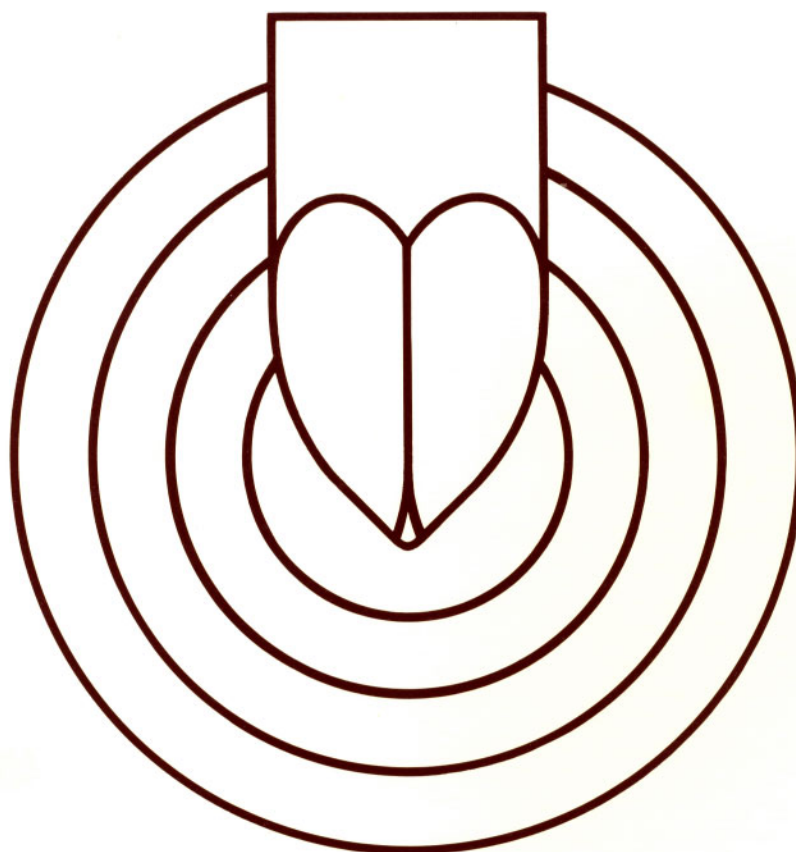




MICRO-POINT INC.

**RECORDING STYLI
MASTER RECORDS**



**ADVANCED TECHNOLOGY
MATCHED MASTERING**

MICRO-POINT MATCHED MASTERING

The disc recording stylus and the master record are two of the most critical, interrelated elements that determine the overall quality of a disc recording. Micro-Point is the *only* company that manufactures both components. This unique position and the ability to conduct sophisticated, precision tests of the disc recording process permits Micro-Point to *match* recording stylus geometry to *master*

record composition for optimum results. This is "Matched Mastering", a process that permits recording studios to improve their mastering quality and efficiency.

The following defines and discusses the recording stylus, the master record, and their joint relationship to mastering quality. This is followed by complete specifications for Micro-Point recording stylus and master records.

CUTTING THE GROOVE

A recording stylus performs two basic functions; it cuts the groove in the master record, and it smooths or burnishes the resulting groove walls. While cutting the groove the stylus is driven by the cutter head in a 45/45 stereo mode to form the complex mechanical waveforms in the master record which are a precise analog of the electrical waveforms fed to the recording amplifier.

The recording stylus and basic groove cutting action are illustrated in Figure 1. This drawing shows an oblique view and a cross section view of the stylus. The section view is from directly overhead as the stylus is cutting and burnishing a groove in the master disc.

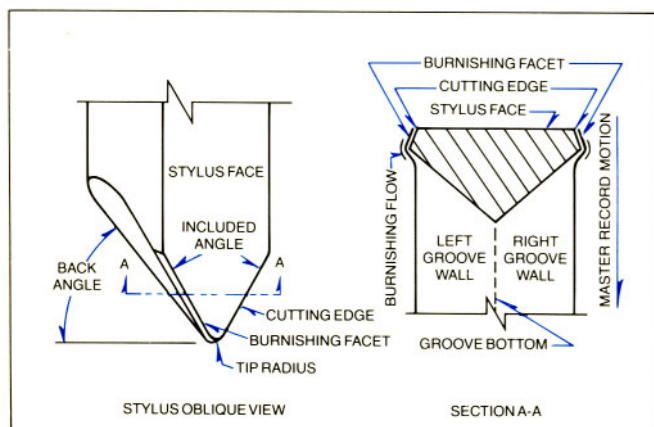


Figure 1. Recording Stylus and Stylus Cutting the Groove.

