97635	10.71318	12.44674	14.17651
10	0.29089	2.03608	3.78065	5.52406	7.26580	9.00532	10.74210	12.47560	14.20531
11	0.31998	2.06516	3.80971	5.55311	7.29481	9.03429	10.77102	12.50446	14.23410
12	0.34907	2.09424	3.83878	5.58215	7.32382	9.06326	10.79994	12.53332	14.26289
13	0.37815	2.12332	3.86785	5.61119	7.35283	9.09223	10.82885	12.56218	14.29168
14	0.40724	2.15241	3.89692	5.64024	7.38184	9.12119	10.85777	12.59104	14.32047
15	0.43633	2.18149	3.92598	5.66928	7.41085	9.15016	10.88669	12.61990	14.34926
16	0.46542	2.21057	3.95505	5.69832	7.43986	9.17913	10.91560	12.64875	14.37805
17	0.49451	2.23965	3.98411	5.72736	7.46887	9.20809	10.94452	12.67761	14.40684
18	0.52360	2.26873	4.01318	5.75640	7.49787	9.23706	10.97343	12.70646	14.43562
19	0.55268	2.29781	4.04224	5.78544	7.52688	9.26602	11.00234	12.73531	14.46440
20	0.58177	2.32690	4.07131	5.81448	7.55589	9.29499	11.03126	12.76416	14.49319
21	0.61086	2.35598	4.10037	5.84352	7.58489	9.32395	11.06017	12.79302	14.52197
22	0.63995	2.38506	4.12944	5.87256	7.61390	9.35291	11.08908	12.82186	14.55075
23	0.66904	2.41414	4.15850	5.90160	7.64290	9.38187	11.11799	12.85071	14.57953
24	0.69813	2.44322	4.18757	5.93064	7.67190	9.41083	11.14689	12.87956	14.60830
25	0.72721	2.47230	4.21663	5.95967	7.70091	9.43979	11.17580	12.90841	14.63708
26	0.75630	2.50138	4.24569	5.98871	7.72991	9.46875	11.20471	12.93725	14.66585
27	0.78539	2.53046	4.27475	6.01775	7.75891	9.49771	11.23361	12.96609	14.69463
28	0.81448	2.55954	4.30382	6.04678	7.78791	9.52666	11.26252	12.99494	14.72340
29	0.84357	2.58862	4.33288	6.07582	7.81691	9.55562	11.29142	13.02378	14.75217
30	0.87265	2.61769	4.36194	6.10485	7.84591	9.58458	11.32032	13.05262	14.78094
31	0.90174	2.64677	4.39100	6.13389	7.87491	9.61353	11.34922	13.08146	14.80971
32	0.93083	2.67585	4.42006	6.16292	7.90391	9.64248	11.37812	13.11030	14.83848
33	0.95992	2.70493	4.44912	6.19196	7.93290	9.67144	11.40702	13.13913	14.86724
34	0.98900	2.73401	4.47818	6.22099	7.96190	9.70039	11.43592	13.16797	14.89601
35	1.01809	2.76309	4.50724	6.25002	7.99090	9.72934	11.46482	13.19681	14.92477
36	1.04718	2.79216	4.53630	6.27905	8.01989	9.75829	11.49372	13.22564	14.95353
37	1.07627	2.82124	4.56536	6.30808	8.04889	9.78724	11.52261	13.25447	14.98230
38	1.10535	2.85032	4.59442	6.33711	8.07788	9.81619	11.55151	13.28330	15.01106
39	1.13444	2.87940	4.62347	6.36614	8.10687	9.84514	11.58040	13.31213	15.03981
40	1.16353	2.90847	4.65253	6.39517	8.13587	9.87408	11.60929	13.34096	15.06857
41	1.19261	2.93755	4.68159	6.42420	8.16486	9.90303	11.63818	13.36979	15.09733
42	1.22170	2.96662	4.71065	6.45323	8.19385	9.93197	11.66707	13.39862	15.12608
43	1.25079	2.99570	4.73970	6.48226	8.22284	9.96092	11.69596	13.42744	15.15484
44	1.27987	3.02478	4.76876	6.51129	8.25183	9.98986	11.72485	13.45627	15.18359
45	1.30896	3.05385	4.79781	6.54031	8.28082	10.01881	11.75374	13.48509	15.21234
46	1.33805	3.08293	4.82687	6.56934	8.30981	10.04775	11.78263	13.51392	15.24109
47	1.36713	3.11200	4.85592	6.59836	8.33880	10.07669	11.81151	13.54274	15.26984
48	1.39622	3.14108	4.88498	6.62739	8.36778	10.10563	11.84040	13.57156	15.29858
49	1.42530	3.17015	4.91403	6.65641	8.39677	10.13457	11.86928	13.60038	15.32733
50	1.45439	3.19922	4.94308	6.68544	8.42576	10.16351	11.89816	13.62919	15.35607
51	1.48348	3.22830	4.97214	6.71446	8.45474	10.19245	11.92704	13.65801	15.38482
52	1.51256	3.25737	4.00119	6.74348	8.48373	10.22138	11.95593	13.68683	15.41356
53	1.54165	3.28644	4.03024	6.77251	8.51271	10.25032	11.98481	13.71564	15.44230
54	1.57073	3.31552	4.05929	6.80153	8.54169	10.27925	12.01368	13.74445	15.47104
55	1.59982	3.34459	5.08835	6.83055	8.57067	10.30819	12.04256	13.77327	15.49978
56	1.62890	3.37366	5.11740	6.85957	8.59966	10.33712	12.07144	13.80208	15.52851
57	1.65799	3.40274	5.14645	6.88859	8.62864	10.36605	12.10031	13.83089	15.55725
58	1.68707	3.43181	5.17550	6.91761	8.65762	10.39499	12.12919	13.85970	15.58598
59	1.71616	3.46088	5.20455	6.94663	8.68660	10.42392	12.15806	13.88850	15.61472

