

TECHNICAL DATA SHEET 261

Page 1 of 2

Diamond Knives

Introduction

The ultra-microtome diamond knife is a remarkable instrument. Its extremely sharp and stable edge allows slices of tissue or other materials to be cut just a few molecules thin and then observed in the Transmission Electron Microscope at magnifications up to 100,000 times. This technique is used in research laboratories, hospitals and universities to make photographs which reveal in sharp detail the ultrastructure of cells and material samples just a few angstroms across.

Diamonds for microtome knives are selected from gem-quality crystals free of inclusions and internal flaws which could interfere with the formation of a perfect edge.

Sharpening and Quality Control

Sharpening the diamond blade to generate the ultra-sharp edge is the most exacting part of the process. In contrast to glass knives, whose sharp edge is the direct result of breaking a glass block, the diamond slab has to be lapped and polished using high-precision equipment. The details of this operation are the key to the successful production of microtome diamond knives and are kept a commercial secret by the manufacturers.

Besides being extremely sharp, a microtome knife has to be defect-free along its entire length. Nicks or flaws in the order of 100 angstroms will produce visible lines on the section micrographs. After the sharpening process has been completed, the knife edge is examined along its entire length with Nomarski optics at a magnification of 1,000 times. Then, purple and gray sections are cut with the entire edge. Each one of the sections is examined optically, and some are analyzed with the TEM. Only if all the tests show a flawless edge with total absence of compression or striations is the knife accepted.

The finished diamond blade in its metal shank is precisely positioned in the boat so that the edge is level and the facets are at the proper angles. The microtome must adjust the microtome knife holder to the desired angle, usually 4° to 5°, as suggested by the label. Too small of a clearance angle causes chatter because the block rubs on the outside facet after cutting. A clearance angle too large, at 10° or more, would exert too much side stress on the knife edge during the cutting and would have the tendency to cause nicks.

Cleaning Procedure

Although the diamond is the hardest material known, the edge of a diamond knife, being only a few atoms across, is very fragile and will break when improperly used. A good rule, which will prolong the life of a diamond knife for several years, is to avoid touching the edge with any solid object except the specimen block in the microtome, following the cutting direction and making sections no thicker than 2,000 angstroms. Solid objects include fingers, tissue paper, cotton swabs, styrofoam, wood sticks, brushes and cloth. Glass particles from Pasture Pippettets used during processing and small slivers from razor blades used to trim blocks are also hazardous to the edge of a diamond knife.

SEM photographs show that at least some of the marks and striations produced by a knife on the sections are caused by microscopic debris that adheres to the edge. This debris comes principally from the embedding materials that have been allowed to dry on the knife.

We recommend the following cleaning procedure:

1. Rinse the knife in distilled water, preferably using a small jet of pressurized water like the ones for dental use.
2. Immerse the knife in a weak solution of mild detergent such as Haemo-Sol, Photo-Flo, or Triton X-100. Strong chemicals, such as ammonia, MEK, caustic soda and acids, should not be used because, although they would not affect the diamond itself, they could discolor and corrode the metals in the boat and welding.
3. Repeat Step 1.
4. Dry with clean pressurized air or other clean gas. We strongly discourage the use of wood sticks or any other solid object on the knife edge as this cleaning method may cause nicks on the cutting edge.

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Resharpenering

Any used microtome diamond knife can be resharpenered unless it has been totally chattered. The quality of the new edge will have no relation to the original one. For instance, a knife which was considered of poor quality can be given a new excellent edge by proper resharpenering. Depending on crystal geometry, a resharpenered edge may be slightly shorter or longer than the original one. **We guarantee unlimited resharpenerings** - assuming that the edge has not been nicked or misused. Resharpenering cost is approximately 60% of the new cost. The turn-around time is 4 to 6 weeks.

Guarantee: We provide a thirty-day return policy, after the receipt of your knife, for testing its quality. In the case of a defective knife, it will be repaired or replaced if it is returned in its original condition.

