

# 旋盤式破碎機

## Gyradisc crushers

旋盤式破碎機是獨一無二的

我們每個人都能回憶起古代煉金術的故事，古人那無數次企圖將鉛變成金的嘗試無不以失敗告終，令人吃驚的是，今天許多制造商正在嘗試借助於破碎設備實現與先人類似的夢想。目前，市場上銷售的所有細碎破碎機中，無一例外都是圓錐破碎機的衍生物。只有 Nordberg 旋盤式破碎機是專為生產細粒級物料而設計的。

破碎多層物料的基本設計思想，不同於破碎單層物料，想用一種設備完美地實現上述兩種破碎是不現實的。修改圓錐破碎機的腔型，便可滿足細碎生產的要求，既不用彌補集中力的再分配，也不用調整破碎周期。破碎周期對產品粒度的均勻性起着至關重要的作用。在設計中我們考慮了整個流程的各個方面，就是說我們有足夠的設計靈活性來滿足物料間層壓破碎的特殊要求。

因為我們達到了設計目標，所以旋盤式破碎機有下列功能：

能夠把大範圍的物料破碎成範圍大，粒度細，形狀好的產品，且比其它破碎機效率高、更經濟。

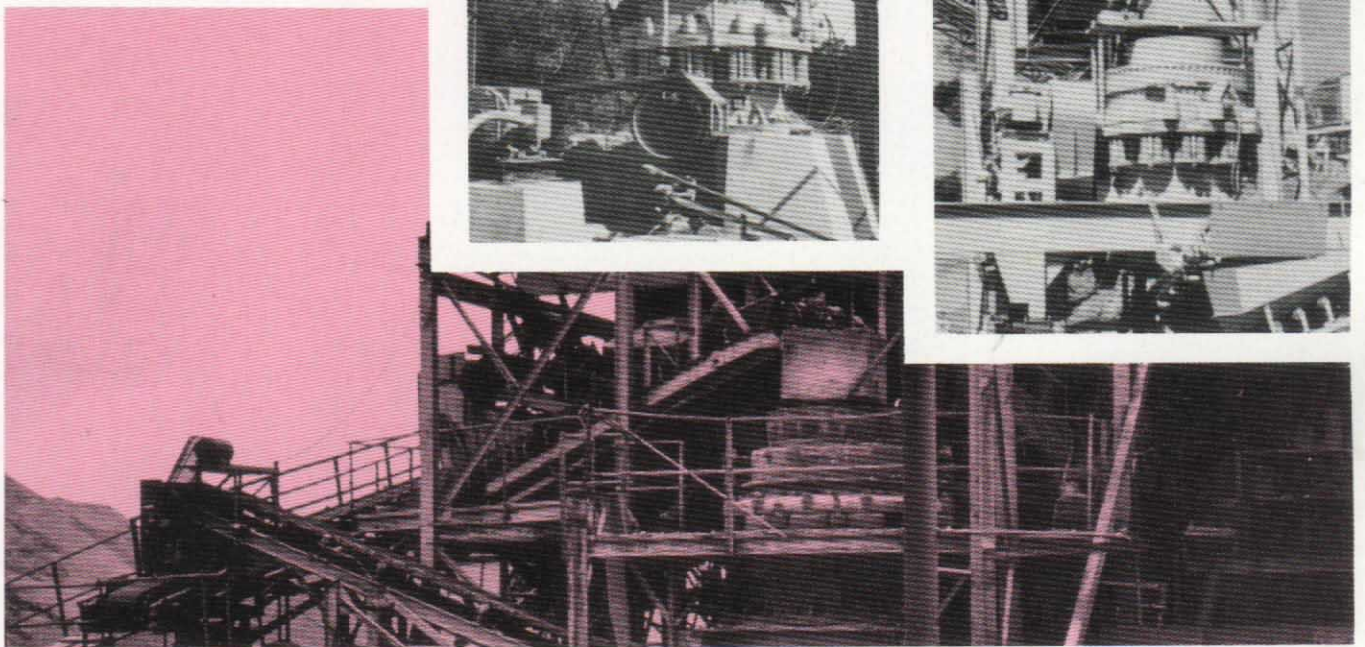
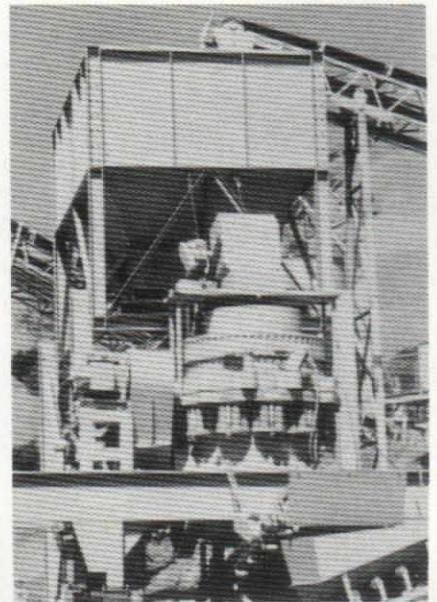
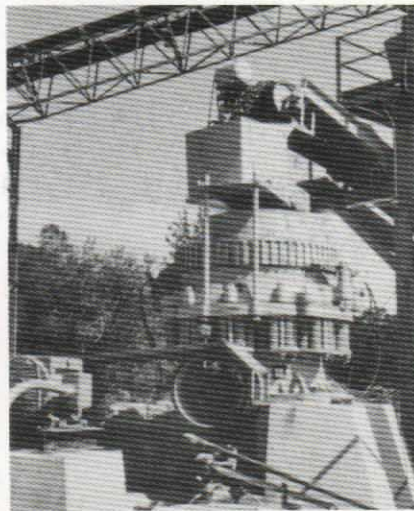
### We Stand Alone

We all recall stories of the ancient alchemists and their unsuccessful experiments in changing lead into gold. Surprisingly enough, there are many manufacturers today trying to perform this same type of wizardry on crushing equipment. All fine product crushers that are marketed today are merely modified cone crushers with only one exception. The Nordberg Gyradisc crusher is the only crusher which was exclusively designed for the sole purpose of fine product crushing.

The fundamental design concept that is applied in crushing a multilayered mass of particles is so dissimilar to the single layer crushing concept that it is unrealistic to believe that a single machine could adequately serve both purposes. To merely modify the contour of the crushing cavity to adapt a cone crusher to suit fine product crushing does nothing to compensate for the redistribution of highly concentrated forces nor does it make any adjustment to the timing which is so critical to uniform particle structure. We started ours from the ground up. This means we had the design flexibility to meet the problems that are unique to interparticle comminution crushing.

Because we were able to achieve our design goals our Gyradisc crusher will:

- crush a wider range of materials into a wider range of sizes with better size and shape control more efficiently and more economically than any other crusher!



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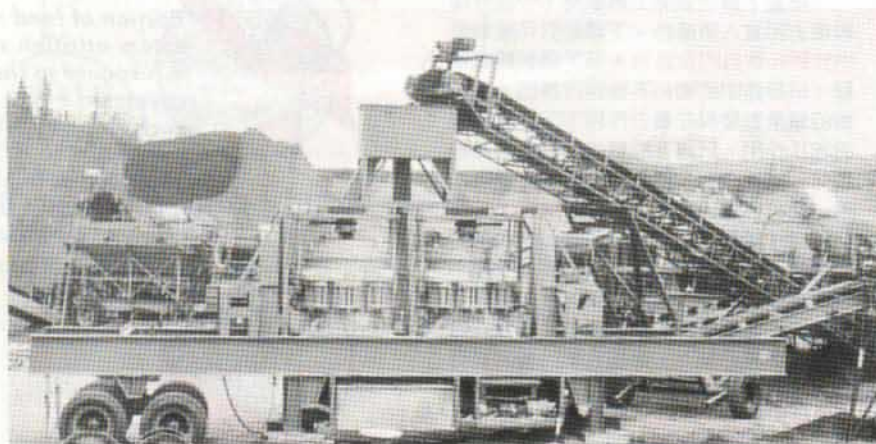
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圖為安裝在美國田納西州Green Brier 破碎場帶有成套潤滑設備的48" 旋盤式破碎機，6' × 16' 雙層 Nordberg GP 篩和 Nordberg 皮帶運輸機。

A 48" Gyradisc crusher with packaged lube system, a 6' × 16' double deck Nordberg GP screen and Nordberg conveyors are installed at this plant site in Green Brier, Tennessee.



圖為裝在移動車上的一對36" 旋盤式破碎機正運行在南美的許多現場。

Twin 36" Gyradisc crushers mounted on a portable rig are kept on the move between various sites throughout the southern United States.

# 層壓破碎

## Interparticle comminution

### 層壓破碎——定義

旋盤式破碎機生產細粒級物料是靠多層物料粒子間的**衝擊和研磨**的綜合作用實現的，這種破碎過程定義為層壓破碎。下面是層壓破碎的工作狀況。

### Interparticle comminution-defined

In the Gyrodisc crusher a fine product is produced by a combination of **impact and attrition** of a multilayered mass of particles. This process of crushing is termed "interparticle comminution." Here's how it works.

### 正確進料與進料的均勻分布——必要條件

粗細料均勻混合連續給入破碎機，以便料堆展開並保持在破碎機內。由破碎腔中心給入的物料經電動旋轉布料器分布到緩沖腔的四周。布料器使注入物料的下落速度減小，慢慢地一層一層地呈環形堆積。松散的呈層狀的給料顆粒間形成的無數空隙，將給入物料中的料塊相互隔開。

單獨驅動的布料器可實現給料速度控制，完全能夠達到實現層壓破碎最佳性能的四項基本要求。這四項要求是：

1. 防止堵塞的最佳空間體積。
2. 粗細料均勻混合。
3. 給料在破碎腔（緩沖腔）中均勻分布。
4. 保證緩沖腔中的物料狀態穩定。

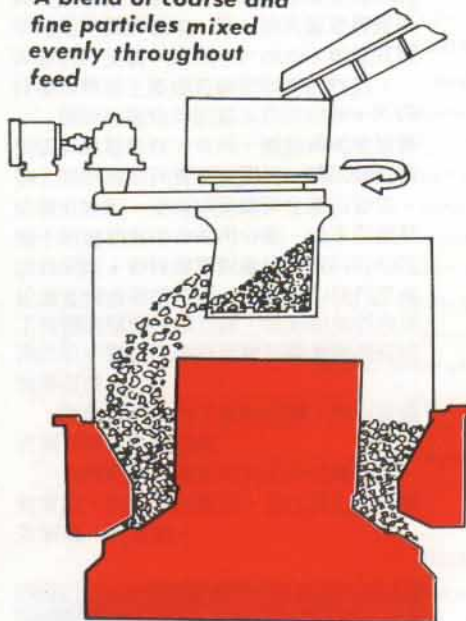
### Proper feed and uniform feed distribution-a must

A homogenous mix of coarse and fine particles is constantly fed to the crusher so that a head of material is developed and maintained within the crusher. Incoming feed, at the center of the crushing cavity, is spread radially outward to the perimeter of the surge chamber by a motorized rotating feed distributor. The descending velocity of the incoming material is reduced by the feed distributor and the feed is lightly deposited, in a circular path, layer upon layer. The particles within the feed mass are separated by a countless number of voids created by the loose layering of feed particles.

The independently powered feed distributor working with a controlled rate of feed completely satisfies the four basic requirements necessary for optimum performance in the process of interparticle comminution. These four

給料中，粗細物料混合均勻

**A blend of coarse and fine particles mixed evenly throughout feed**



電機驅動的布料器使物料分布適宜。

### Proper feed distribution with motorized feed distributor

necessary elements are:

1. A satisfactory volume of voids which prevent packing.
2. A homogenous mix of coarse and fine particles.
3. A uniform distribution of feed around the cavity (surge chamber).
4. A constant maintenance of a head of material in the surge chamber.

