



Gold Gravity Recovery

Testing Services

Modular Plants

Automation

Maintenance Services

Semi-Continuous Knelson Concentrators

Providing Unique Processing Solutions to the World



Semi-Continuous Knelson Concentrator Benefits



Since the introduction of the Semi-Continuous Knelson Concentrator in 1978, this revolutionary technology has become an integral component in many of the most prolific precious metal recovery plants the world over.

The Semi-Continuous Knelson Concentrator is widely recognized and proven to be the most effective enhanced gravity recovery device available to the mineral processing industry. Centrifugally enhanced gravitational force and a patented material fluidization process combine to make the Semi-Continuous Knelson Concentrator the unrivaled leader in the recovery of free-milling precious metal.



SEMI-CONTINUOUS KNELSON CONCENTRATOR BENEFITS

- Unmatched recovery performance
- Environmentally friendly (requires no chemical additives or reagents)
- Total process automation provides complete concentrate security
- Unsurpassed feed to concentrate reduction ratio
- Quality manufacturing provides high unit availability, generally + 98%
- Quick payback on investment, typically less than 3 months



Research & Technology

KNELSON RESEARCH & TECHNOLOGY CENTRE

The Knelson Research and Technology Centre (KRTC) provides state-of-the-art gravity amenability testing and on-going fundamental research in the field of enhanced gravity separation. Through close collaboration with industry, universities and research institutions, Knelson Research and Technology Centre has developed proprietary modeling software known as KC*MODPro which can accurately predict plant scale Knelson performance based on bench-scale test work.



ANCILLARY EQUIPMENT AND OPTIONS

Knelson has developed a wide range of ancillary products to ensure the simple and trouble-free integration of the Semi-Continuous Knelson Concentrator into any circuit. These products range from portable field testing units to complete modular turnkey recovery systems to meet any requirement. Ask your sales representative for a complete listing of these products.



Knelson's Automated Tabling System (ATS) is a chemical-free, fully automated, multiple-pass tabling system used to maximize table gold recovery.



Knelson-Sizetec Screens, available in a variety of models, provide high efficiency screening solutions.

CONTROL OPTIONS

The Semi-Continuous Knelson Concentrator is available with a convenient range of control options to meet specific operating requirements. Control options include:

- **Independent Control System (ICS)**

The Knelson ICS 2.0 is recommended for installations requiring a premium quality process control system with built-in security features and user-friendly functionality. This system is designed to operate automatically and without the need for operator attention. Knelson's Independent Control Systems incorporate Omron, Allan Bradley, Mitsubishi and Foxborough technologies.



- **Independent Control System *junior* (ICS) jr**

The Knelson ICS *junior* is Knelson's basic PLC-based automatic control system that provides complete concentrate security and "hands-off" control in an economic package.

- **Distributed Control System (DCS)**

The Knelson DCS package is recommended where Semi-Continuous Knelson Concentrators are to be integrated with a distributed control system (DCS). The Knelson DCS package consists of an automated piping arrangement complete with all necessary control instrumentation for direct connection to any type of DCS.



- **Manual Control System (MCS)**

The Knelson MCS package is recommended for customers who do not require fully automated operation of their Semi-Continuous Knelson Concentrator. The Knelson MCS consists of a standard manual piping arrangement. During operation the flow control valve is manually adjusted to the desired operating flow setting. Concentrate removal is accomplished by manually opening and closing the ball valve several times at the conclusion of the concentrate cycle.

- **Device Net System (DNS)**

The Knelson DNS system is a communications protocol developed to integrate different manufacturer components into a single control system.