The cutting edge is the intersection of the stylus face and the burnishing facets, and as the master record moves past the stylus, a groove is cut. The cutting action leaves a certain amount of roughness on the groove walls. The burnishing facets, which trail the cutting edges, protrude slightly beyond the cut groove. As they pass by, the new walls are forced to rub against the facets, and in this way are smoothed or burnished. Heat generated by the cutting and burnishing friction, combined with heat supplied by the stylus heater raises the temperature of the lacquer sufficiently to allow a minute amount to flow and thus improve burnishing action. Any roughness remaining in the groove walls after cutting and burnishing is heard as noise during playback.

Low groove noise depends on three factors; recording stylus dimensions, stylus temperature, and lacquer composition. Recording stylus dimensions that influence recorded noise and program levels are; burnishing facet width and angle, cutting edge accuracy, tip radius, and back angle. Optimum dimensions of the stylus depend upon the specific lacquer composition.

BURNISHING FACET WIDTH AND ANGLE

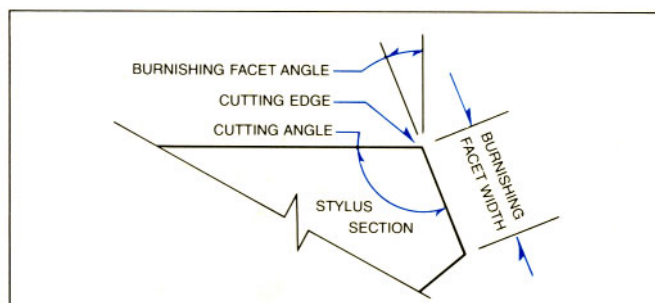


Figure 2. Burnishing Facet Geometry

Burnishing facets are specified by width and angle dimensions as shown in Figure 2. Changes of facet dimensions cause variations in a number of recording quality criteria in opposing directions. Some become better; some become poorer. Figure 3 illustrates this complex relationship between facet dimensions and the three recording qualities they influence; noise level, high frequency performance, and stylus life.

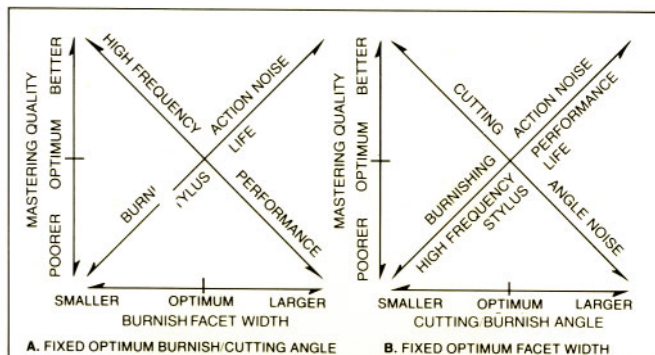


Figure 3. Relationship of Mastering Quality Factors to Burnish Facet Geometry.

Burnishing action increases as facet width and angle are increased and noise levels are reduced. Figure 4 shows that for given facet angle, changes in facet width can influence groove noise by more than 6 dB! However, large facet dimensions degrade high frequency performance.

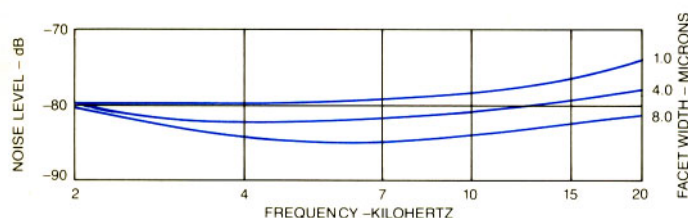


Figure 4. Influence of Burnish Facet Width on Groove Noise.

High frequency performance improves as facet width is reduced and/or facet angle is increased. Facet dimensions influence two high frequency factors; loading on the cutter head, and waveform distortion. Figure 5 illustrates the effect of facet width on high frequency response. Output decreases as facet width becomes larger because of increasing interference between stylus and groove walls which increases cutter loading. As the facet width becomes large and approaches modulation wavelength dimensions at high frequencies and at inner disc diameters, the groove walls will become distorted. Thus an optimum width and angle exist for good high frequency performance at low noise.