### 定量給料的重要性

每當下襯板離開上襯板時，一部分物料從上部進入研磨腔。下襯板的平緩傾角小於破碎物料的安息角。若下襯板靜止不動，研磨腔中的物料不能自行排出。下襯板的傾角對物料在重力作用下下滑起足夠的阻止作用，只有靠軀體的轉動才能使物料向外推進一些。就破碎錐的負荷運動而言，物料通過研磨腔排出是**正向排出**。換句話說，軀體的旋轉運動和破碎腔中物料的高度產生的壓力促使物料破碎，一點一點地逐步向外推進通過研磨腔。物料通過研磨腔不是連續的而是間斷的。類似於內燃機中燃料的輸入，旋盤式破碎機的給料先於工作行程。由於旋盤次數和破碎腔的結構使粒度過大的產品含量百分比大大減小，提高了破碎效率。

### The importance of metered feeding

Each time the lower liner moves away from the upper liner a portion of the feed mix enters the attrition chamber from the surge load above. The flat angle of the lower liner is **less than the angle of repose** of the material undergoing reduction. If the lower liner were at rest the material delivered to the attrition chamber would not of itself slide downward through the chamber. The shallow liner angle offers enough resistance to the flow of material, by gravity, that it is only the motion of the head which advances the material **outwardly** a slight amount at each gyration. The movement of material through the attrition chamber is **positive** in response to the carrying movement of the head. In other words the motion of the gyrating head and the pressure due to the height of the surge capacity in the cavity causes the material undergoing reduction to move progressively outward through the attrition chamber in a series of short steps. The passage of material through the attrition chamber is not continuous but intermittent. Somewhat like the introduction of fuel in an internal combustion engine, the Gyrodisc crusher advances the feed material only prior to the power stroke. **Because of the number of gyrations and cavity design, the percentage of oversize product is greatly reduced and highly efficient crushing takes place.**



隨着軀體的運動，部分物料進入研磨區

**Portion of feed mix enters attrition zone in response to the movement of the head**

**Shallow lower liner properly controls the free flow of material**

下襯板在一定程度上控制物料的自由流動。

## 衝擊加研磨——最有效的破碎

破碎開始時，物料由下襯板帶起來，同時有排出運動和被阻隔在破碎襯板間的情況。破碎錐的沖擊動作借助於研磨及物料粒子間力重新分布時產生的物料粒子間的破碎作用，導致物料的破碎。即使襯板靠得最近時，襯板間仍有一層相當厚的小顆粒物料將其隔開。大多數情況下，優選機器的生產能力和功率消耗時，為得到較好的產品粒度並使滿足要求的物料含量更高，應增大而不是減小排礦口間隙。因此破碎襯板間的排礦口不象圓錐破碎機那樣與所要求的產品粒度成正比。

作旋擺運動的破碎錐在向上推的過程中，靠兩種不同破碎動作的綜合作用將物料破碎成均勻的細產品：

1. 粗物料對細物料的沖擊類似於磨機中球或石子的作用。

2. 在物料粒子間力重新分布趨於減小物料間的空隙時，表面的高摩擦力產生研磨作用。與目前使用的其他細碎或破碎方法相比，由於沖擊和研磨的共同作用，旋盤式破碎機的功率利用率最高。

## Impact with attrition — the most efficient crushing

When reduction begins, the material is picked up by the

lower liner, moved outwardly and caught between the crushing members. The impact of the head results in reduction of material by grinding and by fracture of particle-upon-particle caused by forceful relocation of the particles within the mass. Even at the closest approach of the attrition members, the liners are still separated by a layer of small particles of substantial thickness. In most instances it has been found that a better product and greater usable quantity of desired size is obtained by increase rather than decrease of gap when it becomes a question of optimizing machine capacity and power draw. Therefore, the setting of the crushing members is not as directly related to the size of the product required as is the setting in the cone-type crusher.

Remember that during the upward thrust of the rotating head two distinct processes combine to reduce the feed into a uniform fine product:

1. The impact of coarse particle against fine particle similar to the action of balls or pebbles in a grinding mill.

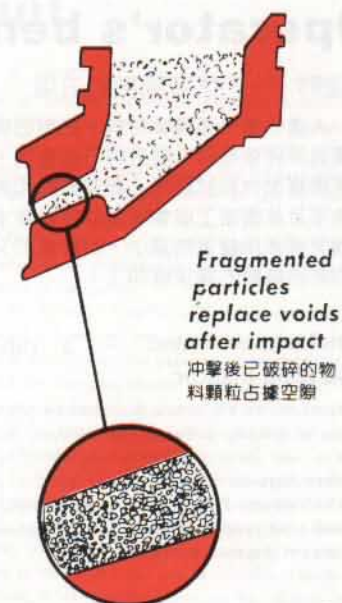
2. The attrition resulting from the high surface friction during forceful relocation of the particles into smaller voids within the feed mass. In the Gyradisc crusher, the combination of impact and attrition offers the most efficient power utilization as compared to other fine crushing or reduction methods employed today.

## 預定行程和周期性旋擺

### ——連續均勻的立方形產品

破碎錐每次退回時，喉部的空間由來自緩沖腔的物料流填充。這一過程重複進行，直到物料從研磨腔排出為止。對於接連不斷的旋擺運動來說，破碎錐的行程和運動周期應保證下襯板撤回速度快於此前已破物料的自由下落速度。因此，在開始下落時，速度相對較慢，旋擺速度可以控制以便已破物料下落一段明顯的距離以前，破碎錐已旋擺半圈。下襯板後撤返回來沖擊下落中的已破物料，使其散開以便在下次沖擊前獲得物料間新的相互位置，每次沖擊時物料的這種重新取向作用使產品粒度和形狀均高度均勻並呈立方形。

最近幾年，許多試圖模仿 Nordberg

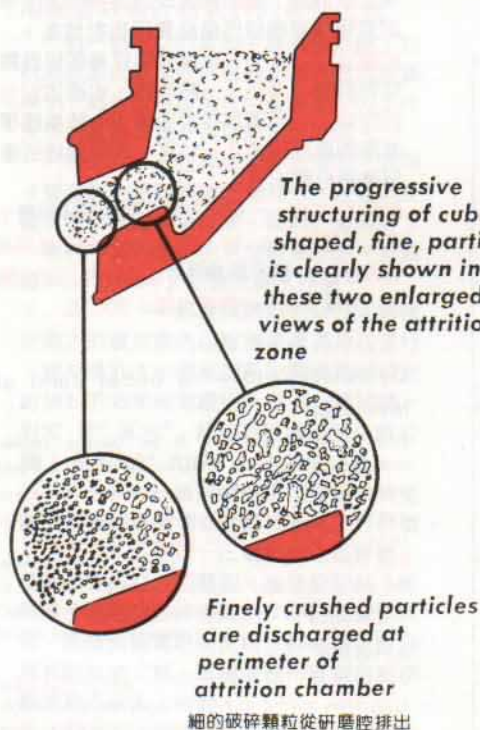


旋盤式破碎機層壓破碎原理的嘗試均告失敗，設計 Nordberg 旋盤式破碎機時，總的努力方向是使機器適應工作狀態。Nordberg 旋盤式破碎機是專為承受層壓破碎力的大小和方向而設計的唯一的一種破碎機。其他破碎機只不過是對現有圓錐破碎機的破碎腔作了一些修改，片面的努力造成破碎機性能不良和大量的結構缺陷。

## Predetermined stroke and timed rotation — consistent uniformity of cubical shaped product

At each recession of the head the void left at the throat is filled by particles flowing in from the surge chamber. This procedure is repeated until the particles at the periphery of the attrition chamber are discharged. With each succeeding gyration, the length of stroke and timing of the movement of the head are such that the lower liner is withdrawn faster than the free fall velocity of the previously crushed mass. Since the speed of descent is relatively slow at the beginning of the fall, the speed of gyration can be timed so that a half revolution of the head can be made before the crushed material falls any appreciable distance. This permits the lower liner to recede and return to hit the previously crushed mass as it is falling, scattering it so that a new alignment of particles is obtained prior to another impact. This reorientation of the particles at each impact results in a high degree of uniformity in both size and shape and produces a cubical shaped product.

In recent years many attempts have been made to copy the Nordberg Gyradisc crusher principle of interparticle comminution with little or no success. In designing the Nordberg Gyradisc crusher a total concentration of effort was devoted to matching machine to job. The Nordberg Gyradisc crusher is the only crusher exclusively designed to support the magnitude and direction of the forces encountered during interparticle comminution. Others have merely modified the crushing cavities on existing cone crushers. This less than total effort has met with poor performance and numerous structural failures.



兩個研磨區的放大圖清晰地給出了立方形細顆粒的逐步形成過程。

細的破碎顆粒從研磨腔排出

# Operator's benefits

人造砂——迅速開拓的市場

人造砂是一種建築材料，由岩石或卵石通過破碎或磨碎、篩分與分級製成，滿足美國國家材料試驗局，聯邦政府和州的交通部及美國軍工協會規定的技術要求。隨著天然砂蘊藏量的減小，對經濟而又高效的制砂機械的需求增加了。

## Manufactured sand — a rapidly expanding market

Manufactured sand is a construction material produced by crushing or grinding, screening, and classifying rock or gravel to meet specifications set forth by ASTM, Federal and State highway departments, and the U.S. Army Corps of Engineers. The demand for economical and efficient sand producing machinery has grown as natural sand deposits diminish.

## 立方形砂——一種銷路更好的產品

旋盤式破碎機連續生產立方形砂的能力不是偶然的。要將砂粒製成立方形，需要精確控制衝擊周期，物料推進速度，給料粒度分布和破碎比。批量混入立方形砂可製成優質混凝土或瀝青。立方形砂是一種更有銷路，售價合適的產品。混凝土——由於立方形砂不僅使混凝土的強度提高，而且因水泥用量減少而進一步降低了費用，因而人們比較喜歡用旋盤式破碎機生產的人造砂。各自獨立的試驗證明，立方形集料越多，片狀和長條狀集料的含量越少，從配料設計方面來說這種材料

更令人滿意。天然砂的棱角有磨圓的趨向，因而用其製成的混凝土不如用人造砂製成的混凝土强度高。

瀝青——因為帶棱角的集料之間有一種相互的鎖緊作用，同時所破碎的立方形物料比圓形物料占有更大的表面積，所以用旋盤破碎機生產的人造砂可製成更牢固，更穩定的瀝青混合物。瀝青與集料粘在一起，減少了位移的可能性。

## Cubical shaped sand — a more marketable product

The ability of the Gyradisc crusher to consistently produce a cubical shaped product is no design accident. Structuring sand particles into a cubical shape, requires precise timing between impact, feed advancement, particle arrangement, and proper reduction ratio. Cubical shaped sand, in batch mixes, makes a superior concrete or asphalt, is a more marketable product and offers cost saving benefits.

Concrete — Manufactured sand produced in a Gyradisc crusher is preferred because the cubical particle shape not only contributes more strength to the concrete, but results in further savings because less cement is required. Independent tests have proved that the more cubical the aggregate and the lower the proportion of flaky and elongated particles, the more acceptable the material will be from the mix design aspect. Natural sands have a tendency to have rounded corners and consequently produce a concrete which is not quite as strong as concrete using manufactured sand.

Asphalt — Gyradisc manufactured sand produces a stronger and more stable mixture for asphalt because of the interlocking of angular aggregate particles, while the surface of the cubical crushed particle provides greater area for the volume occupied than the round particle. This permits cementing the particles together with asphalt and reduces the possibility of displacement.

## 生產費用——降到最低

旋盤式破碎機製砂的順成本包括襯板、維修和功率消耗三個方面。襯板費用與被破物料的磨蝕性及表面濕度有關。每噸砂平均襯板費用在0.03~0.06美元之間。不包括襯板費用在內，每噸砂的正常維修費用不超過0.01美元。每噸砂的功率消耗在3kwh（千瓦小時）範圍內。

## Operating cost—minimal

Gyradisc Crusher operating-at-cost-per-ton of sand includes liners, maintenance and power draw. The liner cost is related to the abrasive characteristics of the material being crushed and the surface moisture. Average liner costs are between \$.03 and \$.06 per ton of sand. Proper maintenance, excluding liners, will result in costs not exceeding \$.01 per ton. Power consumption will be in the area of 3 kwh per ton of sand.