Operation

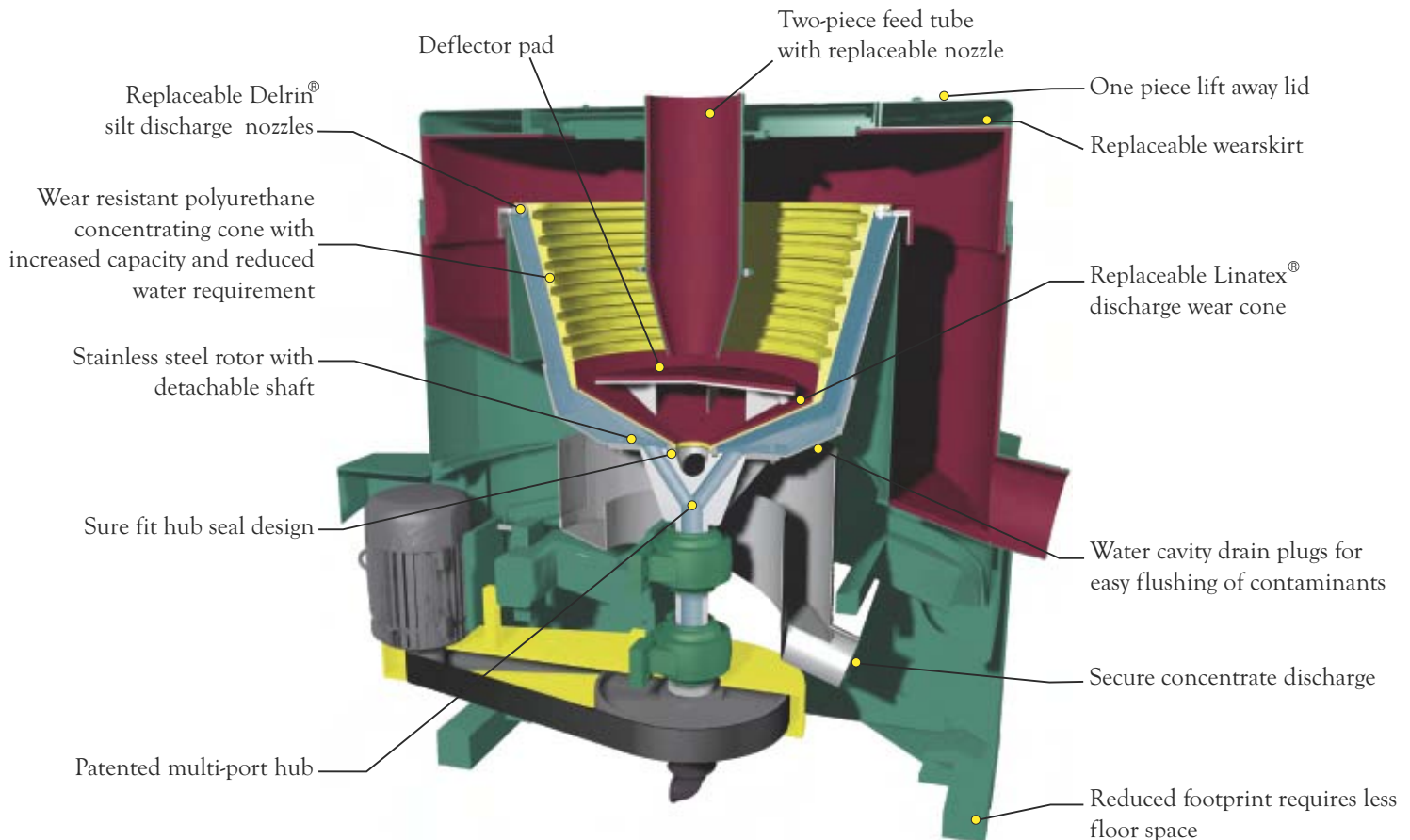
OPERATION OF THE SEMI-CONTINUOUS KNELSON CONCENTRATOR

During feed processing in the Semi-Continuous Knelson Concentrator, particles are subjected to an enhanced gravitational field to enable recovery of even micron-sized particles, previously thought to be unrecoverable. Appropriate “G” force selection combined with a patented fluidization process enables the Semi-Continuous Knelson Concentrator to achieve unsurpassed recovery results while maintaining industry leading equipment availability rates and low maintenance costs.

During operation the Semi-Continuous Knelson Concentrator subjects all particles to an enhanced gravitational field which corresponds to the specific application. The determination of optimum rotor speed is based on a number of metallurgical factors such as lab test results, specific gravity of target and background minerals, particle size distribution and ore grade. In addition to this detailed metallurgical assessment, a review of practical

considerations such as circuit water balance, affect on downstream processes and operating costs must be fully examined prior to making final rotor speed selection.