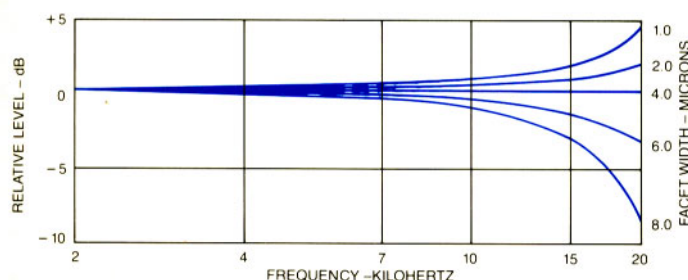


Figure 5. Influence of Burnish Facet Width on Frequency Response.

An increase in facet angle also means an increase in cutting angle. The larger facet angle will improve burnishing action and reduce noise, but the increase in cutting angle means a less sharp cutting edge and an increase in noise. Thus an optimum facet angle exists for minimum noise.

If the facet angle and width are reduced the cutting edge will wear faster. As the cutting edge wears, noise levels increase. To put stylus wear in perspective, each hour of recording produces a groove nearly one mile (1.6 km) in length. Again, in determining optimum facet dimensions, wear is an important consideration.

A combination of precision recording measurements and studio and processing experience involving many brands of recording equipment and master records has led to standard, general purpose facet dimensions of 4.2 microns (0.000165 inch) wide at an angle of 22.5 degrees. Because recording quality does vary with facet dimensions, production tolerances are ± 0.2 micron to assure consistent recording performance.

CUTTING EDGE, TIP RADIUS, BACK ANGLE

The cutting edge is formed by the intersection of the front face and the burnishing facets. The finish of these surfaces determines the accuracy of the cutting edge itself. The finer the polish, the sharper the edge. Production holds these surfaces to a finish specification of better than 0.05 micron. In addition the edge must be flawless to produce a smooth groove without streaking.

The stylus tip radius provides a smooth, defined groove bottom at the intersection of the two groove walls. This permits clean metal-plastic parts separation during processing. To ensure bottom radius smoothness, the burnishing facets continue around the stylus tip from one side to the other. The stylus tip radius at 3.0 microns (0.00012 inch) maintains clearance between playback stylus and groove bottom.

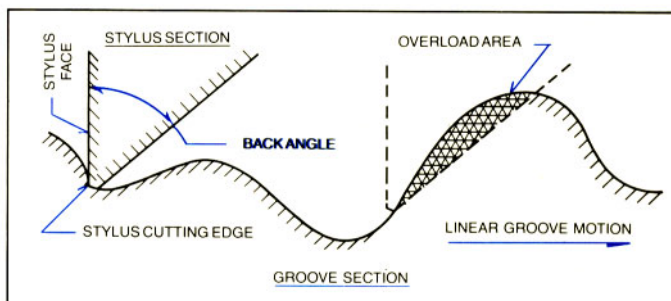


Figure 6. Modulated Groove and Recording Stylus Sections.

The back angle imposes a limit on recording levels due to an interference called slope overload. When the slope of the modulated groove exceeds the slope of the trailing faces of recording stylus, overload occurs and distortion must result. Figure 6 illustrates this condition. The stylus shown by the dashed lines could not have cut the groove modulation as shown. The maximum slope that can be cut is that part of the groove that remains after the shaded section is removed. Older styli designs were made with a back angle of 45°. As compared to the specified angle of 40°, maximum slope has been increased 5°. This translates to an increase in recording level limits of over 1.5 dB.

MASTER RECORD QUALITY AND LACQUER COMPOSITION

Master record quality depends upon three major factors; aluminum base quality, lacquer coating uniformity, and lacquer composition. The aluminum base must be flat, free of surface flaws or contamination, and relieved of internal stresses in order to accept a uniform coating and prevent post-production warping. The coating process must provide uniform lacquer thickness and surface smoothness free of voids or imperfections. The third factor, lacquer composition, influences virtually all master record cutting characteristics. A list of factors influenced by lacquer surface smoothness and composition include:

Noise Level	Impulse Noise (Tics, Pops)
Stylus Life	Heater Current Level
Chip Integrity	Master Processing
Groove Striations	Metal-Plastic Separation
Pressing Quality	Advance Ball Noise
Stamper Life	Groove Echo

Abrasive properties of the lacquer composition is a large variable in master record quality. It varies not only with each manufacturer, but also from lot to lot from the same manufacturer. Since noise levels generally (but not always) increase with increased abrasiveness, groove noise tests also evaluate abrasiveness and hence stylus life.