100mm

100mm SINE BAR CONSTANTS

MIN	9°	10°	11°	12°	13°	14°	15°	16°	17°
0	15.64345	17.36482	19.08090	20.79117	22.49511	24.19219	25.88190	27.56374	29.23717
1	15.67218	17.39346	19.10945	20.81962	22.52345	24.22041	25.91000	27.59170	29.26499
2	15.70091	17.42211	19.13801	20.84807	22.55179	24.24863	25.93810	27.61965	29.29280
3	15.72963	17.45075	19.16656	20.87652	22.58013	24.27685	25.96619	27.64761	29.32061
4	15.75836	17.47939	19.19510	20.90497	22.60846	24.30507	25.99428	27.67556	29.34842
5	15.78708	17.50803	19.22365	20.93341	22.63680	24.33329	26.02237	27.70352	29.37623
6	15.81581	17.53667	19.25220	20.96186	22.66513	24.36150	26.05045	27.73147	29.40403
7	15.84453	17.56531	19.28074	20.99030	22.69346	24.38971	26.07853	27.75941	29.43183
8	15.87325	17.59395	19.30928	21.01874	22.72179	24.41792	26.10662	27.78736	29.45963
9	15.90197	17.62258	19.33782	21.04718	22.75012	24.44613	26.13469	27.81530	29.48743
10	15.93069	17.65121	19.36636	21.07561	22.77844	24.47433	26.16277	27.84324	29.51522
11	15.95940	17.67984	19.39490	21.10405	22.80677	24.50254	26.19085	27.87118	29.54302
12	15.98812	17.70847	19.42344	21.13248	22.83509	24.53074	26.21892	27.89911	29.57080
13	16.01683	17.73710	19.45197	21.16091	22.86341	24.55894	26.24699	27.92704	29.59859
14	16.04555	17.76573	19.4805	21.18934	22.89172	24.58713	26.27506	27.95497	29.62638
15	16.07426	17.79435	19.50903	21.21777	22.92004	24.61533	26.30312	27.98290	29.65416
16	16.10297	17.82298	19.53756	21.24619	22.94835	24.64352	26.33118	28.01083	29.68194
17	16.13167	17.85160	19.56609	21.27462	22.97666	24.67171	26.35925	28.03875	29.70971
18	16.16038	17.88022	19.59461	21.30304	23.00497	24.69990	26.38730	28.06667	29.73749
19	16.18909	17.90884	19.62314	21.33146	23.03328	24.72809	26.41536	28.09459	29.76526
20	16.21779	17.93746	19.65166	21.35988	23.06159	24.75627	26.44342	28.12251	29.79303
21	16.24650	17.96607	19.68018	21.38829	23.08989	24.78445	26.47147	28.15042	29.82079
22	16.27520	17.99469	19.70870	21.41671	23.11819	24.81263	26.49952	28.17833	29.84856
23	16.30390	18.02330	19.73722	21.44512	23.14649	24.84081	26.52757	28.20624	29.87632
24	16.33260	18.05191	19.76573	21.47353	23.17479	24.86899	26.55561	28.23415	29.90408
25	16.36129	18.08052	19.79425	21.50194	23.20309	24.89716	26.58365	28.26205	29.93184
26	16.38999	18.10913	19.82276	21.53035	23.23138	24.92533	26.61170	28.28995	29.95959
27	16.41868	18.13774	19.85127	21.55876	23.25967	24.95350	26.63973	28.31785	29.98734
28	16.44738	18.16635	19.87978	21.58716	23.28796	24.98167	26.66777	28.34575	30.01509
29	16.47607	18.19495	19.90829	21.61556	23.31625	25.00984	26.69581	28.37364	30.04284
30	16.50476	18.22355	19.93679	21.64396	23.34454	25.03800	26.72384	28.40153	30.07058
31	16.53345	18.25215	19.96530	21.67236	23.37282	25.06616	26.75187	28.42942	30.09832
32	16.56214	18.28075	19.99380	21.70076	23.40110	25.09432	26.77989	28.45731	30.12606
33	16.59082	18.30935	20.02230	21.72915	23.42938	25.12248	26.80792	28.48520	30.15380
34	16.61951	18.33795	20.05080	21.75754	23.45766	25.15063	26.83594	28.51308	30.18153
35	16.64819	18.36654	20.07930	21.78593	23.48594	25.17879	26.86396	28.54096	30.20926
36	16.67687	18.39514	20.10779	21.81432	23.51421	25.20694	26.89198	28.56884	30.23699
37	16.70556	18.42373	20.13629	21.84271	23.54248	25.23508	26.92000	28.59671	30.26471
38	16.73423	18.45232	20.16478	21.87110	23.57075	25.26323	26.94801	28.62458	30.29244
39	16.76291	18.48091	20.19327	21.89948	23.59902	25.29137	26.97602	28.65246	30.32016
40	16.79159	18.50949	20.22176	21.92786	23.62729	25.31952	27.00403	28.68032	30.34788
41	16.82026	18.53808	20.25024	21.95624	23.65555	25.34766	27.03204	28.70819	30.37559
42	16.84894	18.56666	20.27873	21.98462	23.68381	25.37579	27.06004	28.73605	30.40331
43	16.87761	18.59524	20.30721	22.01300	23.71207	25.40393	27.08805	28.76391	30.43102
44	16.90628	18.62382	20.33569	22.04137	23.74033	25.43206	27.11605	28.79177	30.45872
45	16.93495	18.65240	20.36418	22.06974	23.76859	25.46019	27.14404	28.81963	30.48643
46	16.96362	18.68098	20.39265	22.09811	23.79684	25.48832	27.17204	28.84748	30.51413
47	16.99228	18.70956	20.42113	22.12648	23.82510	25.51645	27.20003	28.87533	30.54183
48	17.02095	18.73813	20.44961	22.15485	23.85335	25.54458	27.22802	28.90318	30.56953
49	17.04961	18.76670	20.47808	22.18321	23.88159	25.57270	27.25601	28.93103	30.59723
50	17.07828	18.79528	20.50655	22.21158	23.90984	25.60082	27.28400	28.95887	30.62492
51	17.10694	18.82385	20.53502	22.23994	23.93808	25.62894	27.31198	28.98671	30.65261
52	17.13560	18.85241	20.56349	22.26830	23.96633	25.65705	27.33997	29.01455	30.68030
53	17.16425	18.88098	20.59195	22.29666	23.99457	25.68517	27.36794	29.04239	30.70798
54	17.19291	18.90954	20.62042	22.32501	24.02280	25.71328	27.39592	29.07022	30.73566
55	17.22156	18.93811	20.64888	22.35337	24.05104	25.74139	27.42390	29.09805	30.76334
56	17.25022	18.96667	20.67734	22.38172	24.07927	25.76950	27.45187	29.12588	30.79102
57	17.27887	18.99523	20.70580	22.41007	24.10751	25.79760	27.47984	29.15371	30.81869
58	17.30752	19.02379	20.73426	22.43842	24.13574	25.82570	27.50781	29.18153	30.84636
59	17.33617	19.05234	20.76272	22.46676	24.16396	25.85381	27.53577	29.20935	30.87403

3001

100mm SINE BAR CONSTANTS

MIN	18°	19°	20°	21°	22°	23°	24°	25°	26°
0	30.90170	32.55682	34.20201	35.83679	37.46066	39.07311	40.67366	42.26183	43.83711
1	30.92936	32.58432	34.22935	35.86395	37.48763	39.09989	40.70024	42.28819	43.86326
2	30.95702	32.61182	34.25668	35.89110	37.51459	39.12666	40.72681	42.31455	43.88940
3	30.98468	32.63932	34.28400	35.91825	37.54156	39.15343	40.75337	42.34090	43.91553
4	31.01234	32.66681	34.31133	35.94540	37.56852	39.18019	40.77993	42.36725	43.94166
5	31.03999	32.69430	34.33865	35.97254	37.59547	39.20695	40.80649	42.39360	43.96779
6	31.06764	32.72179	34.36597	35.99968	37.62243	39.23371	40.83305	42.41994	43.99392
7	31.09529	32.74928	34.39329	36.02682	37.64938	39.26047	40.85960	42.44628	44.02004
8	31.12294	32.77676	34.42060	36.05395	37.67632	39.28722	40.88615	42.47262	44.04615
9	31.15058	32.80424	34.44791	36.08108	37.70327	39.31397	40.91269	42.49895	44.07227
10	31.17822	32.83172	34.47521	36.10821	37.73021	39.34071	40.93923	42.52528	44.09838
11	31.20586	32.85919	34.50252	36.13534	37.75714	39.36745	40.96577	42.55161	44.12448
12	31.23349	32.88666	34.52982	36.16246	37.78408	39.39419	40.99230	42.57793	44.15059
13	31.26112	32.91413	34.55712	36.18958	37.81101	39.42093	41.01883	42.60425	44.17668
14	31.28875	32.94160	34.58441	36.21669	37.83794	39.44766	41.04536	42.63056	44.20278
15	31.31638	32.96906	34.61171	36.24380	37.86486	39.47439	41.07189	42.65687	44.22887
16	31.34400	32.99653	34.63900	36.27091	37.89178	39.50111	41.09841	42.68318	44.25496
17	31.37163	33.02398	34.66628	36.29802	73.91870	39.52783	41.12492	42.70949	44.28104
18	31.39925	33.05144	34.69357	36.32512	37.94562	39.55455	41.15144	42.73579	44.30712
19	31.42686	33.07889	34.72085	36.35222	37.97253	39.58127	41.17795	42.76208	44.33319
20	31.45448	33.10634	34.74812	36.37932	37.99944	39.60798	41.20445	42.78838	44.35927
21	31.48209	33.13379	34.77540	36.40641	38.02634	39.63468	41.23096	42.81467	44.38534
22	31.50969	33.16123	34.80267	36.43351	38.05324	39.66139	41.25745	42.84095	44.41140
23	31.53730	33.18867	34.82994	36.46059	38.08014	39.68809	41.28395	42.86723	44.43746
24	31.56490	33.21611	34.85720	36.48768	38.10704	39.71479	41.31044	42.89351	44.46352
25	31.59250	33.24355	34.88447	36.51476	38.13393	39.74148	41.33693	42.91979	44.48957
26	31.62010	33.27098	34.91173	36.54184	38.16082	39.76818	41.36342	42.94606	44.51562
27	31.64770	33.29841	34.93898	36.56891	38.18770	39.79486	41.38990	42.97233	44.54167
28	31.67529	33.32584	34.96624	36.59599	38.21459	39.82155	41.41638	42.99859	44.56771
29	31.70288	33.35326	34.99349	36.62306	38.24147	39.84823	41.44285	43.02485	44.59375
30	31.73047	33.38069	35.02074	36.65012	38.26834	39.87491	41.46932	43.05111	44.61978
31	31.75805	33.40810	35.04798	36.67719	38.29522	39.90158	41.49579	43.07736	44.64581
32	31.78563	33.43552	35.07523	36.70425	38.32209	39.92825	41.52226	43.10361	44.67184
33	31.81321	33.46293	35.10246	36.73130	38.34895	39.95492	41.54872	43.12986	44.69786
34	31.84079	33.49034	35.12970	36.75836	38.37582	39.98158	41.57517	43.15610	44.72388
35	31.86836	33.51775	35.15693	36.78541	38.40268	40.00825	41.60163	43.18234	44.74990
36	31.89593	33.54516	35.18416	36.81246	38.42953	40.03490	41.62808	43.20857	44.77591
37	31.92350	33.57256	35.21139	36.83950	38.45639	40.06156	41.65453	43.23481	44.80192
38	31.95106	33.59996	35.23862	36.86654	38.48324	40.08821	41.68097	43.26103	44.82792
39	31.97863	33.62735	35.26584	36.89358	38.51008	40.11486	41.70741	43.28726	44.85392
40	32.00619	33.65475	35.29306	36.92061	38.53693	40.14150	41.73385	43.31348	44.87992
41	32.03374	33.68214	35.32027	36.94765	38.56377	40.16814	41.76028	43.33970	44.90591
42	32.06130	33.70953	35.34748	36.97468	38.59060	40.19478	41.78671	43.36591	44.93190
43	32.08885	33.73691	35.37469	37.00170	38.61744	40.22141	41.81313	43.39212	44.95789
44	32.11640	33.76429	35.40190	37.02872	38.64427	40.24804	41.83956	43.41832	44.98387
45	32.14395	33.79167	35.42910	37.05574	38.67110	40.27467	41.86597	43.44453	45.00984
46	32.17149	33.81905	35.45630	37.08276	38.69792	40.30129	41.89239	43.47072	45.03582
47	32.19903	33.84642	35.48350	37.10977	38.72474	40.32791	41.91880	43.49692	45.06179
48	32.22657	33.87379	35.51070	37.13678	38.75156	40.35453	41.94521	43.52311	45.08775
49	32.25411	33.90116	35.53789	37.16379	38.77837	40.38114	41.97161	43.54930	45.11372
50	32.28164	33.92852	35.56508	37.19079	38.80518	40.40775	41.99801	43.57548	45.13967
51	32.30917	33.95589	35.59226	37.21780	38.83199	40.43436	42.02441	43.60166	45.16563
52	32.33670	33.98325	35.61944	37.24479	38.85880	40.46096	42.05080	43.62784	45.19158
53	32.36422	34.01060	35.64662	37.27179	38.88560	40.48756	42.07719	43.65401	45.21753
54	32.39174	34.03795	35.67380	37.29878	38.91239	40.51416	42.10358	43.68018	45.24347
55	32.41926	34.06531	35.70097	37.32577	38.93919	40.54075	42.12996	43.70634	45.26941
56	32.44678	34.09265	35.72814	37.35275	38.96598	40.56734	42.15634	43.73251	45.29535
57	32.47429	34.12000	35.75531	37.37973	38.99277	40.59393	42.18272	43.75866	45.32128
58	32.50180	34.14734	35.78248	37.40671	39.01955	40.62051	42.20909	43.78482	45.34721
59	32.52931	34.17468	35.80964	37.43369	39.04633	40.64709	42.23546	43.81097	45.37313