How it works – First, water is injected into the rotating concentrating cone through a series of fluidization holes. The feed slurry is then introduced through the stationary feed tube. Once the slurry reaches the bottom of the cone it is forced outward and up the cone wall, filling each ring to capacity to create a concentrating bed. Here, once optimum fluidization has been achieved, high specific gravity particles are retained in the concentrating cone. When the concentration cycle is complete, concentrates are flushed from the cone into the concentrate launder through a patented multi-port hub. This procedure can be completed automatically in less than 1 minute in a totally secure environment.



Semi-Continuous Knelson Concentrator
Extended Duty (XD) Series

Product Categories

APPLICATION

Rugged design and a high degree of quality manufacturing ensures that every Semi-Continuous Knelson Concentrator will provide many years of reliable, trouble-free operation in even the most severe application and environment. The Semi-Continuous Knelson Concentrator has been successfully applied in the recovery of gold, platinum, silver, mercury and native copper.

PRODUCT CATEGORIES

With unit capacities ranging from laboratory scale to 650 tonnes of solids per hour, Semi-Continuous Knelson Concentrators are suitable for a variety of applications; laboratory testing, in-field exploration, small to medium scale production or even high tonnage open pit mining. *For complete details see Semi-Continuous Knelson Concentrator Specifications located on the back of this brochure.*

2 x KC-XD48 machines in operation at Placer Dome/Western Areas' South Deep mine in South Africa.



The Semi-Continuous Knelson Concentrator is available in three model types:

Extended Duty Series (XD): The Knelson Extended Duty (KC-XD) is the premium class of semi-continuous centrifuge concentrators available in the mining industry today. The XD series was specifically designed to withstand the severe operating conditions inherent to the hardrock milling circuit. Compact design, stainless steel construction and the highest quality components make KC-XD the unit of choice for the most demanding precious metal recovery application.

The KC-XD70, introduced in 2003, has a nominal throughput capacity of 650 tonnes per hour. Standing 4 metres high and weighing more than 18 tonnes, the KC-XD70 is the largest concentrator of its kind in the world.



KC-XD20 machine complete with Knelson ICS 2.0 automation.



The KC-XD70 on site at a large Goldmine in South America

Product Categories



On-site processing of ore samples with the Knelson Prospecting Trailer (includes KC-MD7.5 with a vibrating screen, generator and equipment for field testing).

Manual Discharge Series (MD): Knelson offers laboratory and pilot-scale concentrators for bench-scale testwork, in-plant sampling and in-field alluvial exploration projects. Lab and pilot-scale Semi-Continuous Knelson Concentrators have become standard in all state-of-the-art metallurgical laboratories around the world. Ranging in throughput size, the KC-MD3, KC-MD4.5 and KC-MD7.5 are all built with the same strict quality standards as the larger throughput capacity Semi-Continuous Knelson Concentrators.



A custom manufactured stainless steel KC-CD30 in operation at AngloGold Ashanti – Biox Plant Obuasi, Ghana.



KC-CD12SS (Stainless Steel) at work in Avgold's Fairview Mine.