MICRO-POINT MASTER RECORDS AND RECORDING STYLI MATCHED

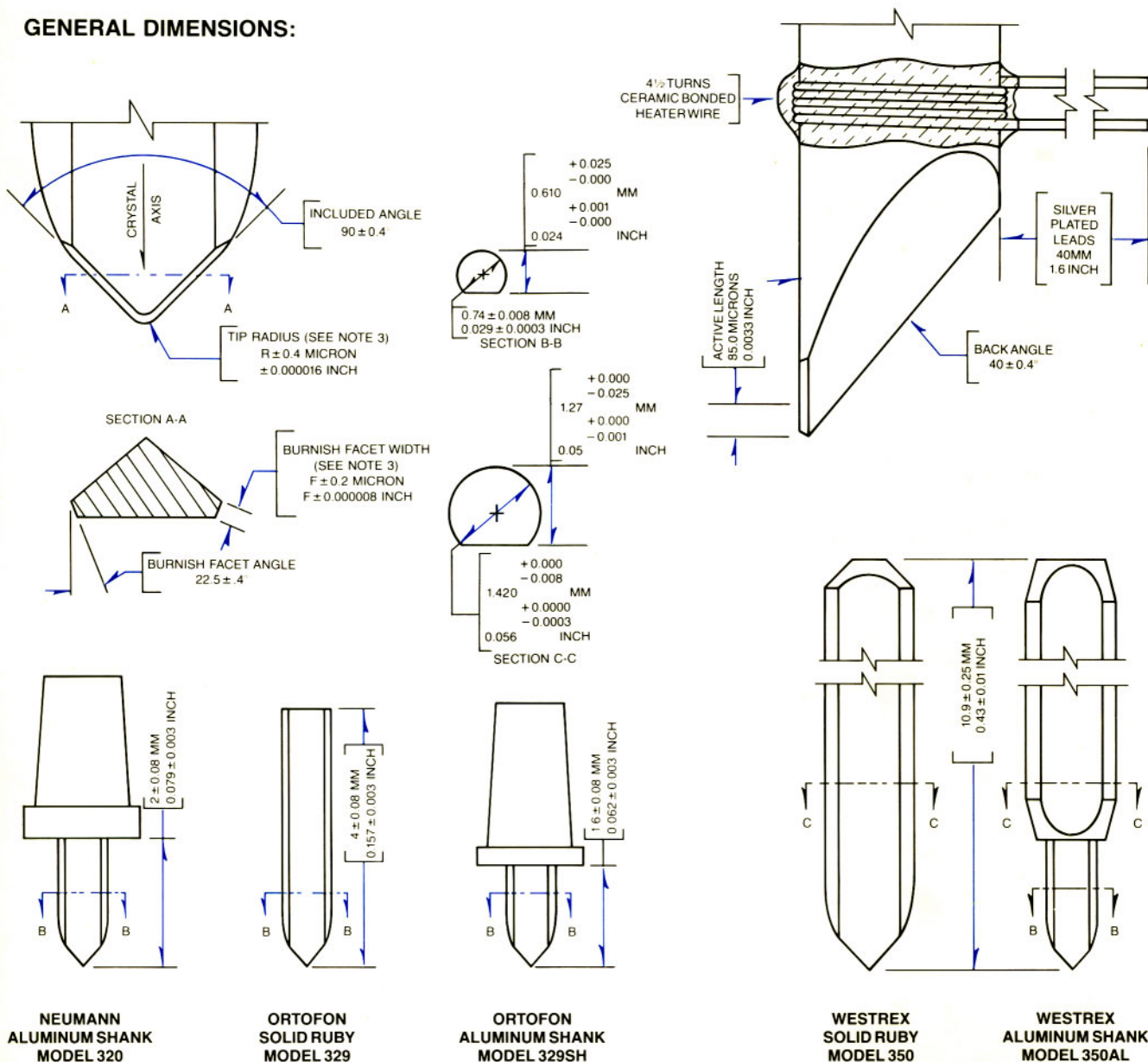
Specifications on the following pages fully describe the thorough, precision inspection and testing given every stylus and each master record lot produced. This not only provides superior quality assurance, but also indicates the window of quality beyond acceptable. This window permits adjustment of recording styli facet dimensions to improve recording quality without exceeding acceptable noise levels or reducing stylus life.