100mm

100mm SINE BAR CONSTANTS

MIN	27°	28°	29°	30°	31°	32°	33°	34°	35°
0	45.39905	46.94716	48.48096	50.00000	51.50381	52.99193	54.46390	55.91929	57.35764
1	45.42497	46.97284	48.50640	50.02519	51.52874	53.01659	54.48830	55.94340	57.38147
2	45.45088	46.99852	48.53184	50.05037	51.55367	53.04125	54.51269	55.96751	57.40529
3	45.47679	47.02419	48.55727	50.07556	51.57859	53.06591	54.53707	55.99162	57.42911
4	45.50269	47.04986	48.58270	50.10073	51.60351	53.09057	54.56145	56.01572	57.45292
5	45.52859	47.07553	48.60812	50.12591	51.62842	53.11521	54.58583	56.03981	57.47672
6	45.55449	47.10119	48.63354	50.15107	51.65333	53.13986	54.61020	56.06390	57.50053
7	45.58038	47.12685	48.65895	50.17624	51.67824	53.16450	54.63456	56.08798	57.52432
8	45.60627	47.15250	48.68436	50.20140	51.70314	53.18913	54.65892	56.11206	57.54811
9	45.63216	47.17815	48.70977	50.22655	51.72804	53.21376	54.68328	56.13614	57.57190
10	45.65804	47.20380	48.73517	50.25170	51.75293	53.23839	54.70763	56.16021	57.59568
11	45.68392	47.22944	48.76057	50.27685	51.77782	53.26301	54.73198	56.18428	57.61946
12	45.70979	47.25508	48.78597	50.30199	51.80270	53.28763	54.75632	56.20834	57.64323
13	45.73566	47.28071	48.81136	50.32713	51.82758	53.31224	54.78066	56.23239	57.66700
14	45.76153	47.30634	48.83674	50.35227	51.85246	53.33685	54.80499	56.25645	57.69076
15	45.78739	47.33197	48.86212	50.37740	51.87733	53.36145	54.82932	56.28049	57.71452
16	45.81325	47.35759	48.88750	50.40252	51.90219	53.38605	54.85365	56.30453	57.73827
17	45.83910	47.38321	48.91288	50.42765	51.92705	53.41064	54.87797	56.32857	57.76202
18	45.86496	47.40882	48.93825	50.45276	51.95191	53.43523	54.90228	56.35260	57.78576
19	45.89080	47.43443	48.96361	50.47788	51.97676	53.45982	54.92659	56.37663	57.80950
20	45.91665	47.46004	48.98897	50.50298	52.00161	53.48440	54.95090	56.40066	57.83323
21	45.94248	47.48564	49.01433	50.52809	52.02646	53.50898	54.97520	56.42467	57.85696
22	45.96832	47.51124	49.03968	50.55319	52.05130	53.53355	54.99950	56.44869	57.88069
23	45.99415	47.53683	49.06503	50.57828	52.07613	53.55812	55.02379	56.47270	57.90440
24	46.01998	47.56242	49.09038	50.60338	52.10096	53.58268	55.04807	56.49670	57.92812
25	46.04580	47.58801	49.11572	50.62846	52.12579	53.60724	55.07236	56.52070	57.95183
26	46.07162	47.61359	49.14105	50.65355	52.15061	53.63179	55.09663	56.54469	57.97553
27	46.09744	47.63917	49.16638	50.67863	52.17543	53.65634	55.12091	56.56868	57.99923
28	46.12325	47.66474	49.19171	50.70370	52.20024	53.68089	55.14518	56.59267	58.02292
29	46.14906	47.69031	49.21704	50.72877	52.22505	53.70543	55.16944	56.61665	58.04661
30	46.17486	47.71588	49.24236	50.75384	52.24986	53.72996	55.19370	56.64062	58.07030
31	46.20066	47.74144	49.26767	50.77890	52.27466	53.75449	55.21795	56.66459	58.09397
32	46.22646	47.76700	49.29298	50.80396	52.29945	53.77902	55.24220	56.68856	58.11765
33	46.25225	47.79255	49.31829	50.82901	52.32424	53.80354	55.26645	56.71252	58.14132
34	46.27804	47.81810	49.34359	50.85406	52.34903	53.82806	55.29069	56.73648	58.16498
35	46.30382	47.84364	49.36889	50.87910	52.37381	53.85257	55.31492	56.76043	58.18864
36	46.32960	47.86919	49.39419	50.90414	53.39859	53.87708	55.33915	56.78437	58.21230
37	46.35538	47.89472	49.41948	50.92918	53.42336	53.90158	55.36338	56.80832	58.23595
38	46.38115	47.92026	49.44476	50.95421	53.44813	53.92608	55.38760	56.83225	58.25959
39	46.40692	47.94579	49.47005	50.97924	53.47290	53.95058	55.41182	56.85619	58.28323
40	46.43269	47.97131	49.49532	51.00426	52.49766	53.97507	55.43603	56.88011	58.30687
41	46.45845	47.99683	49.5206	51.02928	52.52241	53.99955	55.46024	56.90403	58.33050
42	46.48420	48.02235	49.54587	51.05429	52.54717	54.02403	55.48444	56.92795	58.35412
43	46.50996	48.04786	49.57113	51.07930	52.57191	54.04851	55.50864	56.95187	58.37774
44	46.53571	48.07337	49.59639	51.10431	52.59665	54.07298	55.53283	56.97577	58.40136
45	46.56145	48.09888	49.62165	51.12931	52.62139	54.09745	55.55702	56.99968	58.42497
46	46.58719	48.12438	49.64690	51.15431	52.64613	54.12191	55.58121	57.02357	58.44857
47	46.61293	48.14987	49.67215	51.17930	52.67085	54.14637	55.60539	57.04747	58.47217
48	46.63866	48.17537	49.69740	51.20429	52.69558	54.17082	55.62956	57.07136	58.49577
49	46.66439	48.20086	49.72264	51.22927	52.72030	54.19527	55.65373	57.09524	58.51936
50	46.69012	48.22634	49.74787	51.25425	52.74502	54.21971	55.67790	57.11912	58.54294
51	46.71584	48.25182	49.77310	51.27923	52.76973	54.24415	55.70206	57.14299	58.56652
52	46.74156	48.27730	49.79833	51.30420	52.79443	54.26859	55.72621	57.16686	58.59010
53	46.76727	48.30277	49.82355	51.32916	52.81914	54.29302	55.75036	57.19073	58.61367
54	46.79298	48.32824	49.84877	51.35413	52.84383	54.31744	55.77451	57.21459	58.63724
55	46.81869	48.35370	49.87399	51.37908	52.86853	54.34187	55.79865	57.23844	58.66080
56	46.84439	48.37916	49.89920	51.40404	52.89322	54.36628	55.82279	57.26229	58.68435
57	46.87009	48.40462	49.92441	51.42899	52.91790	54.39069	55.84692	57.28614	58.70790
58	46.89578	48.43007	49.94961	51.45393	52.94258	54.41510	55.87105	57.30998	58.73145
59	46.92147	48.45552	49.97481	51.47887	52.96726	54.43951	55.89517	57.33381	58.75499