Centre Discharge Mild Steel Series

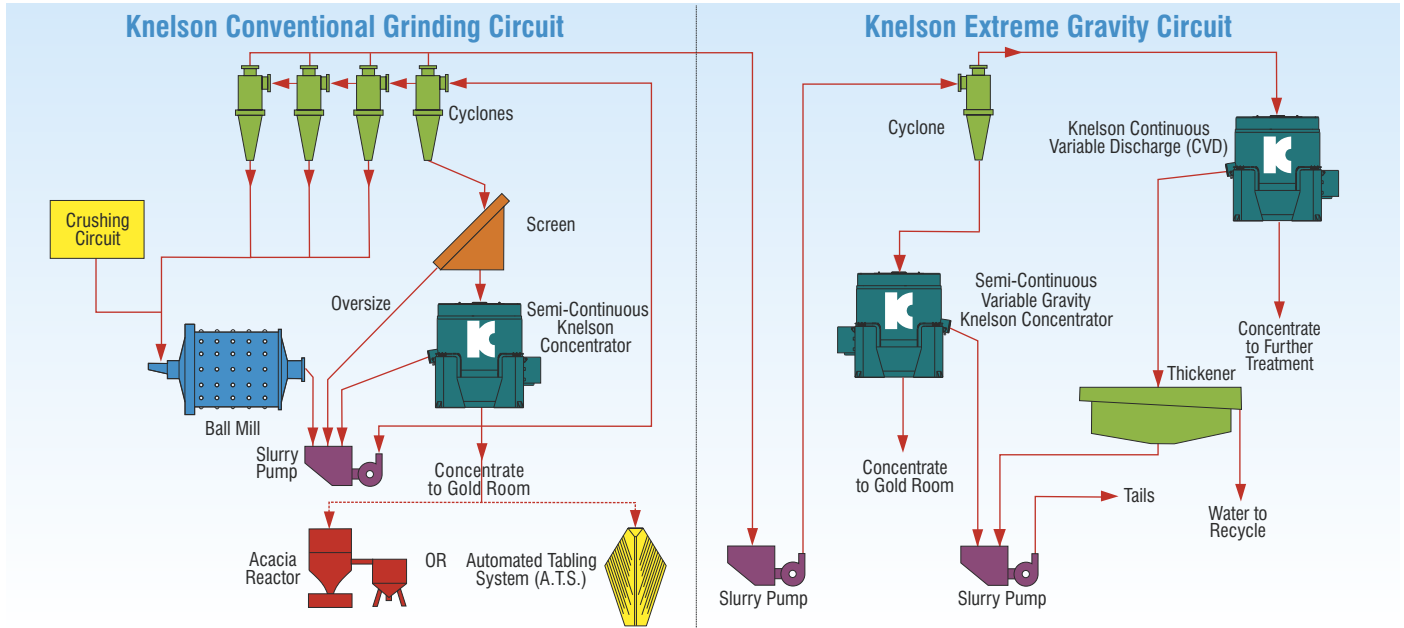
(CDMS): Until the introduction of the XD series, the Knelson Centre Discharge series (KC-CD) was the industry workhorse and most widely used centrifugal recovery device available. The KC-CDMS has now become the machine of choice for most alluvial mining operators where

conditions are generally less severe than those present in hard rock mill environments. The CDMS series is also an economical alternative for applications where project economics may not support the purchase of a premium class KC-XD unit. While the CDMS series provides a cost effective alternative to the XD series through the use of carbon steel construction, it still provides precisely the same high level of metallurgical performance as the XD model line.



The KC-MD3 machine used for laboratory sample testing.

Hard Rock Flowsheet



The above flowsheet illustrates a conventional Semi-Continuous Knelson Concentrator installation in a closed grinding circuit followed by downstream chemical processes such as C.I.P., C.I.L. or flotation. This configuration is an industry standard and typically yields overall recovery rates of 30 to 70% depending on the gravity amenability of the specific ore. Currently there are several thousand Semi-Continuous Knelson Concentrators in base and precious metal grinding circuit applications around the world.

The above flowsheet illustrates the non-conventional use of Semi-Continuous Knelson Concentrators and Continuous Knelson Concentrators applied in series to create the Knelson eXtreme Gravity circuit. This leading edge approach has been proven to provide recoveries in excess of 90% from highly gravity amenable ore. Knelson eXtreme Gravity represents a fundamental change in approach to many high grade, low tonnage deposits. These deposits have been long overlooked due to insufficient resources to support a “typical” mining and milling operation, and in many instances due to the inability to overcome environmental permitting issues associated with the use of chemical processes.

KNELSON GRAVITY SOLUTIONS

In 2002, Knelson Gravity Solutions (KGS) was established to provide total gravity solutions to the mineral processing industry, globally. Knelson Gravity Solutions is the culmination of over 25 years of practical gravity concentration expertise including process development, flow sheet design, amenability testing, circuit modelling, project management, installation, commissioning and on-going support.

The KGS approach is to ensure your project receives the most suitable solution based on its specific needs. Whether you require a simple gravity amenability test or a complete gravity circuit design, KGS is at your service.

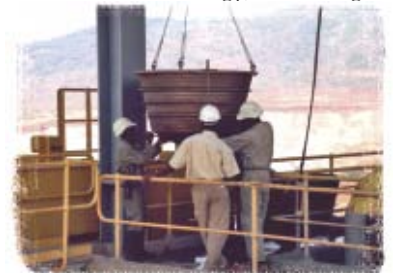
Knelson Gravity Solutions offers:

- Modular Gravity Plants:**
 Pre-piped, pre-wired, skid mounted systems complete with a feed preparation screen, gravity concentrator, tails pumps, concentrate pump, control package, MCC and associated accessories.



