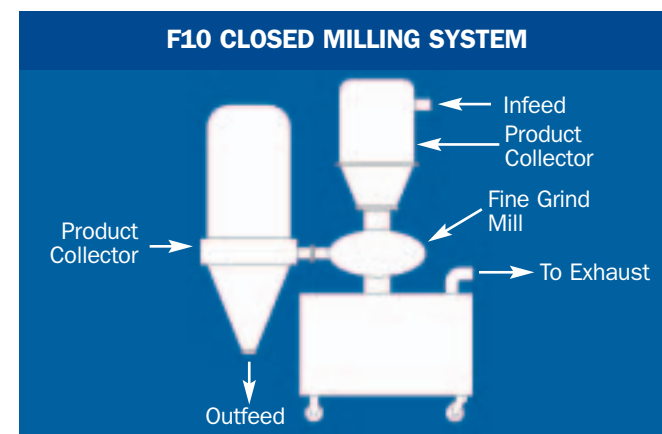


QUADRO® FINE GRIND PERFORMANCE

Additional Benefits of the Quadro® Fine Grind

- Consistent Particle Sizing**
 - performance parameters are product dependant (Typical results range - 90% < 60µm & 50% < 25µm)
 - tight particle distribution with maximum yield on specification
 - sizing flexibility with interchangeable tooling
 - preparation for nano-milling
- Versatile**
 - handles a wide variety of base materials including ones traditionally difficult-to-grind
 - can be adapted for inert milling or cryogenic applications for products with low melting temperatures and high ignition characteristics
 - XP, EX and remote electrical options available
 - CE certified
- Ideal for Process Integration**
 - turnkey automated stand-alone process system
 - mobile unit
 - compact footprint
 - simple connection to existing collection devices
- Cleanability**
 - sanitary GMP design with a minimal number of parts for easy-clean and maintenance
 - quick disassembly of contact parts suitable for ultrasonic cleaning, washing and autoclaving

Systems



The portability, flexibility and versatility of the *Quadro® Fine Grind* lends itself to easy integration into most manufacturing environments. Quadro can provide single-source, turnkey solutions to your processing requirements. Quadro Systems are completely engineered to ensure smooth, continuous operation and are designed to meet your specific environmental/plant needs. Our engineers will work with you to develop a customized and fully supported, cost-effective solution.

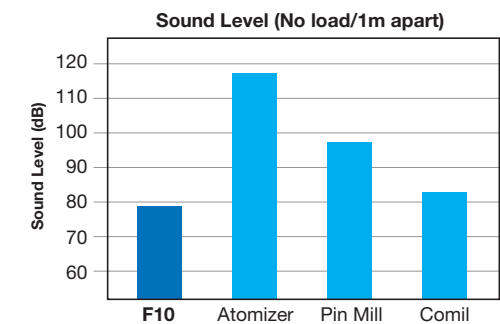
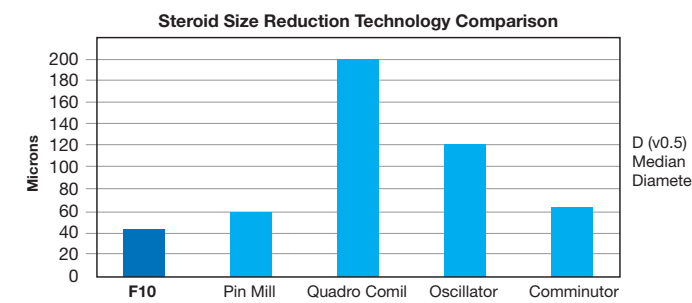
Comparative Analysis

The *Quadro® Fine Grind Model F10* is an extension of Quadro's size reduction capabilities. The *Model F10* allows for optimal grinding flexibility between the 150-5 µm particle range (100 US standard mesh and below).

Size Reduction Capability Comparison															
Comil															
F10 Fine Grind															
Jet Mill															
Micron	1	5	10	25	38	45	75	125	150	180	250	300	425	600	1000
US Mesh	-	-	-	-	400	325	200	120	100	80	60	50	40	30	18

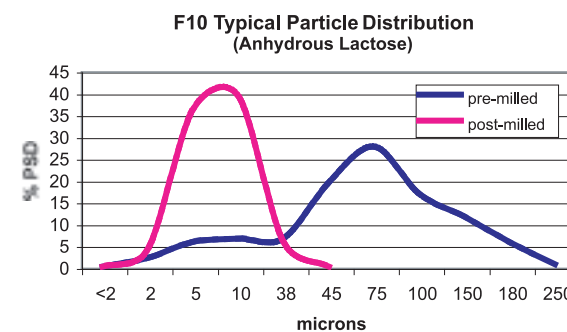
Rivaling Traditional Fine Grinding Methods

- Hammer Mills
- Pin Mills
- Pulverizers
- Comminutors
- Crushers
- Air Classifiers



Typical Results

The *Model F10* ensures controlled size reduction with a tight particle distribution. Minimum "fines" generated with a maximum yield on specification.