33001

100mm SINE BAR CONSTANTS

MIN	36°	37°	38°	39°	40°	41°	42°	43°	44°
0	58.77853	60.18150	61.56615	62.93204	64.27876	65.60590	66.91306	68.19984	69.46584
1	58.80206	60.20473	61.58907	62.95464	64.30104	65.62785	66.93467	68.22111	69.48676
2	58.82558	60.22795	61.61198	62.97724	64.32332	65.64980	66.95628	68.24237	69.50767
3	58.84910	60.25117	61.63489	62.99983	64.34559	65.67174	66.97789	68.26363	69.52858
4	58.87262	60.27439	61.65779	63.02242	64.36785	65.69367	66.99948	68.28489	69.54949
5	58.89613	60.29760	61.68069	63.04500	64.39011	65.71560	67.02108	68.30613	69.57039
6	58.91964	60.32080	61.70359	63.06758	64.41236	65.73752	67.04266	68.32738	69.59128
7	58.94314	60.34400	61.72648	63.09015	64.43461	65.75944	67.06424	68.34861	69.61217
8	59.96663	60.36719	61.74936	63.11272	64.45685	65.78135	67.08582	68.36984	69.63305
9	58.99012	60.39038	61.77224	63.13528	64.47909	65.80326	67.10739	68.39107	69.65392
10	59.01361	60.41356	61.79511	63.15784	64.50132	65.82516	67.12895	68.41229	69.67479
11	59.03709	60.43674	61.81798	63.18039	64.52355	65.84706	67.15051	68.4335	69.69565
12	59.06057	60.45991	61.84084	63.20293	64.54577	65.86895	67.17206	68.45471	69.71651
13	59.08404	60.48308	61.86370	63.22547	64.56798	65.89083	67.19361	68.47591	69.73736
14	59.10750	60.50624	61.88655	63.24800	64.59019	65.91271	67.21515	68.49711	69.75821
15	59.13096	60.52940	61.90939	63.27053	64.61240	65.93458	67.23668	68.51830	69.77905
16	59.15442	60.55255	61.93224	63.29306	64.63460	65.95645	67.25821	68.53948	69.79988
17	59.17787	60.57570	61.95507	63.31557	64.65679	65.97831	67.27973	68.56066	69.82071
18	59.20132	60.59884	61.97790	63.33809	64.67898	66.00017	67.30125	68.58184	69.84153
19	59.22476	60.62198	62.00073	63.36059	64.70116	66.02202	67.32276	68.60300	69.86234
20	59.24819	60.64511	62.02355	63.38310	64.72334	66.04386	67.34427	68.62416	69.88315
21	59.27163	60.66824	62.04636	63.40559	64.74551	66.06570	67.36577	68.64532	69.90396
22	59.29505	60.69136	62.06917	63.42808	64.76767	66.08754	67.38727	68.66647	69.92476
23	59.31847	60.71447	62.09198	63.45057	64.78984	66.10936	67.40876	68.68761	69.94555
24	59.34189	60.73758	62.11478	63.47305	64.81199	66.13119	67.43024	68.70875	69.96633
25	59.36530	60.76069	62.13757	63.49553	64.83414	66.15300	67.45172	68.72988	69.98711
26	59.38871	60.78379	62.16036	63.51800	64.85628	66.17481	67.47319	68.75101	70.00789
27	59.41211	60.80689	62.18314	63.54046	64.87842	66.19662	67.49466	68.77213	70.02866
28	59.43550	60.82998	62.20592	63.56292	64.90056	66.21842	67.51612	68.79325	70.04942
29	59.45889	60.85306	62.22870	63.58537	64.92268	66.24022	67.53757	68.81435	70.07018
30	59.48228	60.87614	62.25146	63.60782	64.94480	66.26200	67.55902	68.83546	70.09093
31	59.50566	60.89922	62.27423	63.63026	64.96692	66.28379	67.58046	68.85655	70.11167
32	59.52904	60.92229	62.29698	63.65270	64.98903	66.30557	67.60190	68.87765	70.13241
33	59.55241	60.94535	62.31974	63.67513	65.01114	66.32734	67.62333	68.89873	70.15314
34	59.57577	60.96841	62.34248	63.69756	65.03324	66.34910	67.64476	68.91981	70.17387
35	59.59913	60.99147	62.36522	63.71998	65.05533	66.37087	67.66618	68.94089	70.19459
36	59.62249	61.01452	62.38796	63.74240	65.07742	66.39262	67.68760	68.96195	70.21531
37	59.64584	61.03756	62.41069	63.76481	65.09951	66.41437	67.70901	68.98302	70.23601
38	59.66918	61.0606	62.43342	63.78721	65.12158	66.43612	67.73041	69.00407	70.25672
39	59.69252	61.08363	62.45614	63.80961	65.14366	66.45785	67.75181	69.02512	70.27741
40	59.71586	61.10666	62.47885	63.83201	65.16572	66.47959	67.77320	69.04617	70.29811
41	59.73919	61.12969	62.50156	63.85440	65.18778	66.50131	67.79459	69.06721	70.31879
42	59.76251	61.15270	62.52427	63.87678	65.20984	66.52304	67.81597	69.08824	70.33947
43	59.78583	61.17572	62.54696	63.89916	65.23189	66.54475	67.83734	69.10927	70.36014
44	59.80915	61.19873	62.56966	63.92153	65.25394	66.56646	67.85871	69.13029	70.38081
45	59.83246	61.22173	62.59235	63.94390	65.27598	66.58817	67.88007	69.15131	70.40147
46	59.85577	61.24473	62.61503	63.96626	65.29801	66.60987	67.90143	69.17232	70.42213
47	59.87906	61.26772	62.63771	63.98862	65.32004	66.63156	67.92278	69.19332	70.44278
48	59.90236	61.29071	62.66038	64.01097	65.34206	66.65325	67.94413	69.21432	70.46342
49	59.92565	61.31369	62.68305	64.03332	65.36408	66.67493	67.96547	69.23531	70.48406
50	59.94893	61.33666	62.70571	64.05566	65.38609	66.69661	67.98681	69.25630	70.50469
51	59.97221	61.35964	62.72837	64.07799	65.40810	66.71828	68.00813	69.27728	70.52532
52	59.99549	61.38260	62.75102	64.10032	65.43010	66.73994	68.02946	69.29825	70.54594
53	60.01876	61.40556	62.77366	64.12264	65.45209	66.76160	68.05078	69.31922	70.56655
54	60.04202	61.42852	62.79631	64.14496	65.47408	66.78326	68.07209	69.34018	70.58716
55	60.06528	61.45147	62.81894	64.16728	65.49607	66.80490	68.09339	69.36114	70.60776
56	60.08854	61.47442	62.84157	64.18958	65.51804	66.82655	68.11469	69.38209	70.62835
57	60.11179	61.49736	62.86420	64.21189	65.54002	66.84818	68.13599	69.40304	70.64894
58	60.13503	61.52029	62.88682	64.23418	65.56198	66.86981	68.15728	69.42398	70.66953
59	60.15827	61.54322	62.90943	64.25647	65.58395	66.89144	68.17856	69.44491	70.69011