## 旋盤式破碎機生產的砂

### ——一種費用低質量好的砂

在旋盤式破碎機研製出來前，人們用棒磨機、反擊式破碎機和輥式破碎機生產人造砂。與旋盤式破碎機相比，這些破碎方法均有不足，這是因為：

棒磨機——棒磨機能產生細粒產品，但是功率消耗、襯板磨損及超細產品過多等因素使棒磨機砂的最終費用相對地高。

反擊式破碎機——反擊式破碎機破碎磨蝕性物料時磨損快，一般地講，也產生過多的超細產品。滿足要求通過100號美國標準篩的產品只占2~10%，其中過細的產品還得分離出去。

輥式破碎機——另一方面，用輥式破碎機生產足夠量的30、50、100號篩的篩下產品是有困難的。輥皮磨損導致粒度控制方面的難題，並產生過多的循環負荷。

## Gyradisc sand — a better sand at less cost

Prior to the development of the Gyradisc crusher, manufactured sand was produced by rod mills, impact crushers, and roll crushers. In comparing all these methods of sand production, with the Gyradisc crusher, they all fall short. Here's why. Rod mill — The rod mill is capable of producing fines, but the power and metal cost and the tendency to produce an excess of extreme fines are the principal factors that contribute to the relatively high final cost of rod mill sand.

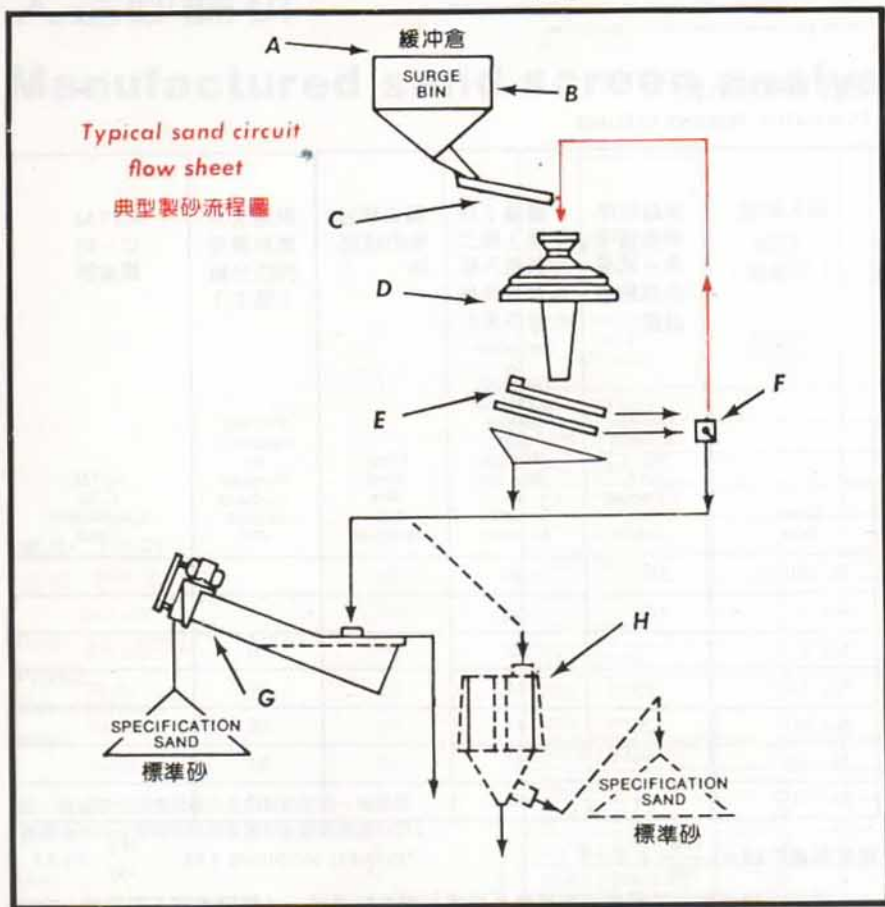
Impact crushers develop high wear rates when crushing abrasive materials and also normally create an excess of extreme fines. Most specifications permit only 2 to 10 percent passing a No. 100 sieve, any excess produced in this range must be removed.

Roll crushers — Roll crushers, on the other hand, have difficulty in producing a sufficient quantity of fines in the 30, 50, and 100 sieve sizes. Roll shell wear contributes to size control problems and develops high circulating loads.

用各種破碎方法生產砂的產品和成本對照表  
Product and cost comparison of various crushing methods in sand production

| 破碎方法<br>Crushing Method    | 給料限制<br>Feed Limitations                                                                                | 維護與襯板費用<br>Maintenance & Metal Cost                                                                                                 | 產品構成<br>Product Make-up                                                                                 | 相對順成本<br>Relative Cost/Ton                                                                                        |
|----------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 旋盤式破碎機<br>Gyradisc Crusher | 適應與粘性物料及含過多細料時效率降低<br>Loss of efficiency in wet, sticky materials and in materials with excessive fines | 磨損量最小，維修費用最低尤其對堅硬礦石更是如此。<br>Has least amount of wear and lowest maintenance cost especially with materials in upper hardness ranges | 良好的粒度構成。產品呈立方狀。<br>Good particle size ratio. Particles cubical in shape                                 | 在中硬到堅硬範圍內，每噸產品成本最佳。<br>Best cost per ton ratio in mid. to upper hardness ranges.                                  |
| 棒磨機<br>Rod Mill            | 減少大塊含量時效率降低<br>loses efficiency when reducing feed containing large particles.                          | 襯板費用高<br>Metal cost high.                                                                                                           | 細料過多形狀不規則<br>Excess fines. Irregular shaped particles.                                                  | 功耗高襯板費用高導致每噸產品的總成本高。<br>High power consumption and high metal cost contribute to overall high cost per ton ratio. |
| 反擊式破碎機<br>Impact Crusher   | 將物料限制在低硬度範圍內時比較經濟。<br>Economically restricted to materials in lower hardness range.                     | 在破碎硬的或磨蝕性物料時襯板費用與維修費用特別高<br>Metal and maintenance cost excessively high when crushing hard or abrasive materials.                   | 細料過多<br>Excess fines.                                                                                   | 在最低硬度範圍內每噸產品成本最佳。<br>Best cost per ton ratio in lowest hardness ranges.                                           |
| 輥式破碎機<br>Roll Crusher      | 將物料限制在低硬度範圍內時比較經濟。<br>Economically restricted to materials in lower hardness range.                     | 處理硬度的或磨蝕性物料時襯板磨損快。換新襯板的成本高昂且工作量大。resurfacing rolls very high. Rapid metal wear when handling hard materials. Cost and labor of      | 粒度不均勻，通過30、50和100號篩的量不足。<br>Poor size uniformity. Insufficient fines in the 30, 50 and 100 sieve sizes. | 在處理硬的或磨蝕性物料時成本過高。<br>Cost prohibitive when handling hard or abrasive materials.                                   |

# Manufactured sand typical sand circuit



## 用旋盤式破碎機製砂的典型流程

對一個成功的製砂生產流程來說，物料流應如典型製砂流程圖和製砂廠流程圖所示。這里按各設備在生產流程中的工作次序對設備本身及其功能加以說明。

**A. 預篩分**——在典型製砂流程中，要用4號篩對新給物料進行預篩分。在進入旋盤式破碎機緩沖倉之前，物料已準備好了。物料中有大量自由水份需要除去。有幾種Nordberg篩適於脫水作業。

**B. 緩沖倉**——將準備好的物料注入容積足夠大的緩沖倉內以維持連續滿負荷運行。緩沖倉的大小直接關係到製砂流程中新給物料的效率和連續性。然而一般地講，對於36"和48"，緩沖倉通過量至少為20噸；對於66"和84"，至少為40噸。

**C. 給料機**——振動給料機或變速皮帶運輸機皮帶將新給物料從緩沖倉注入破碎機。

**D. 旋盤式破碎機**——物料進入破碎機，並被破碎成立方形顆粒。為使控制點（給料機）和旋盤破碎機間的反應時間減至最短，建議根據實際情況將破碎機靠近緩沖倉和給料機安裝。這種流程布置適合於自動或有效的人工控制。

**E. 篩分**——已破產品應在與Nordberg GP篩類似的雙層乾式篩上進行篩分。篩孔尺寸依物料的破碎特性和產品的最終粒度要求而變化。通常4號篩的篩網放在上層

，8-10或12號篩的篩網放在下層。

**F. 分料閘門**——分料閘門可調節兩層篩間返回旋盤式破碎機的物料量，正確控制通過上、下層篩物料的百分數，可以增大或減少循環負荷。要注意將循環負荷返回破碎機的方法。緩沖倉的出料槽可消除緩沖倉內的粒度偏析並增大其緩沖能力。

**G. 分級機**——採用水力分級機除掉過多的細料（100號篩的篩下物料）。

**H. 分離器**——當處理尾礦有困難，無水源或市場需要大量細料做礦用填料的地方，可使用氣體分離器。

另一種製砂流程的篩下產品完全由6號或8號篩的篩下旋盤破碎機產品構成。可是，這種布置方式沒有典型製砂流程圖中標準砂流程的內在靈活性。

## Producing Gyradisc sand in a typical sand circuit

For a successful sand producing circuit, the material flow should be as shown in the flow sheet and the plant diagram. An explanation of the devices and their purpose in the circuit are given in their functional sequence.

**A. Prescreening** — In a typical sand producing circuit, new feed is prescreened on a No. 4 opening screen. Feed should be prepared before it enters the Gyradisc crusher surge bin. As much free water as practical should be removed. There are several Nordberg screens which are well suited for dewatering.

**B. Surge Bin** — The prepared feed enters a surge bin of sufficient capacity to sustain continuous full load operation. The size of the surge bin is related to the efficiency or continuity of the new feed rate entering the sand circuit. Normally, however, the bin sizes should be at least 20 ton live storage for the 36" and 48", and 40 ton for the 66" and 84" sizes.

**C. Feeder** — A vibrating feeder or variable speed conveyor belt takes new feed from the surge bin and delivers it to the crusher.

**D. Gyradisc Crusher** — The feed enters the crusher where it is reduced into cubical shaped particles. To minimize the reaction time between the control point (feeder) and the Gyradisc crusher, it is recommended that the crusher be located as close to the bin and feed as practical. This circuit arrangement is well suited for automation or efficient manual control.

**E. Screening** — The crushed product should be screened on a double deck dry screen like the Nordberg Gp screen. The exact sizes of the screen openings will vary and are dependent on the crushing characteristics of the materials and the final specification. Usually a cloth having a No. 4 opening is used on the top deck and No. 8, 10 or 12 is used on the bottom deck.

**F. Flop Gate** — The Flop gate regulates the amount of between deck material that is returned to the Gyradisc crusher. The correct percentage of material passing the top or bottom deck screen can be controlled by adjusting the flop gate to increase or decrease the recirculating load. Note the method of returning the circulating load to the Gyradisc crusher. Bypassing the surge bin eliminates size segregation in the bin and increases the effective surge capacity.

**G. Classifier** — Excess fines (passing No. 100) are removed through the use of a hydraulic classifier.

**H. Separator** — An air separator can be employed when the disposal of tailing is difficult, when water is unavailable, or where a market exists for excess fines in the form of mineral filler.

An alternate sand circuit would involve producing a screen undersize consisting entirely of a minus No. 6 or No. 8 Gyradisc crusher product. This arrangement, however, does not have the built-in flexibility available in the specification sand circuit shown in the typical flow sheet.



# Test results

如果您已在生產集料，您可以通過增加砂子產量來提高銷售潛力。

通過增加破碎、篩分和分級設備，幾乎每個生產粗集料的公司均能生產符合要求的細集料。在大多數情況下，制砂生產可作為工廠單獨的一部分。製砂設備既可與現有設備一起也可完全獨立於現有設備進行生產。

經驗表明，特別濕、粘、泥漿狀的或細料含量不適當的物料不宜用旋盤式破碎機製造人造砂。還沒有一個確切的濕度能使破碎機失效。通過 Rexnord 或沉重的代表對原料進行檢查，確認物料的適應性。通常可以在破碎機前用脫水篩來解決原料的濕度問題。

大多數適合作為堅固的建築集料的物料都可用作製砂流程的原料。

If you are now making aggregate you can increase your marketing potential considerably by adding sand production

Almost anyone producing a coarse aggregate can produce, with the addition of crushing, screening and classifying equipment, a fine aggregate suitable to meet specifications. In most cases, sand production could be set up as an independent part of an established plant. Under such an arrangement the sand plant could operate either in conjunction with the existing plant or completely independent of it.