Turnkey gravity concentration module, supplied and installed by Knelson Gravity Solutions. (KGS)

- Comprehensive Spare Parts Packages:**
 See www.KnelsonGravitySolutions.com for current specials.
- Rebuild and Exchange Program:** Update your Knelson Concentrator with the most current technology, including CONE*Logic® and FLEX*Flo®. Exchange rotor components in your Centre Discharge (CD) unit with new CDX rotor components to provide the robust features of the premium Extended Duty rotating assembly.
- Contract Maintenance and Training Services:**
 Tailored to your needs and delivered anywhere in the world.



Mine maintenance crew conducting routine concentrator cone maintenance.



Semi-Continuous (Batch) Knelson Concentrator Specifications

Knelson Concentrator Model	Solids Feed Capacity	Fluidization Water Required	Maximum Volumetric Throughput	Active Capture Area	Feed Size	Concentrate Volume	Concentrate Weight	Concentrator Net Weight	Motor Power	ICS or ICS jr Available
----------------------------	----------------------	-----------------------------	-------------------------------	---------------------	-----------	--------------------	--------------------	-------------------------	-------------	-------------------------

Extended Duty (XD) Series

KC-XD70	300-1000 tonnes/hr [330-1100 tons/hr]	45-80 m ³ /hr [200-350 USgpm]	1360 m ³ /hr [6000 USgpm]	32,044 cm ² [4,967 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	52 L [3,200 in ³]	100-140 kg [220-310 lbs]	18,455 kg [40,600 lbs]	150-375 kW [200-500 HP]	●
KC-XD48	200-400 tonnes/hr [220-440 tons/hr]	41-61 m ³ /hr [180-270 USgpm]	545 m ³ /hr [2400 USgpm]	13,941 cm ² [2,161 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	20 L [1,220 in ³]	45-50 kg [100-110 lbs]	5,680 kg [12,500 lbs]	30-75 kW [40-100 HP]	●
KC-XD48VG	200-400 tonnes/hr [220-440 tons/hr]	41-61 m ³ /hr [180-270 USgpm]	545 m ³ /hr [2400 USgpm]	13,941 cm ² [2,161 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	20 L [1,220 in ³]	45-50 kg [100-110 lbs]	5,900 kg [13,000 lbs]	45-75 kW [60-100 HP]	●
KC-XD40	125-250 tonnes/hr [138-275 tons/hr]	27-45 m ³ /hr [120-200 USgpm]	340 m ³ /hr [1500 USgpm]	11,130 cm ² [1,725 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	17 L [1000 in ³]	38-56 kg [85-125 lbs]	4100 kg [9000 lbs]	30kW [40 HP]	●
KC-XD40VG	125-250 tonnes/hr [138-275 tons/hr]	27-45 m ³ /hr [120-200 USgpm]	340 m ³ /hr [1500 USgpm]	11,130 cm ² [1,725 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	17 L [1000 in ³]	38-56 kg [85-125 lbs]	4270 kg [9400 lbs]	30-56kW [40-75 HP]	●
KC-XD30	75-150 tonnes/hr [83-165 tons/hr]	17-25 m ³ /hr [75-110 USgpm]	205 m ³ /hr [900 USgpm]	7,115 cm ² [1,103 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	12 L [730 in ³]	21-27 kg [47-59 lbs]	1,724 kg [3,800 lbs]	11kW [15HP]	●
KC-XD30VG	75-150 tonnes/hr [83-165 tons/hr]	17-25 m ³ /hr [75-110 USgpm]	205 m ³ /hr [900 USgpm]	7,115 cm ² [1,103 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	12 L [730 in ³]	20-27 kg [45-60 lbs]	1,860 kg [4,100 lbs]	11 - 22 kW [15 - 30 HP]	●
KC-XD20	15-80 tonnes/hr [17-88 tons/hr]	8-14 m ³ /hr [35-60 USgpm]	109 m ³ /hr [480 USgpm]	2,982 cm ² [462 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	5 L [300 in ³]	7-10 kg [15-22 lbs]	1,000 kg [2,200 lbs]	5.5 kW [7.5 - 10 HP]	●
KC-XD20VG	15-80 tonnes/hr [17-88 tons/hr]	8-14 m ³ /hr [35-60 USgpm]	109 m ³ /hr [480 USgpm]	2,982 cm ² [462 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	5 L [305.4 in ³]	7-10 kg [16-22 lbs]	1,090 kg [2,400 lbs]	5.5 kW [7.5 - 10 HP]	●