100mm

125mm SINE BAR CONSTANTS

MIN	0°	1°	2°	3°	4°	5°	6°	7°	8°
0	0.0000	2.1816	4.3624	6.5420	8.7196	10.8945	13.0661	15.2337	17.3966
1	0.0364	2.2179	4.3988	6.5783	8.7558	10.9307	13.1022	15.2698	17.4326
2	0.0727	2.2543	4.4351	6.6146	8.7921	10.9669	13.1384	15.3058	17.4686
3	0.1091	2.2906	4.4715	6.6509	8.8284	11.0031	13.1745	15.3419	17.5047
4	0.1454	2.3270	4.5078	6.6872	8.8646	11.0394	13.2107	15.3780	17.5407
5	0.1818	2.3633	4.5441	6.7235	8.9009	11.0756	13.2469	15.4141	17.5767
6	0.2182	2.3997	4.5805	6.7599	8.9372	11.1118	13.2830	15.4502	17.6127
7	0.2545	2.4360	4.6168	6.7962	8.9734	11.1480	13.3192	15.4863	17.6487
8	0.2909	2.4724	4.6531	6.8325	9.0097	11.1842	13.3553	15.5223	17.6846
9	0.3272	2.5087	4.6895	6.8688	9.0460	11.2204	13.3915	15.5584	17.7206
10	0.3636	2.5451	4.7258	6.9051	9.0822	11.2566	13.4276	15.5945	17.7566
11	0.4000	2.5814	4.7621	6.9414	9.1185	11.2929	13.4638	15.6306	17.7926
12	0.4363	2.6178	4.7985	6.9777	9.1548	11.3291	13.4999	15.6667	17.8286
13	0.4727	2.6542	4.8348	7.0140	9.1910	11.3653	13.5361	15.7027	17.8646
14	0.5091	2.6905	4.8711	7.0503	9.2273	11.4015	13.5722	15.7388	17.9006
15	0.5454	2.7269	4.9075	7.0866	9.2636	11.4377	13.6084	15.7749	17.9366
16	0.5818	2.7632	4.9438	7.1229	9.2998	11.4739	13.6445	15.8109	17.9726
17	0.6181	2.7996	4.9801	7.1592	9.3361	11.5101	13.6806	15.8470	18.0085
18	0.6545	2.8359	5.0165	7.1955	9.3723	11.5463	13.7168	15.8831	18.0445
19	0.6909	2.8723	5.0528	7.2318	9.4086	11.5825	13.7529	15.9191	18.0805
20	0.7272	2.9086	5.0891	7.2681	9.4449	11.6187	13.7891	15.9552	18.1165
21	0.7636	2.9450	5.1255	7.3044	9.4811	11.6549	13.8252	15.9913	18.1525
22	0.7999	2.9813	5.1618	7.3407	9.5174	11.6911	13.8613	16.0273	18.1884
23	0.8363	3.0177	5.1981	7.3770	9.5536	11.7273	13.8975	16.0634	18.2244
24	0.8727	3.0540	5.2345	7.4133	9.5899	11.7635	13.9336	16.0994	18.2604
25	0.9090	3.0904	5.2708	7.4496	9.6261	11.7997	13.9698	16.1355	18.2963
26	0.9454	3.1267	5.3071	7.4859	9.6624	11.8359	14.0059	16.1716	18.3323
27	0.9817	3.1631	5.3434	7.5222	9.6986	11.8721	14.0420	16.2076	18.3683
28	1.0181	3.1994	5.3798	7.5585	9.7349	11.9083	14.0781	16.2437	18.4043
29	1.0545	3.2358	5.4161	7.5948	9.7711	11.9445	14.1143	16.2797	18.4402
30	1.0908	3.2721	5.4524	7.6311	9.8074	11.9807	14.1504	16.3158	18.4762
31	1.1272	3.3085	5.4887	7.6674	9.8436	12.0169	14.1865	16.3518	18.5121
32	1.1635	3.3448	5.5251	7.7037	9.8799	12.0531	14.2227	16.3879	18.5481
33	1.1999	3.3812	5.5614	7.7399	9.9161	12.0893	14.2588	16.4239	18.5841
34	1.2363	3.4175	5.5977	7.7762	9.9524	12.1255	14.2949	16.4600	18.6200
35	1.2726	3.4539	5.6340	7.8125	9.9886	12.1617	14.3310	16.4960	18.6560
36	1.3090	3.4902	5.6704	7.8488	10.0249	12.1979	14.3671	16.5320	18.6919
37	1.3453	3.5266	5.7067	7.8851	10.0611	12.2340	14.4033	16.5681	18.7279
38	1.3817	3.5629	5.7430	7.9214	10.0974	12.2702	14.4394	16.6041	18.7638
39	1.4180	3.5992	5.7793	7.9577	10.1336	12.3064	14.4755	16.6402	18.7998
40	1.4544	3.6356	5.8157	7.9940	10.1698	12.3426	14.5116	16.6762	18.8357
41	1.4908	3.6719	5.8520	8.0303	10.2061	12.3788	14.5477	16.7122	18.8717
42	1.5271	3.7083	5.8883	8.0665	10.2423	12.4150	14.5838	16.7483	18.9076
43	1.5635	3.7446	5.9246	8.1028	10.2786	12.4511	14.6200	16.7843	18.9435
44	1.5998	3.7810	5.9609	8.1391	10.3148	12.4873	14.6561	16.8203	18.9795
45	1.6362	3.8173	5.9973	8.1754	10.3510	12.5235	14.6922	16.8564	19.0154
46	1.6726	3.8537	6.0336	8.2117	10.3873	12.5597	14.7283	16.8924	19.0514
47	1.7089	3.8900	6.0699	8.2480	10.4235	12.5959	14.7644	16.9284	19.0873
48	1.7453	3.9263	6.1062	8.2842	10.4597	12.6320	14.8005	16.9644	19.1232
49	1.7816	3.9627	6.1425	8.3205	10.4960	12.6682	14.8366	17.0005	19.1592
50	1.8180	3.9990	6.1789	8.3568	10.5322	12.7044	14.8727	17.0365	19.1951
51	1.8543	4.0354	6.2152	8.3931	10.5684	12.7406	14.9088	17.0725	19.2310
52	1.8907	4.0717	6.2515	8.4294	10.6047	12.7767	14.9449	17.1085	19.2669
53	1.9271	4.1081	6.2878	8.4656	10.6409	12.8129	14.9810	17.1446	19.3029
54	1.9634	4.1444	6.3241	8.5019	10.6771	12.8491	15.0171	17.1806	19.3388
55	1.9998	4.1807	6.3604	8.5382	10.7133	12.8852	15.0532	17.2166	19.3747
56	2.0361	4.2171	6.3967	8.5745	10.7496	12.9214	15.0893	17.2526	19.4106
57	2.0725	4.2534	6.4331	8.6107	10.7858	12.9576	15.1254	17.2886	19.4466
58	2.1088	4.2898	6.4694	8.6470	10.8220	12.9937	15.1615	17.3246	19.4825
59	2.1452	4.3261	6.5057	8.6833	10.8582	13.0299	15.1976	17.3606	19.5184

1
2
5
M

125mm SINE BAR CONSTANTS

MIN	9°	10°	11°	12°	13°	14°	15°	16°	17°
0	19.5543	21.7060	23.8511	25.9890	28.1189	30.2402	32.3524	34.4547	36.5465
1	19.5902	21.7418	23.8868	26.0245	28.1543	30.2755	32.3875	34.4896	36.5812
2	19.6261	21.7776	23.9225	26.0601	28.1897	30.3108	32.4226	34.5246	36.6160
3	19.6620	21.8134	23.9582	26.0957	28.2252	30.3461	32.4577	34.5595	36.6508
4	19.6979	21.8492	23.9939	26.1312	28.2606	30.3813	32.4928	34.5945	36.6855
5	19.7339	21.8850	24.0296	26.1668	28.2960	30.4166	32.5280	34.6294	36.7203
6	19.7698	21.9208	24.0652	26.2023	28.3314	30.4519	32.5631	34.6643	36.7550
7	19.8057	21.9566	24.1009	26.2379	28.3668	30.4871	32.5982	34.6993	36.7898
8	19.8416	21.9924	24.1366	26.2734	28.4022	30.5224	32.6333	34.7342	36.8245
9	19.8775	22.0282	24.1723	26.3090	28.4376	30.5577	32.6684	34.7691	36.8593
10	19.9134	22.0640	24.2080	26.3445	28.4731	30.5929	32.7035	34.8040	36.8940
11	19.9493	22.0998	24.2436	26.3801	28.5085	30.6282	32.7386	34.8390	36.9288
12	19.9851	22.1356	24.2793	26.4156	28.5439	30.6634	32.7736	34.8739	36.9635
13	20.0210	22.1714	24.3150	26.4511	28.5793	30.6987	32.8087	34.9088	36.9982
14	20.0569	22.2072	24.3506	26.4867	28.6147	30.7339	32.8438	34.9437	37.0330
15	20.0928	22.2429	24.3863	26.5222	28.6500	30.7692	32.8789	34.9786	37.0677
16	20.1287	22.2787	24.4220	26.5577	28.6854	30.8044	32.9140	35.0135	37.1024
17	20.1646	22.3145	24.4576	26.5933	28.7208	30.8396	32.9491	35.0484	37.1371
18	20.2005	22.3503	24.4933	26.6288	28.7562	30.8749	32.9841	35.0833	37.1719
19	20.2364	22.3861	24.5289	26.6643	28.7916	30.9101	33.0192	35.1182	37.2066
20	20.2722	22.4218	24.5646	26.6998	28.8270	30.9453	33.0543	35.1531	37.2413
21	20.3081	22.4576	24.6002	26.7354	28.8624	30.9806	33.0893	35.1880	37.2760
22	20.3440	22.4934	24.6359	26.7709	28.8977	31.0158	33.1244	35.2229	37.3107
23	20.3799	22.5291	24.6715	26.8064	28.9331	31.0510	33.1595	35.2578	37.3454
24	20.4157	22.5649	24.7072	26.8419	28.9685	31.0862	33.1945	35.2927	37.3801
25	20.4516	22.6007	24.7428	26.8774	29.0039	31.1215	33.2296	35.3276	37.4148
26	20.4875	22.6364	24.7785	26.9129	29.0392	31.1567	33.2646	35.3624	37.4495
27	20.5234	22.6722	24.8141	26.9484	29.0746	31.1919	33.2997	35.3973	37.4842
28	20.5592	22.7079	24.8497	26.9839	29.1100	31.2271	33.3347	35.4322	37.5189
29	20.5951	22.7437	24.8854	27.0195	29.1453	31.2623	33.3698	35.4671	37.5535
30	20.6310	22.7794	24.9210	27.0550	29.1807	31.2975	33.4048	35.5019	37.5882
31	20.6668	22.8152	24.9566	27.0904	29.2160	31.3327	33.4398	35.5368	37.6229
32	20.7027	22.8509	24.9922	27.1259	29.2514	31.3679	33.4749	35.5716	37.6576
33	20.7385	22.8867	25.0279	27.1614	29.2867	31.4031	33.5099	35.6065	37.6922
34	20.7744	22.9224	25.0635	27.1969	29.3221	31.4383	33.5449	35.6413	37.7269
35	20.8102	22.9582	25.0991	27.2324	29.3574	31.4735	33.5800	35.6762	37.7616
36	20.8461	22.9939	25.1347	27.2679	29.3928	31.5087	33.6150	35.7110	37.7962
37	20.8819	23.0297	25.1704	27.3034	29.4281	31.5439	33.6500	35.7459	37.8309
38	20.9178	23.0654	25.2060	27.3389	29.4634	31.5790	33.6850	35.7807	37.8655
39	20.9536	23.1011	25.2416	27.3744	29.4988	31.6142	33.7200	35.8156	37.9002
40	20.9895	23.1369	25.2772	27.4098	29.5341	31.6494	33.7550	35.8504	37.9348
41	21.0253	23.1726	25.3128	27.4453	29.5694	31.6846	33.7900	35.8852	37.9695
42	21.0612	23.2083	25.3484	27.4808	29.6048	31.7197	33.8251	35.9201	38.0041
43	21.0970	23.2441	25.3840	27.5162	29.6401	31.7549	33.8601	35.9549	38.0388
44	21.1329	23.2798	25.4196	27.5517	29.6754	31.7901	33.8951	35.9897	38.0734
45	21.1687	23.3155	25.4552	27.5872	29.7107	31.8252	33.9301	36.0245	38.1080
46	21.2045	23.3512	25.4908	27.6226	29.7461	31.8604	33.9651	36.0594	38.1427
47	21.2404	23.3869	25.5264	27.6581	29.7814	31.8956	34.0000	36.0942	38.1773
48	21.2762	23.4227	25.5620	27.6936	29.8167	31.9307	34.0350	36.1290	38.2119
49	21.3120	23.4584	25.5976	27.7290	29.8520	31.9659	34.0700	36.1638	38.2465
50	21.3478	23.4941	25.6332	27.7645	29.8873	32.0010	34.1050	36.1986	38.2811
51	21.3837	23.5298	25.6688	27.7999	29.9226	32.0362	34.1400	36.2334	38.3158
52	21.4195	23.5655	25.7044	27.8354	29.9579	32.0713	34.1750	36.2682	38.3504
53	21.4553	23.6012	25.7399	27.8708	29.9932	32.1065	34.2099	36.3030	38.3850
54	21.4911	23.6369	25.7755	27.9063	30.0285	32.1416	34.2449	36.3378	38.4196
55	21.5270	23.6726	25.8111	27.9417	30.0638	32.1767	34.2799	36.3726	38.4542
56	21.5628	23.7083	25.8467	27.9771	30.0991	32.2119	34.3148	36.4073	38.4888
57	21.5986	23.7440	25.8823	28.0126	30.1344	32.2470	34.3498	36.4421	38.5234
58	21.6344	23.7797	25.9178	28.0480	30.1697	32.2821	34.3848	36.4769	38.5580
59	21.6702	23.8154	25.9534	28.0835	30.2050	32.3173	34.4197	36.5117	38.5925