QUADRO PROCESS PRODUCTIVITY SOLUTIONS

For more than 25 years, Quadro has made an unparalleled commitment to delivering the highest production efficiencies, product quality and consistency to market leaders in the Pharmaceutical, Food, Fine Chemical, Personal Care and Cosmetics industries worldwide.



With the engineering experience gained from developing reliable application-specific solutions for major processors in more than 70 countries, our knowledge of size reduction and dispersion is unmatched. In fact, meeting the evolving needs of our customers drives the

development of some of the industry's most advanced processing technologies and systems – such as the *Quadro® Comil®*, *Ytron* inline mixers, dispersers and emulsifiers, and *Quadro Vac®* vacuum transfer systems.

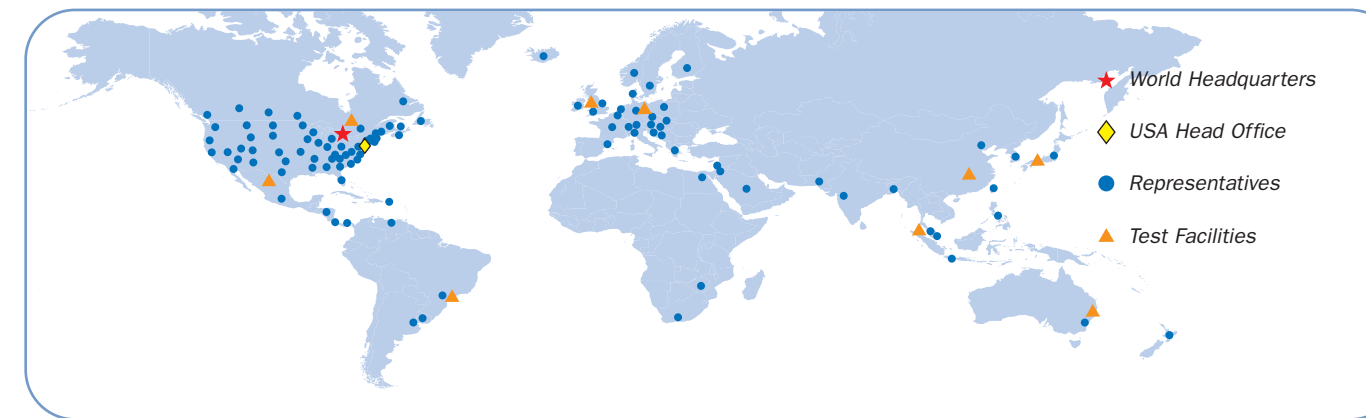
Since 1976, Quadro has led the industry in research & development. Through the Quadro R&D Test Center we work

directly with our customers, to run real-world tests of their process requirements on the latest Quadro equipment. The result has been



technical breakthroughs that have changed the way many of our customers manufacture, and led to new global processing standards.

As the world's leading supplier of size reduction technology – with a vast global network of agents, distributors, OEMs and partners – Quadro provides a level of service and technical support that is unequalled in the industry. Our passion for technology is exceeded only by our dedication to meeting the needs of our customers.



SIZE REDUCTION • FLUID MIXING • PNEUMATIC TRANSFER



LOCAL REPRESENTATIVE



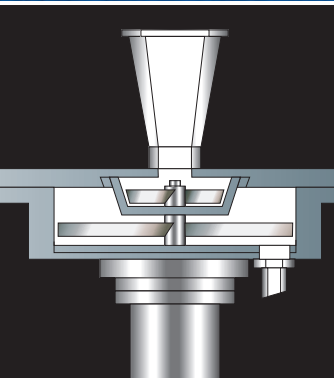
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Quadro® Fine Grind