Experience has shown that material which is excessively wet, sticky, muddy, or contains a disproportionate quantity of fines is generally unsuitable for producing manufactured sand in the Gyrodisc crusher. There is no exact moisture

content at which the crusher will become ineffective. An examination of the potential feed by a Rexnord or SHMP representative will confirm the suitability of the material. Moisture problems can usually be overcome through the use of dewatering screens before the crusher.

Most materials that qualify as sound construction aggregate can be used as raw material for the sand circuit.

## 篩下累積百分數

### CUMULATIVE PERCENT PASSING

| 篩孔規格<br>Sieve Size | 旋盤破碎機流程中負4號篩的試驗通過量<br>Test run of minus No. 4 from Gyrodisc Crusher circuit | 下層篩(10號篩)篩上物料給入旋盤式破碎機的返砂部分<br>Correction by returning portion of bottom deck oversize (No. 10) to Gyrodisc Crusher | 篩去細砂後的成品砂<br>Final sand after fines removal | 供細度系數計算用的百分數(篩上)<br>Percent (retained) for fineness modulus calculation | ASTM C-33 標準砂<br>ASTM C-33 Specification Sand |
|--------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------|
| 3/8" (9mm)         | 100                                                                         | 100                                                                                                                | 100                                         |                                                                         | 100                                           |
| No. 4              | 100                                                                         | 100                                                                                                                | 100                                         |                                                                         | 95-100                                        |
| No. 8              | 75                                                                          | 92                                                                                                                 | 91                                          | 9                                                                       | 80-100                                        |
| No. 16             | 53                                                                          | 64                                                                                                                 | 60                                          | 40                                                                      | 50-85                                         |
| No. 30             | 35                                                                          | 41                                                                                                                 | 34                                          | 66                                                                      | 25-60                                         |
| No. 50             | 23                                                                          | 27                                                                                                                 | 19                                          | 81                                                                      | 10-30                                         |
| No. 100            | 14                                                                          | 17                                                                                                                 | 8                                           | 92                                                                      | 2-10                                          |

$$\text{細度系數 } 2.88 = \frac{288}{100} \cdot 2.3 - 3.1$$

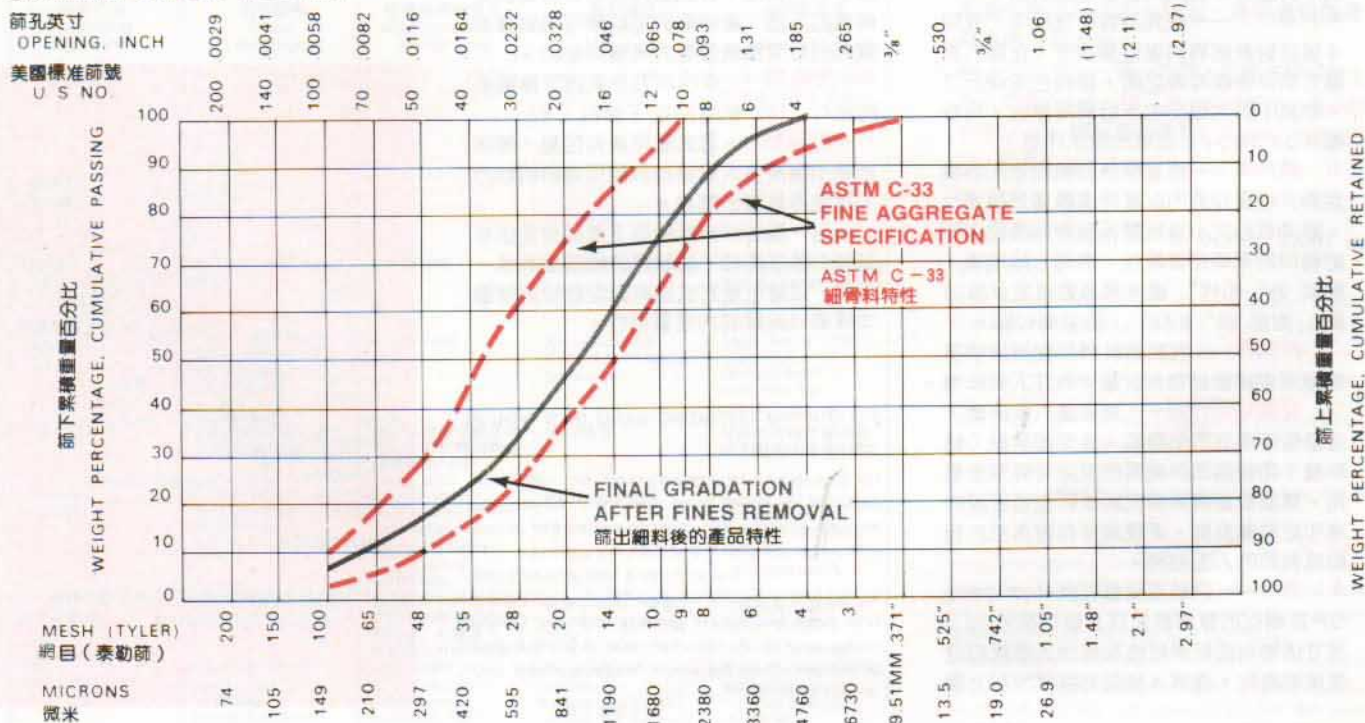
$$\text{FINENESS MODULUS } 2.88 = \frac{288}{100} \cdot 2.3 - 3.1$$

這兩個圖表給出了旋盤式破碎機系統處於穩定狀態時，4號篩的篩下產品與ASTM（美國國家材料試驗局）C-33標準礦樣相比較的試驗結果。

The two charts show the results of a test conducted, with the Gyrodisc Crusher circuit in balance, comparing minus No. 4 screen undersize with ASTM C-33 Specification Sand.

## 標準篩析

### STANDARD SCREEN ANALYSIS



# 人造砂篩析

## Manufactured sand screen analysis

產品: 人造砂  
給料: 石灰石

Feed: limestone

Product:  
manufactured  
sand

注: 通過篩分的成品指篩去細料前的砂。得到最終標準砂的過程如製砂流程圖和試驗結果圖所示。

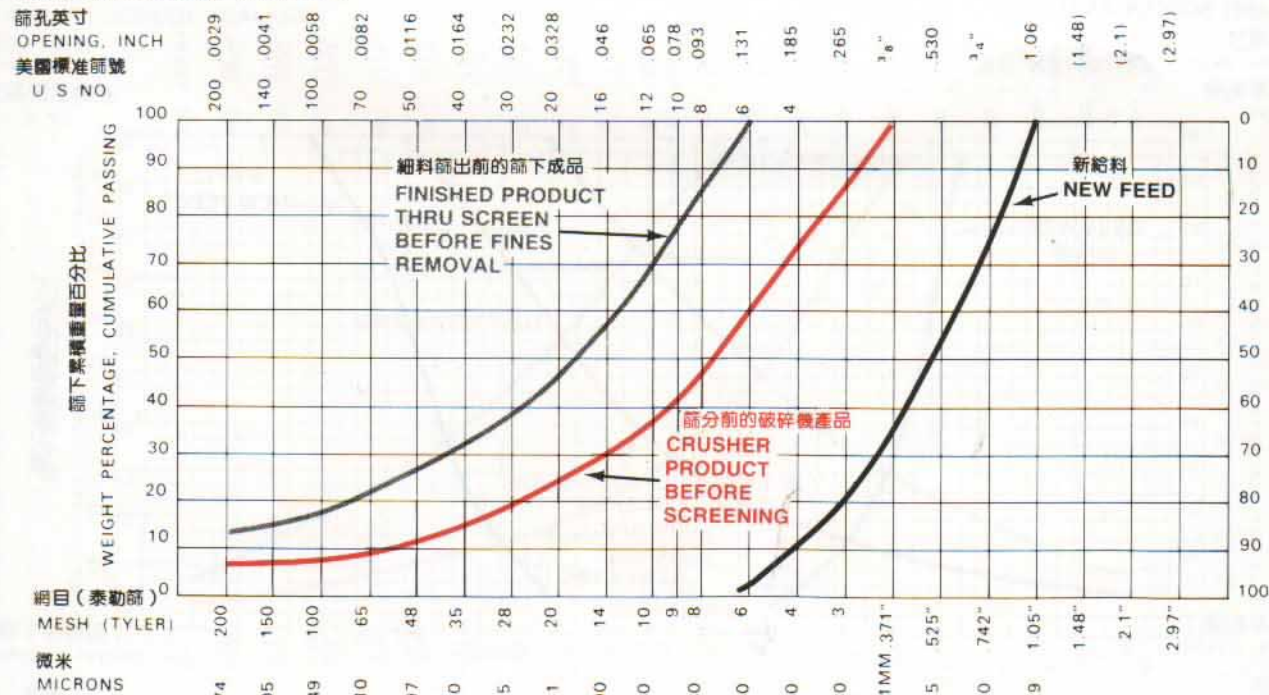
Note:

Finished product thru screen refers to the sand before fines removal. The procedure for obtaining the final specification sand is shown in the Sand Circuit diagrams and the Test Results charts.

| 篩孔規格<br>(英寸)   | 網目<br>(泰勒篩) | 美國標準篩號 | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                            |                                                      |
|----------------|-------------|--------|----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                |             |        | 新給料<br>NEW FEED                        | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)    |             |        |                                        |                                                            |                                                      |
| 1.06 (27mm)    |             |        | 98                                     |                                                            |                                                      |
| .742 (19mm)    |             |        | 75                                     |                                                            |                                                      |
| .525 (13mm)    |             |        | 50                                     | 100                                                        |                                                      |
| .371 (9mm)     |             |        | 30                                     | 98                                                         |                                                      |
| .263 (7mm)     | 3           |        | 22                                     | 87                                                         |                                                      |
| .185 (5mm)     | 4           | 4      | 10                                     | 73                                                         |                                                      |
| .131 (3mm)     | 6           | 6      | 1                                      | 58                                                         | 100                                                  |
| .093 (2mm)     | 8           | 8      |                                        | 46                                                         | 88                                                   |
| .065 (1.6mm)   | 10          | 12     |                                        | 37                                                         | 72                                                   |
| .046 (1mm)     | 14          | 16     |                                        | 30                                                         | 58                                                   |
| .0328 (.833mm) | 20          | 20     |                                        | 24                                                         | 46                                                   |
| .0232 (.589mm) | 28          | 30     |                                        | 20                                                         | 38                                                   |
| .0164 (.416mm) | 35          | 40     |                                        | 17                                                         | 31                                                   |
| .0116 (.294mm) | 48          | 50     |                                        | 14                                                         | 26                                                   |
| .0082 (.208mm) | 65          | 70     |                                        | 12                                                         | 22                                                   |
| .0058 (.147mm) | 100         | 100    |                                        | 10                                                         | 18                                                   |
| .0041 (.104mm) | 150         | 140    |                                        | 8                                                          | 14                                                   |
| .0029 (.073mm) | 200         | 200    |                                        | 7                                                          | 11                                                   |

### 標準篩析

#### STANDARD SCREEN ANALYSIS



# 人造砂篩析

## Manufactured sand screen analysis

給料: 礫石

產品: 人造砂

Feed: gravel

Product:  
manufactured  
sand

注: 通過篩分的成品指篩去細料前的砂。得到最終標準砂的過程如製砂流程和試驗結果圖所示。

Note:

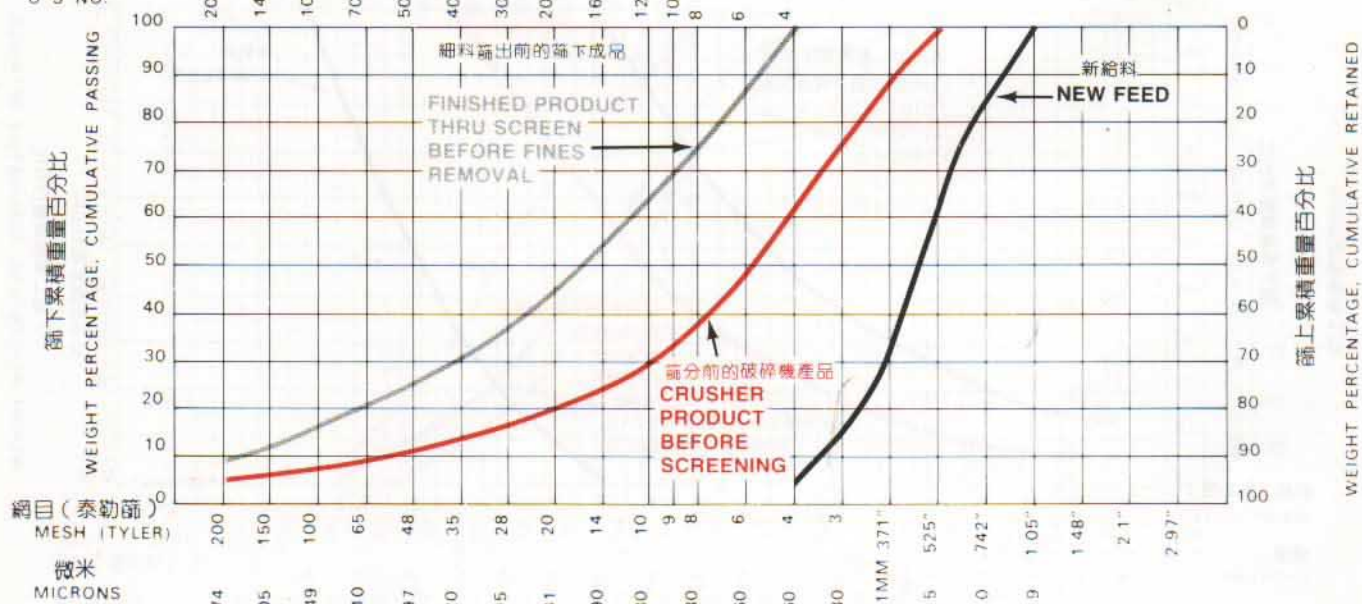
Finished product thru screen refers to the sand before fines removal. The procedure for obtaining the final specification sand is shown in the Sand Circuit diagrams and the Test Results charts.

| 篩孔尺寸<br>(英寸)              | 網目<br>(泰勒篩)     | 美國標準篩號      | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                           |                                       |
|---------------------------|-----------------|-------------|----------------------------------------|-------------------------------------------|---------------------------------------|
|                           |                 |             | 新給料                                    | 篩分前的<br>破碎機產品                             | 通過篩分的<br>成品                           |
| SIEVE<br>SIZE<br>(INCHES) | MESH<br>(TYLER) | U.S.<br>NO. | NEW<br>FEED                            | CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)               |                 |             |                                        |                                           |                                       |
| 1.06 (27mm)               |                 |             | 100                                    |                                           |                                       |
| .742 (19mm)               |                 |             | 87                                     |                                           |                                       |
| .525 (13mm)               |                 |             | 58                                     | 100                                       |                                       |
| .371 (9mm)                |                 |             | 30                                     | 92                                        |                                       |
| .263 (7mm)                | 3               |             | 14                                     | 76                                        |                                       |
| .185 (5mm)                | 4               | 4           | 4                                      | 60                                        | 100                                   |
| .131 (3mm)                | 6               | 6           |                                        | 49                                        | 88                                    |
| .093 (2mm)                | 8               | 8           |                                        | 38                                        | 75                                    |
| .065 (1.6mm)              | 10              | 12          |                                        | 30                                        | 61                                    |
| .046 (1mm)                | 14              | 16          |                                        | 25                                        | 52                                    |
| .0328 (.833mm)            | 20              | 20          |                                        | 22                                        | 45                                    |
| .0232 (.589mm)            | 28              | 30          |                                        | 18                                        | 38                                    |
| .0164 (.416mm)            | 35              | 40          |                                        | 15                                        | 33                                    |
| .0116 (.294mm)            | 48              | 50          |                                        | 13                                        | 27                                    |
| .0082 (.208mm)            | 65              | 70          |                                        | 10.5                                      | 22                                    |
| .0058 (.147mm)            | 100             | 100         |                                        | 8                                         | 17                                    |
| .0041 (.104mm)            | 150             | 140         |                                        | 6                                         | 12                                    |
| .0029 (.073mm)            | 200             | 200         |                                        | 4                                         | 7                                     |

### 標準篩析

#### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



給料: 花崗岩  
產品: 人造砂

Feed: gravel  
Product:  
manufactured  
sand

注: 通過篩分的成品指篩去細料前的砂。得到最終標準砂的過程如製砂流程和試驗結果圖所示。

Note:

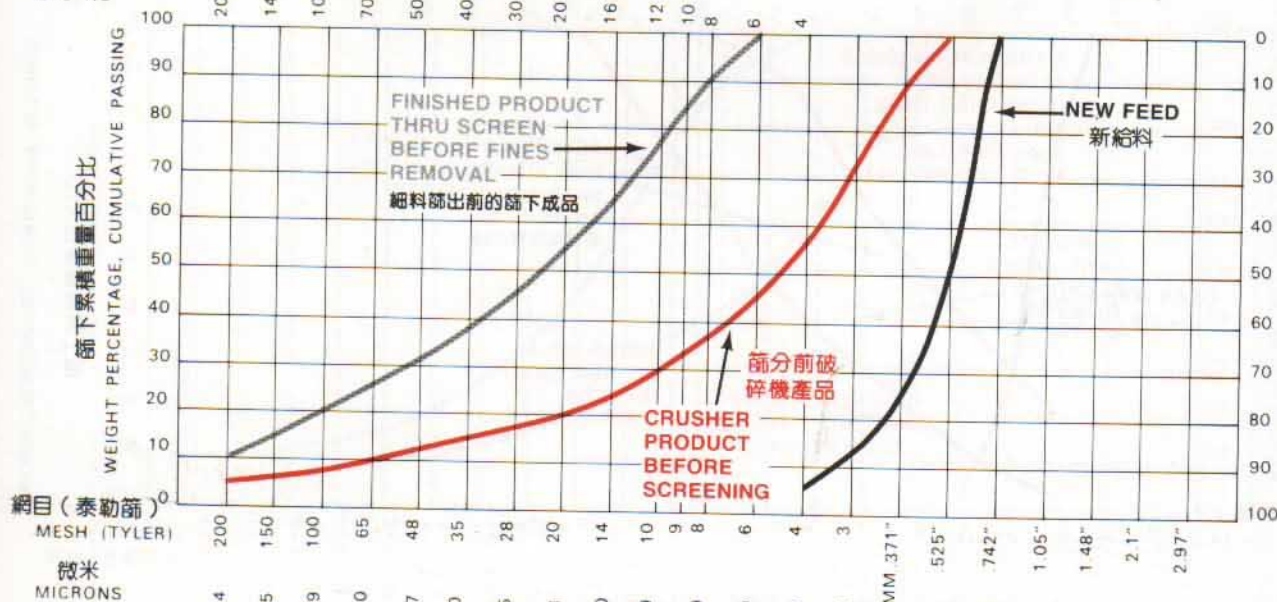
Finished product thru screen refers to the sand before fines removal. The procedure for obtaining the final specification sand is shown in the Sand Circuit diagrams and the Test Results charts.

| 篩孔規格<br>(英寸)<br>SIEVE<br>SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH<br>(TYLER) | 美國標準篩號<br>U.S.<br>NO. | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                            |                                                      |
|-------------------------------------------|--------------------------------|-----------------------|----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                                           |                                |                       | 新給料<br>NEW<br>FEED                     | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)                               |                                |                       |                                        |                                                            |                                                      |
| 1.06 (27mm)                               |                                |                       |                                        |                                                            |                                                      |
| .742 (19mm)                               |                                |                       | 100                                    |                                                            |                                                      |
| .525 (13mm)                               |                                |                       | 51                                     | 100                                                        |                                                      |
| .371 (9mm)                                |                                |                       | 22                                     | 92                                                         |                                                      |
| .263 (7mm)                                | 3                              |                       | 12                                     | 72                                                         |                                                      |
| .185 (5mm)                                | 4                              | 4                     | 5                                      | 57                                                         |                                                      |
| .131 (3mm)                                | 6                              | 6                     | 1                                      | 46                                                         | 100                                                  |
| .093 (2mm)                                | 8                              | 8                     |                                        | 37                                                         | 94                                                   |
| .065 (1.6mm)                              | 10                             | 12                    |                                        | 30                                                         | 77                                                   |
| .046 (1mm)                                | 14                             | 16                    |                                        | 25                                                         | 63                                                   |
| .0328 (.833mm)                            | 20                             | 20                    |                                        | 21                                                         | 53                                                   |
| .0232 (.589mm)                            | 28                             | 30                    |                                        | 18                                                         | 46                                                   |
| .0164 (.416mm)                            | 35                             | 40                    |                                        | 16                                                         | 39                                                   |
| .0116 (.294mm)                            | 48                             | 50                    |                                        | 13                                                         | 32                                                   |
| .0082 (.208mm)                            | 65                             | 70                    |                                        | 11                                                         | 26                                                   |
| .0058 (.147mm)                            | 100                            | 100                   |                                        | 8                                                          | 20                                                   |
| .0041 (.104mm)                            | 150                            | 140                   |                                        | 6                                                          | 14                                                   |
| .0029 (.073mm)                            | 200                            | 200                   |                                        | 5                                                          | 10                                                   |

### 標準篩析

#### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



篩上累積重量百分比  
WEIGHT PERCENTAGE, CUMULATIVE RETAINED

## Standard screen analysis

給料: 礫石

產品: 混合砂

混合砂用於彌補天然沉積砂和破碎機篩分經常存在的在砂子規格方面的不足。級配不足一般在16、36和50號篩孔尺寸範圍內變化。將不足粒級含量百分比高的混合砂與天然砂混合即可得到正確級配的砂。對每台設備來說, 混合砂與天然砂的精確混合是變化的並取決於天然砂的沉積情況。

閉路流程中的旋盤式破碎機具有保持恒定產品篩析特性的能力, 很適於生產混合砂。因為細度系數的許用變化值通常不超過0.15, 所以在製砂生產中均勻的產品篩析特性顯得很重要。給入旋盤式破碎機的物料一般在閉路篩上進行預篩分, 最小粒度為1/2"。採用乾式篩分, 通常採用8號、10號或12號篩。

Feed: gravel

Product: blend sand

Blend sand is used to make up the deficiencies in sand specifications often found in natural sand deposits and crusher screenings. Grading deficiencies vary, but generally are in the No. 16, 30 and 50 size ranges. Mixing a blend sand that has a high percentage of normally deficient sizes with natural sands will result in a properly graded sand. The precise mixture of blend sand to natural sand varies in each installation and depends on the natural sand deposit.

The ability of a Gyradisc Crusher to maintain constant product analysis in a closed circuit operation makes it ideally suited for the production of blend sand.