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125mm SINE BAR CONSTANTS

MIN	18°	19°	20°	21°	22°	23°	24°	25°	26°
0	38.6271	40.6960	42.7525	44.7960	46.8258	48.8414	50.8421	52.8273	54.7964
1	38.6617	40.7304	42.7867	44.8299	46.8595	48.8749	50.8753	52.8602	54.8291
2	38.6963	40.7648	42.8208	44.8639	46.8932	48.9083	50.9085	52.8932	54.8617
3	38.7309	40.7991	42.8550	44.8978	46.9269	48.9418	50.9417	52.9261	54.8944
4	38.7654	40.8335	42.8892	44.9317	46.9606	48.9752	50.9749	52.9591	54.9271
5	38.8000	40.8679	42.9233	44.9657	46.9943	49.0087	51.0081	52.9920	54.9597
6	38.8346	40.9022	42.9575	44.9996	47.0280	49.0421	51.0413	53.0249	54.9924
7	38.8691	40.9366	42.9916	45.0335	47.0617	49.0756	51.0745	53.0579	55.0250
8	38.9037	40.9709	43.0257	45.0674	47.0954	49.1090	51.1077	53.0908	55.0577
9	38.9382	41.0053	43.0599	45.1014	47.1291	49.1425	51.1409	53.1237	55.0903
10	38.9728	41.0396	43.0940	45.1353	47.1628	49.1759	51.1740	53.1566	55.1230
11	39.0073	41.0740	43.1281	45.1692	47.1964	49.2093	51.2072	53.1895	55.1556
12	39.0419	41.1083	43.1623	45.2031	47.2301	49.2427	51.2404	53.2224	55.1882
13	39.0764	41.1427	43.1964	45.2370	47.2638	49.2762	51.2735	53.2553	55.2209
14	39.1109	41.1770	43.2305	45.2709	47.2974	49.3096	51.3067	53.2882	55.2535
15	39.1455	41.2113	43.2646	45.3048	47.3311	49.3430	51.3399	53.3211	55.2861
16	39.1800	41.2457	43.2987	45.3386	47.3647	49.3764	51.3730	53.3540	55.3187
17	39.2145	41.2800	43.3329	45.3725	47.3984	49.4098	51.4062	53.3869	55.3513
18	39.2491	41.3143	43.3670	45.4064	47.4320	49.4432	51.4393	53.4197	55.3839
19	39.2836	41.3486	43.4011	45.4403	47.4657	49.4766	51.4724	53.4526	55.4165
20	39.3181	41.3829	43.4352	45.4742	47.4993	49.5100	51.5056	53.4855	55.4491
21	39.3526	41.4172	43.4692	45.5080	47.5329	49.5434	51.5387	53.5183	55.4817
22	39.3871	41.4515	43.5033	45.5419	47.5666	49.5767	51.5718	53.5512	55.5142
23	39.4216	41.4858	43.5374	45.5757	47.6002	49.6101	51.6049	53.5840	55.5468
24	39.4561	41.5201	43.5715	45.6096	47.6338	49.6435	51.6381	53.6169	55.5794
25	39.4906	41.5544	43.6056	45.6435	47.6674	49.6769	51.6712	53.6497	55.6120
26	39.5251	41.5887	43.6397	45.6773	47.7010	40.7102	51.7043	53.6826	55.6445
27	39.5596	41.6230	43.6737	45.7111	47.7346	49.7436	51.7374	53.7154	55.6771
28	39.5941	41.6573	43.7078	45.7450	47.7682	49.7769	51.7705	53.7482	55.7096
29	39.6286	41.6916	43.7419	45.7788	47.8018	49.8103	51.8036	53.7811	55.7422
30	39.6631	41.7259	43.7759	45.8127	47.8354	49.8436	51.8367	53.8139	55.7747
31	39.6976	41.7601	43.8100	45.8465	47.8690	49.8770	51.8697	53.8467	55.8073
32	39.7320	41.7944	43.8440	45.8803	47.9026	49.9103	51.9028	53.8795	55.8398
33	39.7665	41.8287	43.8781	45.9141	47.9362	49.9437	51.9359	53.9123	55.8723
34	39.8010	41.8629	43.9121	45.9479	47.9698	49.9770	51.9690	53.9451	55.9049
35	39.8355	41.8972	43.9462	45.9818	48.0033	50.0103	52.0020	53.9779	55.9374
36	39.8699	41.9314	43.9802	46.0156	48.0369	50.0436	52.0351	54.0107	55.9699
37	39.9044	41.9657	44.0142	46.0494	48.0705	50.0769	52.0682	54.0435	55.0024
38	39.9388	41.9999	44.0483	46.0832	48.1040	50.1103	52.1012	54.0763	56.0349
39	30.9733	42.0342	44.0823	46.1170	48.1376	50.1436	52.1343	54.1091	56.0674
40	40.0077	42.0684	44.1163	46.1508	48.1712	50.1769	52.1673	54.1418	56.0999
41	40.0422	42.1027	44.1503	46.1846	48.2047	50.2102	52.2003	54.1746	56.1324
42	40.0766	42.1369	44.1844	46.2183	48.2383	50.2435	52.2334	54.2074	56.1649
43	40.1111	42.1711	44.2184	46.2521	48.2718	50.2768	52.2664	54.2401	56.1974
44	40.1455	42.2054	44.2524	46.2859	48.3053	50.3101	52.2994	54.2729	56.2298
45	40.1799	42.2396	44.2864	46.3197	48.3389	50.3433	52.3325	54.3057	56.2623
46	40.2144	42.2738	44.3204	46.3535	48.3724	50.3766	52.3655	54.3384	56.2948
47	40.2488	42.3080	44.3544	46.3872	48.4059	50.4099	52.3985	54.3711	56.3272
48	40.2832	42.3422	44.3884	46.4210	48.4394	50.4432	52.4315	54.4039	56.3597
49	40.3176	42.3764	44.4224	46.4547	48.4730	50.4764	52.4645	54.4366	56.3921
50	40.3520	42.4107	44.4563	46.4885	48.5065	50.5097	52.4975	54.4694	56.4246
51	40.3865	42.4449	44.4903	46.5222	48.5400	50.5429	52.5305	54.5021	56.4570
52	40.4209	42.4791	44.5243	46.5560	48.5735	50.5762	52.5635	54.5348	56.4895
53	40.4553	42.5133	44.5583	46.5897	48.6070	50.6095	52.5965	54.5675	56.5219
54	40.4897	42.5474	44.5922	46.6235	48.6405	50.6427	52.6295	54.6002	56.5543
55	40.5241	42.5816	44.6262	46.6572	48.6740	50.6759	52.6625	54.6329	56.5868
56	40.5585	42.6158	44.6602	46.6909	48.7075	50.7092	52.6954	54.6656	56.6192
57	40.5929	42.6500	44.6941	46.7247	48.7410	50.7424	52.7284	54.6983	56.6516
58	40.6273	42.6842	44.7281	46.7584	48.7744	50.7756	52.7614	54.7310	56.6840
59	40.6616	42.7183	44.7620	46.7921	48.8079	50.8089	52.7943	54.7637	56.7164