Centre Discharge (CD) Series

KC-CD30	50-100 tonnes/hr [55-110 tons/hr]	17-25 m ³ /hr [75-110 USgpm]	135 m ³ /hr [600 USgpm]	7,115 cm ² [1,103 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	13 L [780 in ³]	21-27 kg [47-59 lbs]	1,590 kg [3,500 lbs]	11 kW [15 HP]	●
KC-CD20	15-80 tonnes/hr [16-88 tons/hr]	8-14 m ³ /hr [35-60 USgpm]	110 m ³ /hr [485 USgpm]	2,982 cm ² [462 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	5 L [300 in ³]	7-10 kg [15-22 lbs]	900 kg [2,000 lbs]	7.5 kW [10 HP]	●
KC-CD12	6-20 tonnes/hr [6.6-22 tons/hr]	4.1-5.7 m ³ /hr [18-25 USgpm]	27 m ³ /hr [120 USgpm]	1,044 cm ² [162 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	1.6 L [95 in ³]	2.5-4.5 kg [6-10 lbs]	260 kg [580 lbs]	2.3 kW [2-3 HP]	●
KC-CD12VG	6-20 tonnes/hr [6.6-22 tons/hr]	4.1-5.7 m ³ /hr [18-25 USgpm]	27 m ³ /hr [120 USgpm]	1,044 cm ² [162 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	1.6 L [95 in ³]	2.5-4.5 kg [6-10 lbs]	332 kg [730 lbs]	2.3-3.8 kW [3-5 HP]	●
KC-CD10	0.9-8 tonnes/hr [1-8.8 tons/hr]	3.4-4.5 m ³ /hr [15-20 USgpm]	10 m ³ /hr [50 USgpm]	770 cm ² [119 in ²]	Max. 6mm [1/4"] Recommended 1.7mm [10 mesh]	1.2 L [72 in ³]	2.0-3.8 kg [4.5-8.5 lbs]	201 kg [443 lbs]	1.1 kW [1.5 HP]	●

Manual Discharge (MD) Series (Laboratory / Testwork)

KC-MD7.5	0-680 kg/hr [0-1500 lbs/hr]	45-68 Lpm [12-18 USgpm]	95 Lpm [25 USgpm]	322 cm ² [50 in ²]	Max. 4.7mm [3/16"]	0.7 L [42 in ³]	1.0-1.4 kg [2.2-3.0lbs]	113 kg [250 lbs]	3/4 HP	
KC-MD7.5VG	0-680 kg/hr [0-1500 lbs/hr]	45-68 Lpm [12-18 USgpm]	95 Lpm [25 USgpm]	322 cm ² [50 in ²]	Max. 4.7mm [3/16"]	0.7 L [42 in ³]	1.0-1.4 kg [2.2-3.0lbs]	113 kg [250 lbs]	3/4 HP	
KC-MD4.5	0-275 kg/hr [0-605 lbs/hr]	11-19 Lpm [3-5 USgpm]	18 Lpm [5 USgpm]	157 cm ² [24 in ²]	Max. 1.7mm [10 Mesh]	0.18 L [11 in ³]	200-350 g [0.5-0.8 lbs]	113 kg [250 lbs]	3/4 HP	
KC-MD3	0-45 kg/hr [0-100 lbs/hr]	0.7-4.5 Lpm [0.2-1.1 USgpm]	8 Lpm [2 USgpm]	48 cm ² [7.4 in ²]	Max. 1.7mm [10 Mesh]	58 ml [3.5 in ³]	80-150 g [0.18-0.33 lbs]	28 kg [61 lbs]	1/6 HP	



KNELSON (a corporate partnership)
19855 98 Ave, Langley, BC
Canada V1M 2X5
Tel: 604.888.4015
Fax: 604.888.4013

General Email: knelson@knelson.com
Parts & Service: parts@knelson.com
Testing Services: krtc@knelson.com
Website: www.knelson.com

- Variable Gravity (VG) Package is available for all models
- Feed density: 0-75% Solids/Weight for all listed models