篩下累積百分比

CUMULATIVE PER CENT PASSING

| 篩子規格<br>(美國標準篩號)<br>Sieve Size<br>(U.S. No.) | 負4號篩<br>未分選的<br>原砂<br>Minus<br>No. 4<br>Pit Run<br>Sand | 旋盤式破碎機<br>Gyradisc Crusher |               | 經10號篩<br>篩分<br>Screened<br>Through<br>No. 10 | 混合後的<br>混凝土用<br>砂<br>Concrete<br>Sand<br>after<br>Blending | ASTM<br>C-33<br>標準砂<br>ASTM<br>C-33<br>Specifica-<br>tion Sand |
|----------------------------------------------|---------------------------------------------------------|----------------------------|---------------|----------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|
|                                              |                                                         | 給料<br>Feed                 | 產品<br>Product |                                              |                                                            |                                                                |
| 3/8" (9mm)                                   |                                                         | 100                        | 100           |                                              | 100                                                        | 100                                                            |
| No. 4                                        | 100                                                     | 84.5                       | 92            |                                              | 99                                                         | 95-100                                                         |
| No. 8                                        | 74.5                                                    | 42.6                       | 69            | 100                                          | 93                                                         | 80-100                                                         |
| No. 10                                       |                                                         | 29.7                       | 60            | 99.5                                         |                                                            |                                                                |
| No. 16                                       | 46                                                      | 10.2                       | 43            | 90.5                                         | 70                                                         | 50-85                                                          |
| No. 30                                       | 27                                                      | 4.7                        | 28            | 60.5                                         | 40.6                                                       | 25-60                                                          |
| No. 40                                       |                                                         |                            | 21            | 50.2                                         |                                                            |                                                                |
| No. 50                                       | 11                                                      | 3.4                        | 18            | 37                                           | 18                                                         | 10-30                                                          |
| No. 80                                       |                                                         |                            | 12            | 26.5                                         |                                                            |                                                                |
| No. 100                                      | 1.5                                                     |                            | 10            | 20.5                                         | 8                                                          | 2-10                                                           |
| No. 200                                      |                                                         |                            | 6             | 11.4                                         | 3                                                          | 0-5                                                            |
| 細度系數<br>Fineness Modulus                     |                                                         | 3.4                        | 3.36          | 1.96                                         | 2.7                                                        |                                                                |

上例中的混合率為一份天然砂對一份人造砂

The blending ratio in the above example is one part natural to one part manufactured sand.

ation makes it ideally suited for the production of blend sand.

Uniform product analysis is important in sand production because the allowable variation in the fineness modulus

frequently is no more than 0.15. Gyradisc Crusher feed is usually a minimum 1/2" prescreened at the closed circuit screen opening. Screening is dry with the opening normally at No. 8, 10 or 12.

## 標準篩析

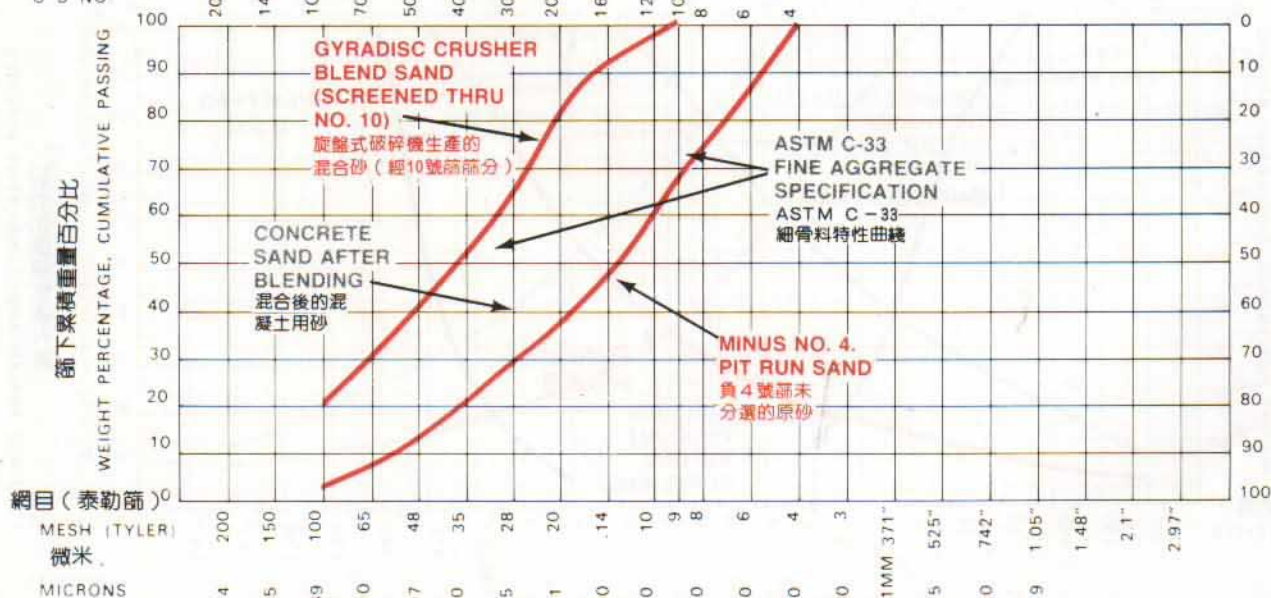
## STANDARD SCREEN ANALYSIS

篩孔 英寸

OPENING, INCH

美國標準篩號

U.S. NO.



給料: 玄武岩

產品: 瀝青混凝土用細集料

一般地講,除了不需要篩去細粒物料而去掉分級機和氣體分離器外,瀝青混凝土用的細集料生產流程圖與人造砂的相似。適當選擇雙層篩的下層篩網可保證最終產品的級配。

Feed: basalt

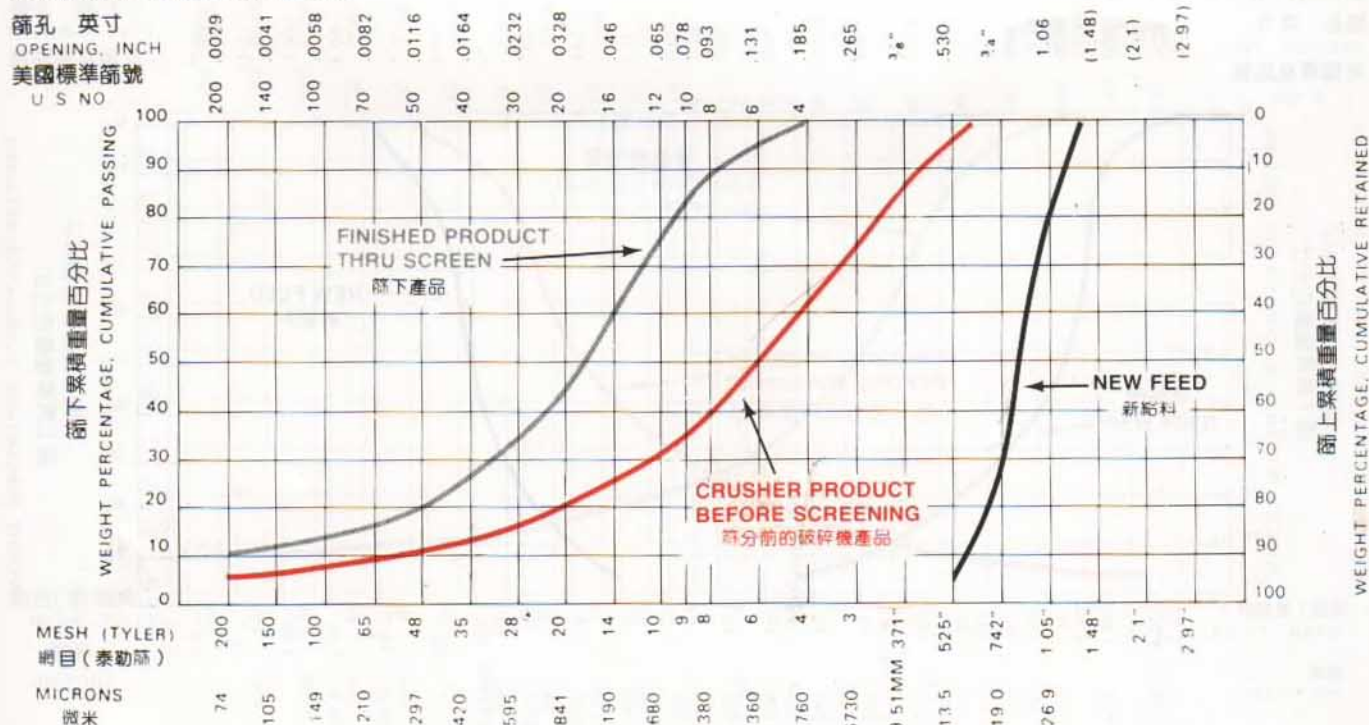
Product: fine aggregate for asphalt concrete

The flow sheet for the production of fine aggregate for asphalt concrete is similar to the flow sheet for manufactured sand except that removal of fines is usually not required and the need for a classifier or air separator is eliminated. The proper selection of screen cloth for the bottom deck of a double deck screen will provide a correctly graded end product.

| 篩孔尺寸<br>(英寸)<br>SIEVE<br>SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH<br>(TYLER) | 美國標準篩號<br>U.S.<br>NO. | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                            |                                                  |
|-------------------------------------------|--------------------------------|-----------------------|----------------------------------------|------------------------------------------------------------|--------------------------------------------------|
|                                           |                                |                       | 新給料<br>NEW<br>FEED                     | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)                               |                                |                       | 100                                    |                                                            |                                                  |
| 1.06 (27mm)                               |                                |                       | 77                                     |                                                            |                                                  |
| .742 (19mm)                               |                                |                       | 25                                     | 100                                                        |                                                  |
| .525 (13mm)                               |                                |                       | 5                                      | 97                                                         |                                                  |
| .371 (9mm)                                |                                |                       |                                        | 84                                                         |                                                  |
| .263 (7mm)                                | 3                              |                       |                                        | 71                                                         |                                                  |
| .185 (5mm)                                | 4                              | 4                     |                                        | 59                                                         | 100                                              |
| .131 (3mm)                                | 6                              | 6                     |                                        | 49                                                         | 96                                               |
| .093 (2mm)                                | 8                              | 8                     |                                        | 41                                                         | 89                                               |
| .065 (1.6mm)                              | 10                             | 12                    |                                        | 32                                                         | 76                                               |
| .046 (1mm)                                | 14                             | 16                    |                                        | 26                                                         | 58                                               |
| .0328 (.833mm)                            | 20                             | 20                    |                                        | 20                                                         | 40                                               |
| .0232 (.589mm)                            | 28                             | 30                    |                                        | 17                                                         | 34                                               |
| .0164 (.416mm)                            | 35                             | 40                    |                                        | 13                                                         | 29                                               |
| .0116 (.294mm)                            | 48                             | 50                    |                                        | 11                                                         | 24                                               |
| .0082 (.208mm)                            | 65                             | 70                    |                                        | 9                                                          | 19                                               |
| .0058 (.147mm)                            | 100                            | 100                   |                                        | 7                                                          | 16                                               |
| .0041 (.104mm)                            | 150                            | 140                   |                                        | 6                                                          | 13                                               |
| .0029 (.073mm)                            | 200                            | 200                   |                                        | 5                                                          | 10                                               |

### 標準篩析

#### STANDARD SCREEN ANALYSIS



# 標準篩析

## Standard screen analysis

給料: 暗色岩  
產品: 密集料

用普通的破碎機很難從暗色岩或花崗岩生產出足夠量的10號篩下產品。但是，旋盤式破碎機的破碎作用可提高細料產量並保持良好的顆粒形狀。

大多數旋盤破碎機用於閉路系統。偶爾也有用開路系統制取細料的。開路產品與制砂廠產品混合時，可得到粒級適宜的產品。如果要求增加細料，用4號篩構成的閉路系統大約是10號篩的篩下產品的兩倍。

Feed: trap rock  
Product: dense grade aggregate

The production of a sufficient amount of fines below the No. 10 screen size from trap rock or granite by conventional crushers is difficult. However, the crushing action of a Gyradisc Crusher increases fines production and maintains a good particle shape.

Most Gyradisc Crushers operate in closed circuit. Occasionally a sufficient quantity of fines is produced in open circuit. When open circuit product is blended with plant product, a suitably graded material results. If additional fines are required, closed circuiting on a No. 4 screen would approximately double the amount passing the sizes below a No. 10 sieve.