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125mm SINE BAR CONSTANTS

MIN	27°	28°	29°	30°	31°	32°	33°	34°	35°
0	56.7488	58.6839	60.6012	62.5000	64.3798	66.2399	68.0799	69.8991	71.6971
1	56.7812	58.7160	60.6330	62.5315	64.4109	66.2707	68.1104	69.9293	71.7268
2	56.8136	58.7481	60.6648	62.5630	64.4421	66.3016	68.1409	69.9594	71.7566
3	56.8460	58.7802	60.6966	62.5944	64.4732	66.3324	68.1713	69.9895	71.7864
4	56.8784	58.8123	60.7284	62.6259	64.5044	66.3632	68.2018	70.0196	71.8161
5	56.9107	58.8444	60.7601	62.6574	64.5355	66.3940	68.2323	70.0498	71.8459
6	56.9431	58.8765	60.7919	62.6888	64.5667	66.4248	68.2627	70.0799	71.8757
7	56.9755	58.9086	60.8237	62.7203	64.5978	66.4556	68.2932	70.1100	71.9054
8	57.0078	58.9406	60.8555	62.7517	64.6289	66.4864	68.3237	70.1401	71.9351
9	57.0402	58.9727	60.8872	62.7832	64.6600	66.5172	68.3541	70.1702	71.9649
10	57.0726	59.0047	60.9190	62.8146	64.6912	66.5480	68.3845	70.2003	71.9946
11	57.1049	59.0368	60.9507	62.8461	64.7223	66.5788	68.4150	70.2303	72.0243
12	57.1372	59.0688	60.9825	62.8775	64.7534	66.6095	68.4454	70.2604	72.0540
13	57.1696	59.1009	61.0142	62.9089	64.7845	66.6403	68.4758	70.2905	72.0837
14	57.2019	59.1329	61.0459	62.9403	64.8156	66.6711	68.5062	70.3206	72.1135
15	57.2342	59.1650	61.0777	62.9717	64.8467	66.7018	68.5367	70.3506	72.1431
16	57.2666	59.1970	61.1094	63.0032	64.8777	66.7326	68.5671	70.3807	72.1728
17	57.2989	59.2290	61.1411	63.0346	64.9088	66.7633	68.5975	70.4107	72.2025
18	57.3312	59.2610	61.1728	63.0660	64.9399	66.7940	68.6279	70.4408	72.2322
19	57.3635	59.2930	61.2045	63.0973	64.9710	66.8248	68.6582	70.4708	72.2619
20	57.3958	59.3250	61.2362	63.1287	65.0020	66.8555	68.6886	70.5008	72.2915
21	57.4281	59.3570	61.2679	63.1601	65.0331	66.8862	68.7190	70.5308	72.3212
22	57.4604	59.3890	61.2996	63.1915	65.0641	66.9169	68.7494	70.5609	72.3509
23	57.4927	59.4210	61.3313	63.2229	65.0952	66.9476	68.7797	70.5909	72.3805
24	57.5250	59.4530	61.3630	63.2542	65.1262	66.9783	68.8101	70.6209	72.4101
25	57.5573	59.4850	61.3946	63.2856	65.1572	67.0090	68.8404	70.6509	72.4398
26	57.5895	59.5170	61.4263	63.3169	65.1883	67.0397	68.8708	70.6809	72.4694
27	57.6218	59.5490	61.4580	63.3483	65.2193	67.0704	68.9011	70.7109	72.4990
28	57.6541	59.5809	61.4896	63.3796	65.2503	67.1011	68.9315	70.7408	72.5287
29	57.6863	59.6129	61.5213	63.4110	65.2813	67.1318	68.9618	70.7708	72.5583
30	57.7186	59.6448	61.5529	63.4423	65.3123	67.1625	68.9921	70.8008	72.5879
31	57.7508	59.6768	61.5846	63.4736	65.3433	67.1931	69.0224	70.8307	72.6175
32	57.7831	59.7087	61.6162	63.5049	65.3743	67.2238	69.0528	70.8607	72.6471
33	57.8153	59.7407	61.6479	63.5363	65.4053	67.2544	69.0831	70.8907	72.6766
34	57.8475	59.7726	61.6795	63.5676	65.4363	67.2851	69.1134	70.9206	72.7062
35	57.8798	59.8046	61.7111	63.5989	65.4673	67.3157	69.1437	70.9505	72.7358
36	57.9120	59.8365	61.7427	63.6302	65.4982	67.3463	69.1739	70.9805	72.7654
37	57.9442	59.8684	61.7743	63.6615	65.5292	67.3770	69.2042	71.0104	72.7949
38	57.9764	59.9003	61.8060	63.6928	65.5602	67.4076	69.2345	71.0403	72.8245
39	58.0087	59.9322	61.8376	63.7240	65.5911	67.4382	69.2648	71.0702	72.8540
40	58.0409	59.9641	61.8692	63.7553	65.6221	67.4688	69.2950	71.1001	72.8836
41	58.0731	59.9960	61.9007	63.7866	65.6530	67.4994	69.3253	71.1300	72.9131
42	58.1053	60.0279	61.9323	63.8179	65.6840	67.5300	69.3556	71.1599	72.9427
43	58.1374	60.0598	61.9639	63.8491	65.7149	67.5606	69.3858	71.1898	72.9722
44	58.1696	60.0917	61.9955	63.8804	65.7458	67.5912	69.4160	71.2197	73.0017
45	58.2018	60.1236	62.0271	63.9116	65.7767	67.6218	69.4463	71.2496	73.0312
46	58.2340	60.1555	62.0586	63.9429	65.8077	67.6524	69.4765	71.2795	73.0607
47	58.2662	60.1873	62.0902	63.9741	65.8386	67.6830	69.5067	71.3093	73.0902
48	58.2983	60.2192	62.1217	64.0054	65.8695	67.7135	69.5370	71.3392	73.1197
49	58.3305	60.2511	62.1533	64.0366	65.9004	67.7441	69.5672	71.3691	73.1492
50	58.3626	60.2829	62.1848	64.0678	65.9313	67.7746	69.5974	71.3989	73.1787
51	58.3948	60.3148	62.2164	64.0990	65.9622	67.8052	69.6276	71.4287	73.2082
52	58.4269	60.3466	62.2479	64.1302	65.9930	67.8357	69.6578	71.4586	73.2376
53	58.4591	60.3785	62.2794	64.1615	66.0239	67.8663	69.6880	71.4884	73.2671
54	58.4912	60.4103	62.3110	64.1927	66.0548	67.8968	69.7181	71.5182	73.2965
55	58.5234	60.4421	62.3425	64.2239	66.0857	67.9273	69.7483	71.5481	73.3260
56	58.5555	60.4740	62.3740	64.2550	66.1165	67.9579	69.7785	71.5779	73.3554
57	58.5876	60.5058	62.4055	64.2862	66.1474	67.9884	69.8087	71.6077	73.3849
58	58.6197	60.5376	62.4370	64.3174	66.1782	68.0189	69.8388	71.6375	73.4143
59	58.6518	60.5694	62.4685	64.3486	66.2091	68.0494	69.8690	71.6673	73.4437