ADVANCED SIZE REDUCTION • PERFORMANCE & FLEXIBILITY



QUADRO® FINE GRIND

Fine Grinding has reached a whole new level

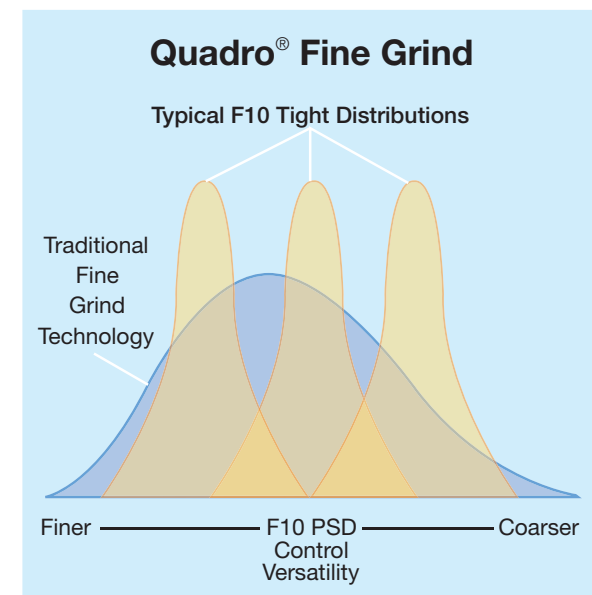
Superior product quality, unparalleled mobility, higher productivity, greater flexibility and control are all innovative features that make the *Quadro® Fine Grind F10* a technological advancement in the field of fine grinding.

Maximum Consistency and Yield

For milling between 5 - 150 microns (<100 US standard mesh), the *Quadro® Fine Grind* delivers unsurpassed particle size consistency and maximum yield on specification when size reducing materials such as API's, excipients, fine chemicals, flavors and spices.

Efficiency, Versatility and Control

The *Quadro® Fine Grind's* wide range of tooling, small footprint and mobile design provide unrivaled process flexibility. What's more, its quick disassembly enables easy maintenance and cleaning. Add to this further advantages such as low heat, low noise and low power/air consumption, along with fully integrated controls, and you have the optimum production tool.



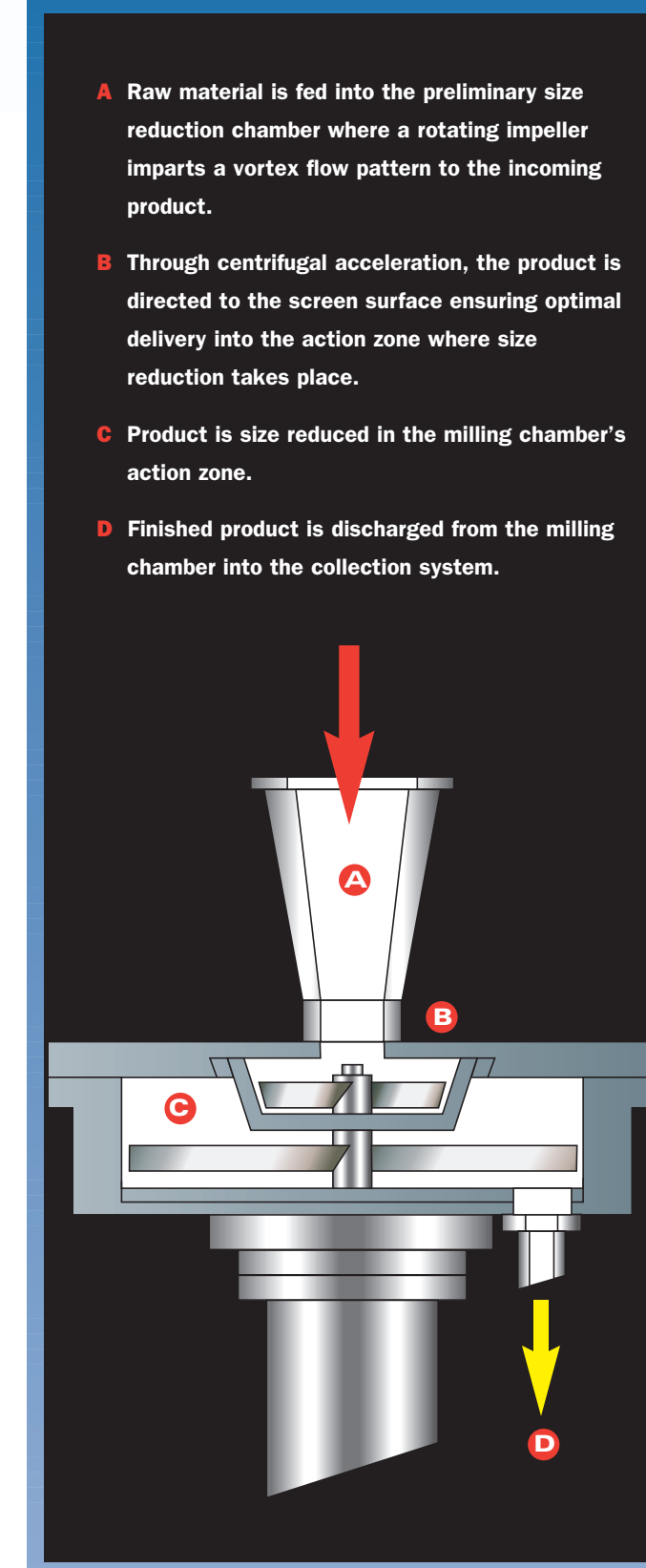
The *Quadro® Fine Grind* produces tight particle distributions, with minimum fines and overs. Graph illustrates typical control of particle distribution compared to conventional methods.