For example, if a given lot of master records exceeds acceptable noise levels by several dB with an appropriate heater current range as tested using standard burnishing facet dimensions, it is possible to change those dimensions and thereby improve recorded levels and high frequency performance without exceeding acceptable noise levels or reducing stylus life. This is Micro-Point's "Matched Mastering".

On request Micro-Point will run the required tests to make recommendations matching styli and master records to achieve your particular recording goals. A number of studios maintain a stock of recording styli with smaller facets as well as standard sizes. Based upon their own noise tests and processing experience they choose the stylus size best suited for each recording project. Three of these smaller alternate sizes that have become popular are listed under *Recording Stylus Specifications*.

RECORDING STYLUS SPECIFICATIONS:

GENERAL DIMENSIONS:



RECORDING STYLUS SPECIFICATIONS: (continued)

NOTES: 1) Neumann styli manufactured with Micro-Point shanks. Neumann shanks available on request.
2) Westrex 350AL has 35% less effective tip mass for increased high frequency range.
3) Facet width and tip radius options:

Model Number Suffix	Facet Width "F"	Tip Radius "R"
None (Standard)	4.2 Microns 0.00017 Inch	3.0 Microns 0.00012 Inch
- 4.0	4.0 Microns 0.00016 Inch	3.0 Microns 0.00012 Inch
- K	3.8 Microns 0.00015 Inch	2.0 Microns 0.00008 Inch
- M	3.5 Microns 0.00014 Inch	2.0 Microns 0.00008 Inch

STYLUS HEATER SPECIFICATIONS:

WIRE: 39 Gauge Nichrome, 0.0035 ± 0.0001 Inch, Dia.
RESISTANCE COLD: Models 320, 329, 329SH, 350AL: 2.1 ± 0.1 Ohms.
Model 350: 4.2 ± 0.2 Ohms.
RESISTANCE HOT: Models 320, 329, 329SH, 350AL: 2.0 ± 0.1 Ohms.
Model 350: 4.0 ± 0.2 Ohms.

MASTER RECORD SPECIFICATIONS:

UNMODULATED GROOVE NOISE:

TEST EQUIPMENT:

Cutting Lathe: Scully Automatic Disc Recorder.
Cutting Head: Westrex 3D Stereodisk Recorder.
Cutting Stylus: Micro-Point 350.
Turntable: Scully Automatic Disc Recorder.
Cartridge/Stylus: Shure ML120HE/N120HE.
Stylus Force: 1 Gram.
Preamplifier: UREI 1122, Transcription.
Noise Meter: Computer Controlled, Sound Technology
1510A, $\frac{1}{3}$ Octave Noise Spectrum Analyzer.

TEST CONDITIONS:

Signal Reference: 5.0 cm/sec Peak Velocity, 1000 Hz
Heater Current: That level below which noise would begin to rise.
Test Groove Diameter: 2 Inches less than disc diameter.
Test Groove Width: 2.5 Mils.
Advance Ball: Raised to clear surface, cutter balanced
to control groove depth.
Playback Weighting: RIAA Equalization.
Playback Bandwidth: 400 to 20,000 Hz.
Spectral Analysis: 18, $\frac{1}{3}$ octave bands.
Record Amplifiers: Off.
System Signal/Noise: Tone arm on rest, turntable running:
Each Spectral Band: Greater than 80 dB.
Ave All 18 Bands: Greater than 82 dB.

SIGNAL TO NOISE RATIO SPECIFICATIONS:

Left or Right Channel: Each Spectral Band: 70 dB Minimum.
Ave All 18 Bands: 75 dB Minimum.

SUBJECTIVE LISTENING—NOISE TEST GROOVE:

PURPOSE: To evaluate and rate all unmodulated groove sounds which are not always revealed by noise measurement.

TEST CONDITIONS:

Playback Equipment: Standard Studio Monitor Quality.
Playback Equalization: Flat.
Playback Gain: 30 dB Above Normal Program Levels.
Playback Bandwidth: 20 – 20,000 Hz.
Test Groove: Recorded As Above Except for Advance Ball.
Advance Ball: Set to Contact Surface. Cutter Balanced for
Advance Ball Control.
Evaluation Categories: 1) Tics and Pops, 2) Hiss, 3) Chip Tube and
Advance Ball Noise.

MASTER RECORD SPECIFICATIONS: (continued)

SUBJECTIVE LISTENING SPECIFICATION:

Each category is rated on a scale of one to ten, poor to excellent, by an experienced listener with a knowledge of studio requirements. All categories must exceed a rating of five for lot acceptance.