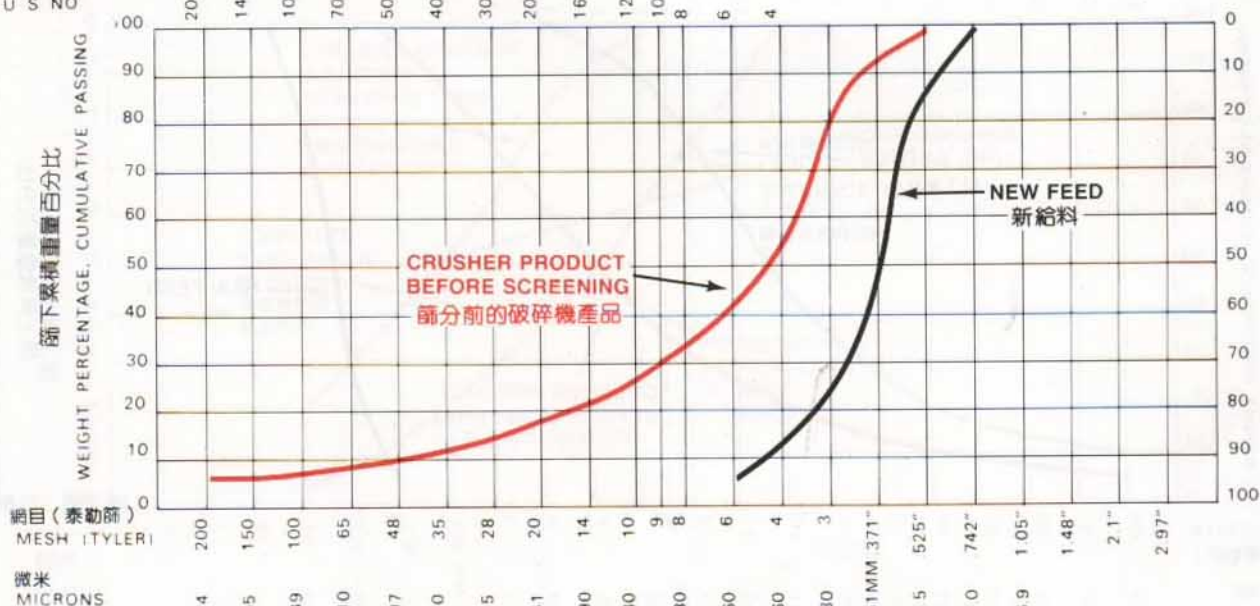
| 篩孔尺寸<br>(英寸)<br>SIEVE SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH (TYLER) | 美國<br>標準篩<br>U.S.<br>NO. | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                            |                                                      |
|----------------------------------------|-----------------------------|--------------------------|----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                                        |                             |                          | 新給料<br>NEW<br>FEED                     | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)                            |                             |                          |                                        |                                                            |                                                      |
| 1.06 (27mm)                            |                             |                          |                                        |                                                            |                                                      |
| .742 (19mm)                            |                             |                          | 100                                    |                                                            |                                                      |
| .525 (13mm)                            |                             |                          | 89                                     | 100                                                        |                                                      |
| .371 (9mm)                             |                             |                          | 44                                     | 95                                                         |                                                      |
| .263 (7mm)                             | 3                           |                          | 24                                     | 77                                                         |                                                      |
| .185 (5mm)                             | 4                           | 4                        | 12                                     | 58                                                         |                                                      |
| .131 (3mm)                             | 6                           | 6                        | 6                                      | 45                                                         |                                                      |
| .093 (2mm)                             | 8                           | 8                        |                                        | 34                                                         |                                                      |
| .065 (1.6mm)                           | 10                          | 12                       |                                        | 27                                                         |                                                      |
| .046 (1mm)                             | 14                          | 16                       |                                        | 22                                                         |                                                      |
| .0328 (.833mm)                         | 20                          | 20                       |                                        | 18                                                         |                                                      |
| .0232 (.589mm)                         | 28                          | 30                       |                                        | 15                                                         |                                                      |
| .0164 (.416mm)                         | 35                          | 40                       |                                        | 13                                                         |                                                      |
| .0116 (.294mm)                         | 48                          | 50                       |                                        | 11                                                         |                                                      |
| .0082 (.208mm)                         | 65                          | 70                       |                                        | 9                                                          |                                                      |
| .0058 (.147mm)                         | 100                         | 100                      |                                        | 8                                                          |                                                      |
| .0041 (.104mm)                         | 150                         | 140                      |                                        | 7                                                          |                                                      |
| .0029 (.073mm)                         | 200                         | 200                      |                                        | 6                                                          |                                                      |

開路系統  
OPEN CIRCUIT

### 標準篩析

#### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING INCH  
美國標準篩號  
U.S. NO.



給料: 長形(粘性)粗粒集料

產品: 立方砂

如本樣本第四頁所述, 旋盤式破碎機的破碎為粒子間的層壓破碎, 是由多層物料粒子間相互沖擊和研磨的綜合作用實現的。因為是粒子對粒子的破碎, 在物料的長度方向發生破碎, 因而能形成立方形產品。這種獨特的破碎作用利用適當的速度和破碎比生產出粒度範圍很寬的產品。與高速雙轉子反擊式破碎機和錘式破碎機相比, 在使過細物料或廢品減至最少的同時能保持較低的鐵板費用。

除細集料的生產外, 在要求把產品顆粒改進成立方形的地方, 也可用旋盤式破碎機生產粒度在3/4"至4號篩孔之間的粗集料。機器在排礦口尺寸3/8"到1"的狀態下工作, 給料粒度不大於3"時, 無論開路還是閉路均可達到上述目的。

Feed: elongated (slabby)  
coarse aggregate

Product: cubical shape

As defined on page 4 of this bulletin, the Gyrodisc crushing action known as Interparticle Comminution is performed by a combination of impact and attrition of a multi-layered mass of particles. It is through the reduction of this depth of material, as particle is fractured upon particle, that creates the cubical product shape. This unique crushing action utilizes the proper speed and reduction ratios for a wide range of product sizes. This keeps metal costs low while minimizing the production of extreme fines or waste products when compared to high speed secondary impact crushers and hammermills.

In addition to fine aggregate production, coarse aggregate sizes between 3/4" and # 4 are

produced in the Gyrodisc Crusher where improved cubical particle shape is a requirement. With feed

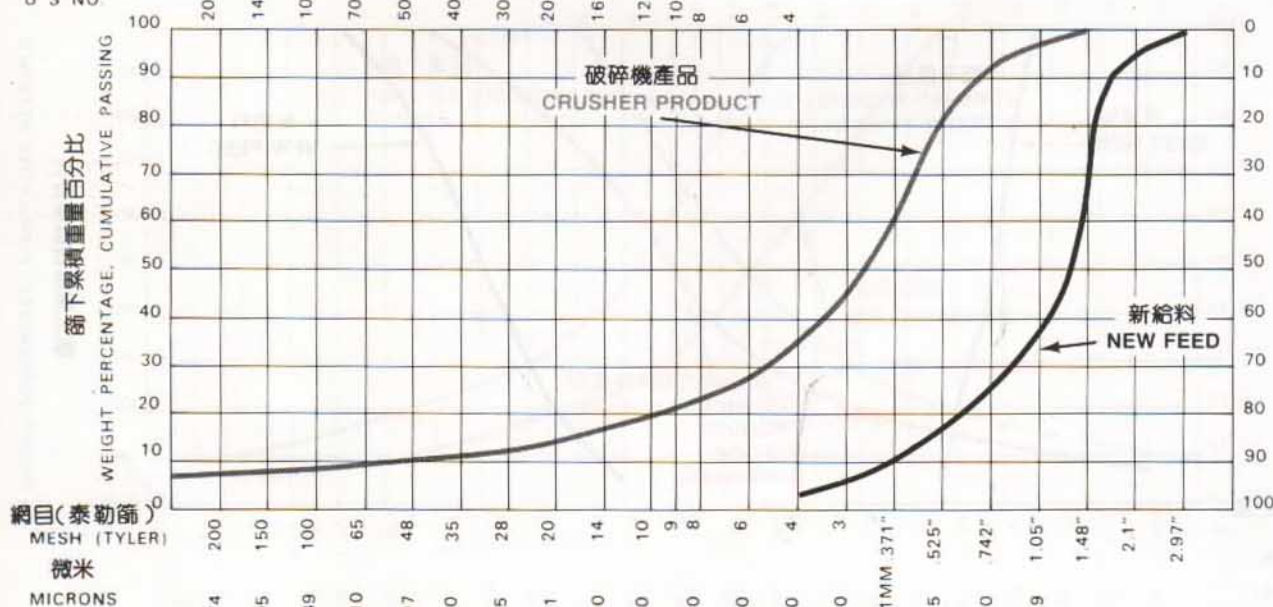
sizes ranging up to 3" and operating at setting of 3/8" to 1", either open or closed circuit has been successful.

| 篩孔尺寸<br>(英寸)<br>SIEVE<br>SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH<br>(TYLER) | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |     |                                                            |
|-------------------------------------------|--------------------------------|----------------------------------------|-----|------------------------------------------------------------|
|                                           |                                | 美國標準篩號                                 | 新給料 | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING |
| 2.97 (75mm)                               |                                |                                        | 100 |                                                            |
| 2.1 (53mm)                                |                                |                                        | 98  |                                                            |
| 1.48 (38mm)                               |                                |                                        | 86  | 100                                                        |
| 1.06 (27mm)                               |                                |                                        | 37  | 99                                                         |
| .742 (19mm)                               |                                |                                        | 28  | 95                                                         |
| .525 (13mm)                               |                                |                                        | 19  | 85                                                         |
| .371 (9mm)                                |                                |                                        | 13  | 61                                                         |
| .263 (7mm)                                | 3                              |                                        | 8   | 45                                                         |
| .185 (5mm)                                | 4                              | 4                                      | 4   | 35                                                         |
| .131 (3mm)                                | 6                              | 6                                      | 2   | 28                                                         |
| .093 (2mm)                                | 8                              | 8                                      | 1   | 24                                                         |
| .065 (1.6mm)                              | 10                             | 12                                     |     | 20                                                         |
| .046 (1mm)                                | 14                             | 16                                     |     | 17                                                         |
| .0328 (.833mm)                            | 20                             | 20                                     |     | 15                                                         |
| .0232 (.589mm)                            | 28                             | 30                                     |     | 13                                                         |
| .0164 (.416mm)                            | 35                             | 40                                     |     | 12                                                         |
| .0116 (.294mm)                            | 48                             | 50                                     |     | 10                                                         |
| .0082 (.208mm)                            | 65                             | 70                                     |     | 9                                                          |
| .0058 (.147mm)                            | 100                            | 100                                    |     | 8                                                          |
| .0041 (.104mm)                            | 150                            | 140                                    |     | 7                                                          |
| .0029 (.073mm)                            | 200                            | 200                                    |     | 6                                                          |

## 標準篩析

### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



篩上累積重量百分比  
WEIGHT PERCENTAGE, CUMULATIVE RETAINED

# 標準篩析 Standard screen analysis

給料: 膨脹油頁岩

產品: 輕集料

旋盤式破碎機可將膨脹油頁岩制成粒  
度均勻的輕集料。除了不需要篩去細粒物  
料而丟掉分級機和氣體分離器外, 生產輕  
集料的流程圖與人造砂流程圖類似。

膨脹油頁岩的磨蝕特性和5~10%的  
含水量不會提高本來很低的旋盤破碎機生  
產和維修費用。例如: 用一台旋盤式破碎  
機將磨蝕性油頁岩破碎成4號篩下的輕集  
料, 順成本為0.04美元, 而反擊式破碎機  
的順成本則為0.15美元。當給料為低磨蝕  
性物料時, 生產輕集料的順成本低於0.02  
美元。