FEATURES

- 1 Milling Head.** The heart of the F10 Fine Grind Milling System utilizes two-stage size reduction technology. This revolutionary method ensures an extremely tight particle size distribution bell curve, time-after-time.
- 2 Product Feeder.** Hopper's easy-flow design with tapered sides ensures continuous and positive product feed availability. Feeder's dual counter-rotating screw mechanism provides consistent lump-free product. Feed rates can be controlled to compensate for a wide range of products with varying characteristics.
- 3 Control Panel.** User-friendly control panel incorporates an array of easy-to-use features, including a VFD to adjust milling speeds as dictated by in-feed material properties. The control panel is conveniently secured to a compact mobile platform which also houses the balance of ancillary equipment, all within an easy-to-access enclosure for maintenance and cleaning.
- 4 Product Collector.** High efficiency and easy-to-clean product collector system utilizes four PTFE membrane filter bags with a 99.997% efficiency rate when tested with 100% silicate particulate (0.5µm median size for 50 hours).

PRINCIPLES OF OPERATION



- A Raw material is fed into the preliminary size reduction chamber where a rotating impeller imparts a vortex flow pattern to the incoming product.**
- B Through centrifugal acceleration, the product is directed to the screen surface ensuring optimal delivery into the action zone where size reduction takes place.**
- C Product is size reduced in the milling chamber's action zone.**
- D Finished product is discharged from the milling chamber into the collection system.**

TECHNICAL SPECIFICATIONS

Quadro® Fine Grind		Model F10
Power (Motor)	Hp kW	10 Hp 7.5 kW
Impeller Velocity		Min. 363 ft/sec 111 m/sec Max. 508 ft/sec 155 m/sec
Air Flow		60 cfm
Capacity	lb/hr kg/hr	500* 230*
Footprint	Imperial (in) Metric (mm)	L x W x H 85x24x76 2159x610x1930
Sound Pressure Level		<80dBA

*Capacities may vary based on product characteristics, particle granulometry, inlet and discharge conditions. Consult your local Representative or Quadro for product testing.

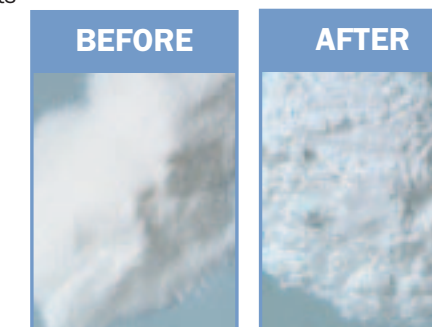
Innovative Technology for Fine Grinding

Quadro's continuous efforts to innovate process technology in the field of size reduction are once again realized with the development of a breakthrough grinding concept. The *Model F10* offers the following benefits:

- **Savings** - reduced downtime, space requirements, rapid product changeover and enhanced process efficiency.
- **Quick disassembly** for maintenance, tooling change and cleaning.
- **Low power consumption** as compared to traditional mills.
- **Low noise** - sound-proofing is not a necessity.
- **Uniform grinding capabilities** - higher yields on specification.
- **Wide tooling selection** to meet all grinding needs.
- **Complete stand-alone process system** eliminates the need for costly ancillary equipment typically applied in traditional methods.

Typical Applications

- Active Pharmaceutical Ingredients
- Nutritionals/Nutraceuticals
- Fine Chemicals
- Flavors/Fragrances
- Excipients
- Cosmetics
- Herbs/Spices
- Polymers



PRODUCT TESTING



Dedicated to supporting our customers in achieving precise results, Quadro offers free process testing at our R&D Test Center. Quadro also provides a rental program for product testing at your facility. Our qualified personnel will assist you in your training needs, plant start-up and IQ/OQ activities.

Proven Performance Reference Guide

Typical fine grinding results of common products:

Material	D ₁₀	D ₅₀	D ₉₀
Avicel	11	32	90
Lactose	1	15	45
Granular Sugar	2	17	49
Talc	4	13	49
Black Peppercorns	16	49	100
Granular Salt	3	12	25
Melamine Powder	10	45	100
Tri-Calcium Phosphate	20	37	75
Testosterone Propionate	6	22	68
MCC	11	32	90
Zinc Organic	6	33	81
Maltodextrin®	5	18	44
Dairy Blend	8	27	58
Buttermilk Powder	7	25	63
Cheese Seasoning	8	29	76
Sodium Sulfite	2	8	17
Manitol	4	20	75
Budesonide	1	5	11
Creatine	1	6	21
Midodrine	6	17	58

*Particle size analysis conducted with Malvern Mastersizer 2000 in liquid suspension of isopropyl.