MICROSCOPIC EXAMINATION, 220X TO 1220X:

EVALUATION CATEGORIES:

1) Groove Wall Polish, 2) Groove Bottom Polish, 3) Surface Flaws, 4) Surface Flatness, 5) Horns.

SPECIFICATION:

Experienced inspection guided by field knowledge with regard to successful processing from master to pressing determines final acceptance of each lot.

DIMENSIONS:

MODEL	DIAMETER INCHES	DIAMETER MM
MP-110	10	254.0
MP-112	12	304.8
MP-114	14	355.8

THICKNESS AND TOLERANCES; CUTTING AREA

	INCHES	MM
ALUMINUM BASE:	0.039 ± 0.002	1 ± 0.05
LACQUER COATING:	0.0079 ± 0.0006	0.2 ± 0.015
OVERALL:	0.055 ± 0.003	1.4 ± 0.008
CENTER HOLE DIA.:	0.285 ± 0.001	7.239 ± 0.025

RECOMMENDED CUTTING SIDE:

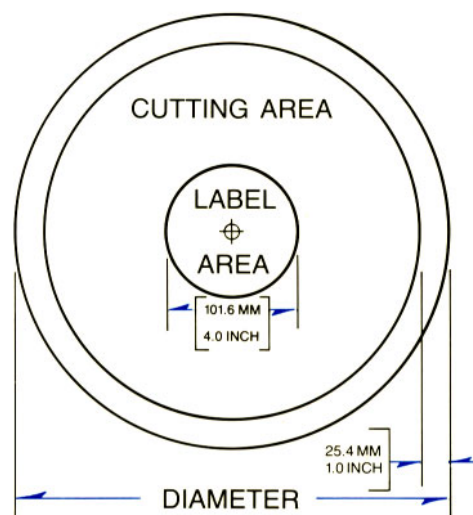
Side without "0" mark. All records are double faced and although other side may be cuttable, it may have minor defects.

STORAGE CONDITIONS:

$70 \pm 10^{\circ}\text{F}$ ($21 \pm 5.5^{\circ}\text{C}$) and 50% Relative Humidity.

SHIPPING OF UNCUT MASTERS:

Temperature must not exceed 110°F (43.3°C).



MATCHED MASTERING, A CONTINUING PROCESS

Experience and Engineering in the disc recording field combined with state-of-the-art, computer controlled, high tech, high speed equipment provides Micro-Point with the facilities necessary to continue the search for ever better ways to improve the recording art.

The concept of Matched Mastering is but one example of the possibilities. Micro-Point invites related comments and questions so that we may better serve the needs of the recording professionals.

RECORDING STYLI

Micro-Point is the World's Largest Manufacturer of Recording Styli. 3 out of 4 Records Mastered in the United States use Micro-Point Styli.

MASTER RECORDS

High Quality and Uniform Production Establishes Micro-Point as the Premium Master Record Brand.



MICRO-POINT INC.280 N. Bedford Rd.
Suite 2D
Mt. Kisco, NY 10549**PRICE SHEET**

TELEPHONE (914)241-4439 FAX (914)241-8529

RECORDING STYLI PRICES

CUTTER HEAD	MODEL	UNIT PRICE
Neumann (Micro-Point shank)	320	43.00
Neumann (Neumann shank)	320NS	49.00
Ortofon (Solid ruby)	329	41.25
Ortofon (Aluminum shank)	329SH	44.00
Westrex 3D (Solid ruby)	350	43.00
Westrex 3D (Aluminum shank)	350AL	45.00
Westrex 2B	340	35.00
Haeco SC-1	342	35.00
Gramplan (Short shank)	362	33.50
Fairchild/Presto (Long shank)	462	33.00

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STYLI ACCESSORY PRICES

DESCRIPTION	MODEL	UNIT PRICE
Westrex Advance Ball	ADVB1	40.25
Pithwood	PITH	10.00

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MASTER RECORD PRICES

DESCRIPTION	MODEL	UNIT PRICE
14 Inch master record	MP-114	26.50
12 Inch master record	MP-112	19.50
10 Inch master record	MP-110	18.50
7 Inch master record	MP-107	9.90

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TERMS AND CONDITIONS**TERMS:** Net 30 days with approved credit. COD on all orders valued under \$150.00**SHIPPING CONDITIONS:** UPS ground for lacquers. UPS second day air for styli.*Federal Express or UPS next day air on request.*