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125mm SINE BAR CONSTANTS

MIN	36°	37°	38°	39°	40°	41°	42°	43°	44°
0	73.4732	75.2269	76.9577	78.6650	80.3485	82.0074	83.6413	85.2498	86.8323
1	73.5026	75.2559	76.9863	78.6933	80.3763	82.0348	83.6683	85.2764	86.8584
2	73.5320	75.2849	77.0150	78.7216	80.4041	82.0622	83.6954	85.3030	86.8846
3	73.5614	75.3140	77.0436	78.7498	80.4320	82.0897	83.7224	85.3295	86.9107
4	73.5908	75.3430	77.0722	78.7780	80.4598	82.1171	83.7494	85.3561	86.9369
5	73.6202	75.3720	77.1009	78.8063	80.4876	82.1445	83.7763	85.3827	86.9630
6	73.6495	75.4010	77.1295	78.8345	80.5155	82.1719	83.8033	85.4092	6.98910
7	73.6789	75.4300	77.1581	78.8627	80.5433	82.1993	83.8303	85.4358	87.0152
8	73.7083	75.4590	77.1867	78.8909	80.5711	82.2267	83.8573	85.4623	87.0413
9	73.7377	75.4880	77.2153	78.9191	80.5989	82.2541	83.8842	85.4888	87.0674
10	73.7670	75.5170	77.2439	78.9473	80.6267	82.2815	83.9112	85.5154	87.0935
11	73.7964	75.5459	77.2725	78.9755	80.6544	82.3088	83.9381	85.5419	87.1196
12	73.8257	75.5749	77.3010	79.0037	80.6822	82.3362	83.9651	85.5684	87.1456
13	73.8550	75.6038	77.3296	79.0318	80.7100	82.3635	83.9920	85.5949	87.1717
14	73.8844	75.6328	77.3582	79.0600	80.7377	82.3909	84.0189	85.6214	87.1978
15	73.9137	75.6617	77.3867	79.0882	80.7655	82.4182	84.0459	85.6479	87.2238
16	73.9430	75.6907	77.4153	79.1163	80.7932	82.4456	84.0728	85.6744	87.2498
17	73.9723	75.7196	77.4438	79.1445	80.8210	82.4729	84.0997	85.7008	87.2759
18	74.0016	75.7486	77.4724	79.1726	80.8487	82.5002	84.1266	85.7273	87.3019
19	74.0309	75.7775	77.5009	79.2007	80.8765	82.5275	84.1535	85.7538	87.3279
20	74.0602	75.8064	77.5294	79.2289	80.9042	82.5548	84.1803	85.7802	87.3539
21	74.0895	75.8353	77.5580	79.2570	80.9319	82.5821	84.2072	85.8066	87.3799
22	74.1188	75.8642	77.5865	79.2851	80.9596	82.6094	84.2341	85.8331	87.4059
23	74.1481	75.8931	77.6150	79.3132	80.9873	82.6367	84.2609	85.8595	87.4319
24	74.1774	75.9220	77.6435	79.3413	81.0150	82.6640	84.2878	85.8859	87.4579
25	74.2066	75.9509	77.6720	79.3694	81.0427	82.6913	84.3146	85.9124	87.4839
26	74.2359	75.9797	77.7005	79.3975	81.0704	82.7185	84.3415	85.9388	87.5099
27	74.2651	76.0086	77.7289	79.4256	81.0980	82.7458	84.3683	85.9652	87.5358
28	74.2944	76.0375	77.7574	79.4536	81.1257	82.7730	84.3951	85.9916	87.5618
29	74.3236	76.0663	77.7859	79.4817	81.1534	82.8003	84.4220	86.0179	87.5877
30	74.3528	76.0952	77.8143	79.5098	81.1810	82.8275	84.4488	86.0443	87.6137
31	74.3821	76.1240	77.8428	79.5378	81.2087	82.8547	84.4756	86.0707	87.6396
32	74.4113	76.1529	77.8712	79.5659	81.2363	82.8820	84.5024	86.0971	87.6655
33	74.4405	76.1817	77.8997	79.5939	81.2639	82.9092	84.5292	86.1234	87.6914
34	74.4697	76.2105	77.9281	79.6220	81.2915	82.9364	84.5560	86.1498	87.7173
35	74.4989	76.2393	77.9565	79.6500	81.3192	82.9636	84.5827	86.1761	87.7432
36	74.5281	76.2681	77.9849	79.6780	81.3468	82.9908	84.6095	86.2024	87.7691
37	74.5573	76.2970	78.0134	79.7060	81.3744	83.0180	84.6363	86.2288	87.7950
38	74.5865	76.3257	78.0418	79.7340	81.4020	83.0451	84.6630	86.2551	87.8209
39	74.6157	76.3545	78.0702	79.7620	81.4296	83.0723	84.6898	86.2814	87.8468
40	74.6448	76.3833	78.0986	79.7900	81.4572	83.0995	84.7165	86.3077	87.8726
41	74.6740	76.4121	78.1270	79.8180	81.4847	83.1266	84.7432	86.3340	87.8985
42	74.7031	76.4409	78.1553	79.8460	81.5123	83.1538	84.7700	86.3603	87.9243
43	74.7323	76.4696	78.1837	79.8739	81.5399	83.1809	84.7967	86.3866	87.9502
44	74.7614	76.4984	78.2121	79.9019	81.5674	83.2081	84.8234	86.4129	87.9760
45	74.7906	76.5272	78.2404	79.9299	81.5950	83.2352	84.8501	86.4391	88.0018
46	74.8197	76.5559	78.2688	79.9578	81.6225	83.2623	84.8768	86.4654	88.0277
47	74.8488	76.5846	78.2971	79.9858	81.6500	83.2894	84.9035	86.4916	88.0535
48	74.8779	76.6134	78.3255	80.0137	81.6776	83.3166	84.9302	86.5179	88.0793
49	74.9071	76.6421	78.3538	80.0416	81.7051	83.3437	84.9568	86.5441	88.1051
50	74.9362	76.6708	78.3821	80.0696	81.7326	83.3708	84.9835	86.5704	88.1309
51	74.9653	76.6995	78.4105	80.0975	81.7601	83.3978	85.0102	86.5966	88.1566
52	74.9944	76.7283	78.4388	80.1254	81.7876	83.4249	85.0368	86.6228	88.1824
53	75.0234	76.7570	78.4671	80.1533	81.8151	83.4520	85.0635	86.6490	88.2082
54	75.0525	76.7856	78.4954	80.1812	81.8426	83.4791	85.0901	86.6752	88.2339
55	75.0816	76.8143	78.5237	80.2091	81.8701	83.5061	85.1167	86.7014	88.2597
56	75.1107	76.8430	78.5520	80.2370	81.8976	83.5332	85.1434	86.7276	88.2854
57	75.1397	76.8717	78.5802	80.2649	81.9250	83.5602	85.1700	86.7538	88.3112
58	75.1688	76.9004	78.6085	80.2927	81.9525	83.5873	85.1966	86.7800	88.3369
59	75.1978	76.9290	78.6368	80.3206	81.9799	83.6143	85.2232	86.8061	88.3626

3 5 2 1

HOLDING POWER INFORMATION

MAGNETIC ANGLE IRONS, CHUCKS & SINE PLATES

Holding power varies greatly, depending on the size and thickness of the workpiece, the contact area between the part and the chuck, the material the workpiece is made out of, workpiece surface finish and air gaps between the part and the chuck. Things that create air gaps are air, protective coatings, paint, galvanizing, oil, rust, dirt, etc. Holding power falls off at the ends and sides of the chuck (where the frame is and therefore no magnets). Under near ideal conditions at the center of the chuck, using a ground 1" X 1" X 1" cube of CRS, the following average **MAXIMUM** holding powers were found.

MAGNETIC ANGLE IRON, CHUCK OR SINE PLATE TYPE	AVERAGE MAXIMUM HOLDING FORCE
8866, A-xx-MS, B-xx-MS, DMB	90-100 PSI
9195, MAI	35-50 PSI
EMC, EMCB, ESP, ESPC	44-55 PSI
MC, MCB, MSP, MSPC	40-50 PSI
MTC	10-18 PSI
RMC	30-35 PSI

The holding powers above should be derated, based on material and surface finish, using these tables.

LEVEL OF SURFACE FINISH	HOLDING FORCE
GROUND	90-100%
FINE MILLED	60-80%
ROUGH MILLED	40-50%
CAST FINISH	20-30%

MATERIAL	HOLDING FORCE
NON-ALLOY STEEL 0.1-0.3% C	100%
NON-ALLOY STEEL 0.4-0.5% C	90%
NON-DISTORTING ALLOY STEEL	80-90%
GREY CASTING	40-60%
NON-ALLOY STEEL HARDENED TO 55-60 HRc	30-50%
AUSTENITIC STAINLESS STEEL, BRASS, ALUMINUM, COPPER	0%

VACUUM CHUCKS

In theory 14.7 PSI can be obtained with a vacuum chuck. In the real world, under ideal conditions, using a ground workpiece with all unused holes completely masked off, a **MAXIMUM** of approximately 10 PSI can be obtained. Dirt, warped parts, a rough surface finish and other factors can reduce this significantly.

GENERAL TERMS & CONDITIONS

GUARANTEE

Unless otherwise stated, all products manufactured by Suburban Tool, Inc. are guaranteed against defects in material and workmanship for one (1) year from the date of purchase.

DISTRIBUTORS

Suburban's products are available through most industrial distributors. Contact Suburban Tool or one of the sales representatives listed on our website for the names of the dealers in your area.

SPECIFICATIONS & ENGINEERING DATA

Specifications and engineering data are listed as nominal sizes and are subject to change without notice. Contact Suburban's engineering department for current information, if certain specifications are critical to your design or usage.

WEIGHTS

All weights are approximate shipping weights.

MINIMUM ORDER

\$25.00

TERMS

Appropriate terms will be set up on a dealer by dealer basis. A 1-1/2% per month (18% per annum) service charge will be added on all past due invoices. All prices are in U.S. dollars. All shipments are F.O.B. Auburn Hills, Michigan.

RETURNED GOODS

Catalog items suitable for resale, that were purchased from Suburban Tool, may be returned for credit, under the following conditions:

End users are to return goods through the dealer from whom they were purchased.

Dealer returns are to be authorized by us in writing with a **Return Goods Authorization** (RGA). We will need to know:

GENERAL TERMS & CONDITIONS

- The model number of the item being returned.
- The reason for the return.
- The date of purchase and purchase order number.
- The invoice number, if possible.

Transportation charges must be prepaid on all returns.

Credit based on the invoice price will be issued, **minus a 20% restocking charge**, after our inspection and acceptance of the returned goods. The restocking charge will be waived, if another item of similar value is ordered as a replacement.

Special orders are not returnable.

WARRANTY REPAIRS

If a Suburban Tool product is deemed to be defective, during the warranty period, please contact the customer service department to obtain a **Return Goods Authorization (RGA)**. We will need the following:

- The model number of the item being returned.
- The defect claimed.
- Proof of purchase, showing the item, the date and who it was purchased from.

The item must be returned with the transportation prepaid. The package must be marked with "Warranty Repair" and the RGA number. A copy of the RGA should be included inside the package.

Upon receipt of the item, it will be inspected and if found to be defective, it will be repaired or replaced at Suburban Tool's discretion.

OUT-OF-WARRANTY REPAIRS

Most of Suburban's products can be rebuilt to like new condition for half the cost of a new one. The rebuild would include:

- Replacing all wear parts.
- Regrinding work surfaces to original tolerances.
- Repainting all appropriate surfaces.

Contact our repair department for a quote on repairing your item and instructions on returning it to Suburban Tool for repair. Upon receipt of your shipment, your tools will be inspected to determine if an adjustment to the quote is required. You will be contacted with price and delivery information and your repair will commence, when a purchase order is received. The customer is responsible for all freight charges.

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