Types of Knives

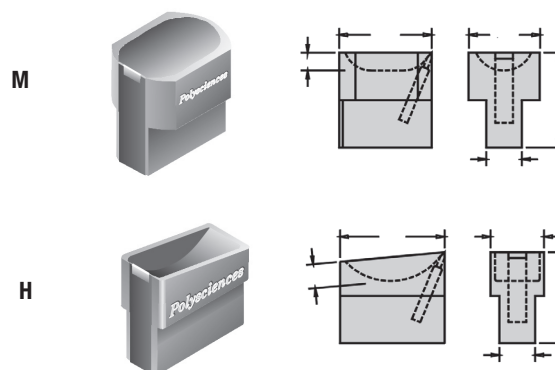
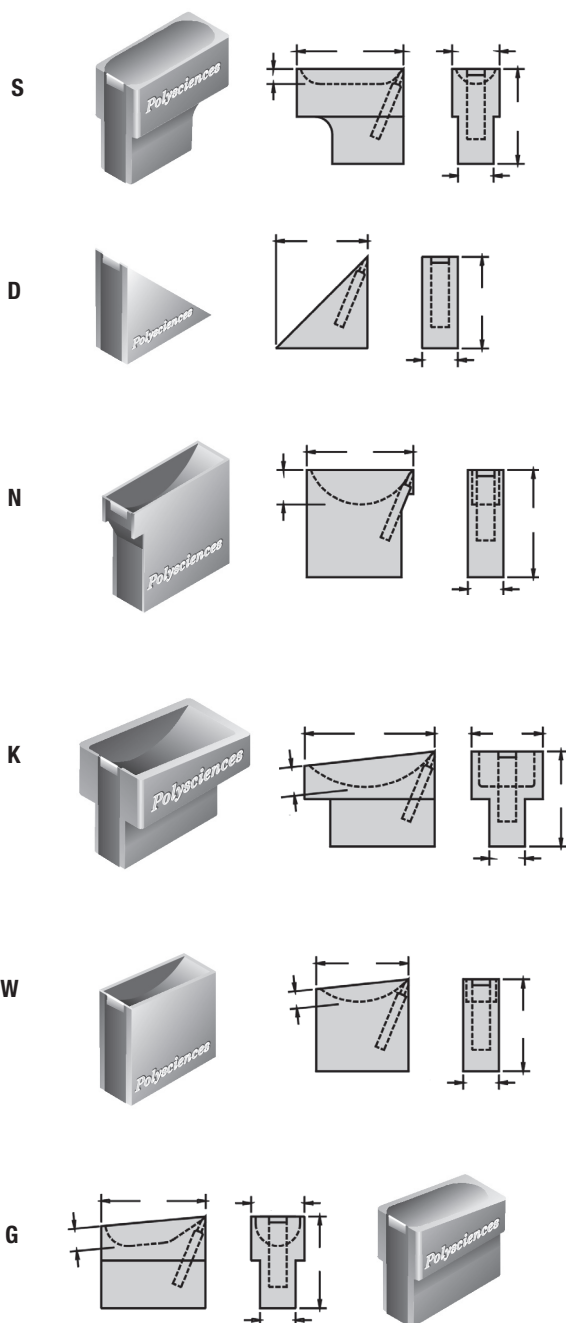
STYLE-CD for cutting dry sections in cryo microtomy. Mounted in a stainless steel holder capable of sustaining extremely low temperatures and designed for easy section retrieval. (No boat.)

STYLE-CW for cutting wet sections in cryo microtomy. Mounted in a stainless steel boat similar to those of our standard ultramicrotomy knives, but this boat is engineered to withstand low temperatures.

Our knives are mounted in boats at 45° unless otherwise specified and are designed to fit all standard microtomes. Edge lengths are available from 2.0 to 4.0 mm in .5 mm increments.

TECHNICAL DATA SHEET 261

Page 2 of 2



Ordering Information

When placing Diamond Knife orders please specify catalog number, knife type, (CD & CW) and boat style.

ORDERING INFORMATION

Cat. #	Description	Size
08452	2.0 - 2.4 mm usable edge	1ea
08453	2.9 mm usable edge	1ea
08454	3.0 - 3.4 mm usable edge	1ea
08455	3.9 mm usable edge	1ea
18383	4.4 mm usable edge	1ea

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In The U.S. Call: 1(800) 523-2575 / (215) 343-6484
In The U.S. Fax: 1(800) 343-3291 / (215) 343-0214
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