Feed: expanded shale

Product: lightweight  
aggregate

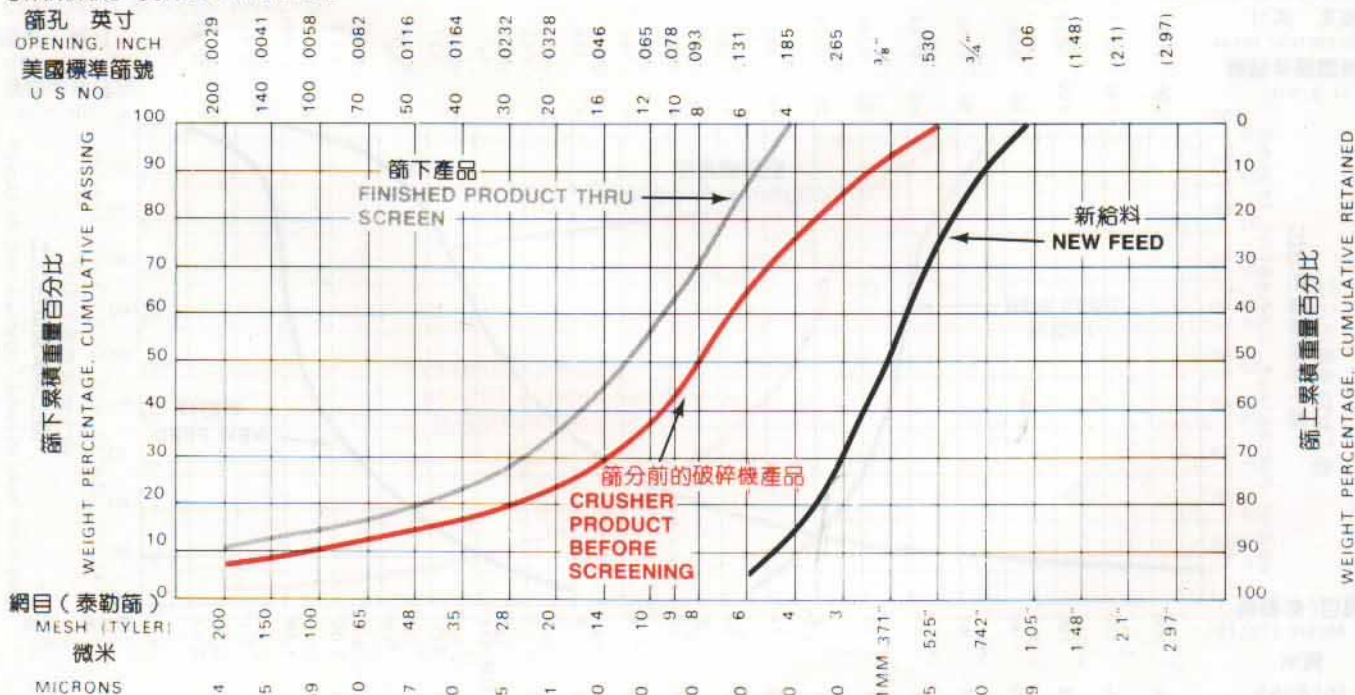
The Gyradisc Crusher produces an consistent  
uniformly graded lightweight aggregate from  
expanded shale. The flow sheet for the production of li-  
ghtweight aggregate is similar to the flow sheet for  
manufactured sand except that removal of fines is not  
required. This eliminates the need for a classifier or air  
separator.

Expanded shale's abrasive nature and 5 to 10 percent  
moisture content does not increase the low operating and  
maintenance costs of Gyradisc Crushers. In one  
example, a Gyradisc Crusher reduced abrasive  
shale rock to minus No. 4 lightweight aggregate for  
\$.04 per ton compared to \$.15 per ton for an im-  
pact crusher. When a less abrasive material is used as  
feed, a lightweight aggregate can be produced for less  
than \$.02 per ton.

| 篩孔尺寸<br>(英寸)<br>SIEVE SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH (TYLER) | 美國標<br>准篩號<br>U.S.<br>NO. | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                            |                                                      |
|----------------------------------------|-----------------------------|---------------------------|----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                                        |                             |                           | 新給料<br>NEW<br>FEED                     | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)                            |                             |                           |                                        |                                                            |                                                      |
| 1.06 (27mm)                            |                             |                           | 100                                    |                                                            |                                                      |
| .742 (19mm)                            |                             |                           | 95                                     |                                                            |                                                      |
| .525 (13mm)                            |                             |                           | 75                                     | 99                                                         |                                                      |
| .371 (9mm)                             |                             |                           | 50                                     | 95                                                         |                                                      |
| .263 (7mm)                             | 3                           |                           | 27                                     | 87                                                         |                                                      |
| .185 (5mm)                             | 4                           | 4                         | 12                                     | 75                                                         | 100                                                  |
| .131 (3mm)                             | 6                           | 6                         | 4                                      | 63                                                         | 87                                                   |
| .093 (2mm)                             | 8                           | 8                         |                                        | 48                                                         | 72                                                   |
| .065 (1.6mm)                           | 10                          | 12                        |                                        | 38                                                         | 56                                                   |
| .046 (1mm)                             | 14                          | 16                        |                                        | 30                                                         | 43                                                   |
| .0328 (.833mm)                         | 20                          | 20                        |                                        | 25                                                         | 34                                                   |
| .0232 (.589mm)                         | 28                          | 30                        |                                        | 20                                                         | 26                                                   |
| .0164 (.416mm)                         | 35                          | 40                        |                                        | 17                                                         | 21                                                   |
| .0116 (.294mm)                         | 48                          | 50                        |                                        | 14                                                         | 18                                                   |
| .0082 (.208mm)                         | 65                          | 70                        |                                        | 12                                                         | 15                                                   |
| .0058 (.147mm)                         | 100                         | 100                       |                                        | 10                                                         | 12                                                   |
| .0041 (.104mm)                         | 150                         | 140                       |                                        | 8                                                          | 10                                                   |
| .0029 (.073mm)                         | 200                         | 200                       |                                        | 7                                                          | 8                                                    |

## 標準篩析

### STANDARD SCREEN ANALYSIS



給料: 石灰岩  
產品: 助熔石

新的熔煉方法的發展，迅速改變着對助熔石的粒度要求。通常細粒級的助熔石可以減緩熔爐內的熱裂現象。對更細的助熔石的需求，要求有效率更高的細碎破碎機。產品粒度均勻加上襯板、維修的噸成本低於0.01美元，使得旋盤式破碎機成為這種作業的理想設備。

Feed: dolomite

Product: flux  
stone

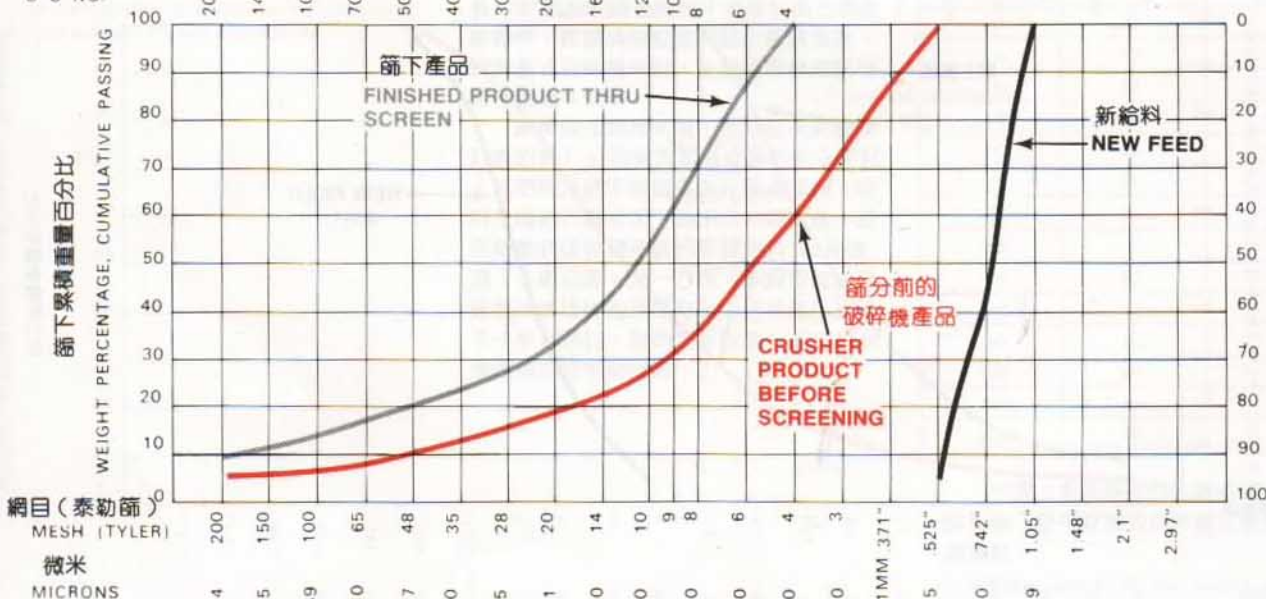
Size requirements for flux stone have been changing rapidly with the development of new smelting procedures. Because flux stone is usually fine-grained to reduce decrepitation in the furnace, the finer gradations now in demand require more efficient fine crushers. The consistent gradation obtained, combined with liner and maintenance costs at less than \$.01 per ton, make the Gyradisc Crusher ideal for this type of application.

| 篩孔尺寸<br>(英寸)              | 網目<br>(泰勒篩)     | 美國標準篩號      | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                           |                                       |
|---------------------------|-----------------|-------------|----------------------------------------|-------------------------------------------|---------------------------------------|
|                           |                 |             | 新給料                                    | 篩分前的<br>破碎機產品                             | 通過篩分的<br>成品                           |
| SIEVE<br>SIZE<br>(INCHES) | MESH<br>(TYLER) | U.S.<br>NO. | NEW<br>FEED                            | CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)               |                 |             |                                        |                                           |                                       |
| 1.06 (27mm)               |                 |             | 100                                    |                                           |                                       |
| .742 (19mm)               |                 |             | 41                                     |                                           |                                       |
| .525 (13mm)               |                 |             | 4                                      | 100                                       |                                       |
| .371 (9mm)                |                 |             |                                        | 89                                        |                                       |
| .263 (7mm)                | 3               |             |                                        | 75                                        |                                       |
| .185 (5mm)                | 4               | 4           |                                        | 59                                        | 100                                   |
| .131 (3mm)                | 6               | 6           |                                        | 46                                        | 88                                    |
| .093 (2mm)                | 8               | 8           |                                        | 36                                        | 68                                    |
| .065 (1.6mm)              | 10              | 12          |                                        | 28                                        | 53                                    |
| .046 (1mm)                | 14              | 16          |                                        | 22                                        | 41                                    |
| .0328 (.833mm)            | 20              | 20          |                                        | 17                                        | 33                                    |
| .0232 (.589mm)            | 28              | 30          |                                        | 15                                        | 27                                    |
| .0164 (.416mm)            | 35              | 40          |                                        | 12                                        | 23                                    |
| .0116 (.294mm)            | 48              | 50          |                                        | 10                                        | 19                                    |
| .0082 (.208mm)            | 65              | 70          |                                        | 8                                         | 17                                    |
| .0058 (.147mm)            | 100             | 100         |                                        | 6                                         | 14                                    |
| .0041 (.104mm)            | 150             | 140         |                                        | 4                                         | 11                                    |
| .0029 (.073mm)            | 200             | 200         |                                        | 3                                         | 9                                     |

## 標準篩析

### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



篩上累積重量百分比  
WEIGHT PERCENTAGE, CUMULATIVE RETAINED

# 標準篩析

## Standard screen analysis

給料: 花崗岩

產品: 屋頂材料用砂

生產屋頂材料用砂需要破碎硬而韌的物料。並且一般說來, 這些物料具有磨蝕性, 連續的瀝青灌注作業要求砂粒為立方形。

雖然有好幾種粒度規定, 但最常用的應符合下述要求:

Feed: granite

Product: roofing granules

The manufacture of roofing granules requires the reduction of a hard, tough, and often abrasive rock. The subsequent asphalt embedding process requires the granule to have a cubical shape.

While there are several grading specifications, the most common size granules must comply with the following specifications:

| 篩號<br>SIEVE NO.    |                           | 篩上百分數<br>PERCENTAGE RETAINED |                               |
|--------------------|---------------------------|------------------------------|-------------------------------|
| 美國標準篩號<br>U.S. NO. | 網目<br>泰勒篩<br>MESH (TYLER) | 9號篩<br>粒級<br>NO. 9<br>GRADE  | 11號篩<br>粒級<br>NO. 11<br>GRADE |
| 8                  | 8                         | 0-10                         | 0-30                          |
| 12                 | 10                        | 30-50                        | 25-40                         |
| 16                 | 14                        | 25-45                        | 35-45                         |
| 20                 | 20                        | 10-20                        | 10-30                         |
| 30                 | 28                        | 0-5                          | 0-10                          |
| 40                 | 35                        |                              | 0-2                           |
| 50                 | 48                        |                              |                               |

粒砂生產中破碎的目的是始終保持立方形產品, 且不產生過細產品, 可控的旋盤式破碎機的破碎作用使粒砂產量大致保持在50~65%。

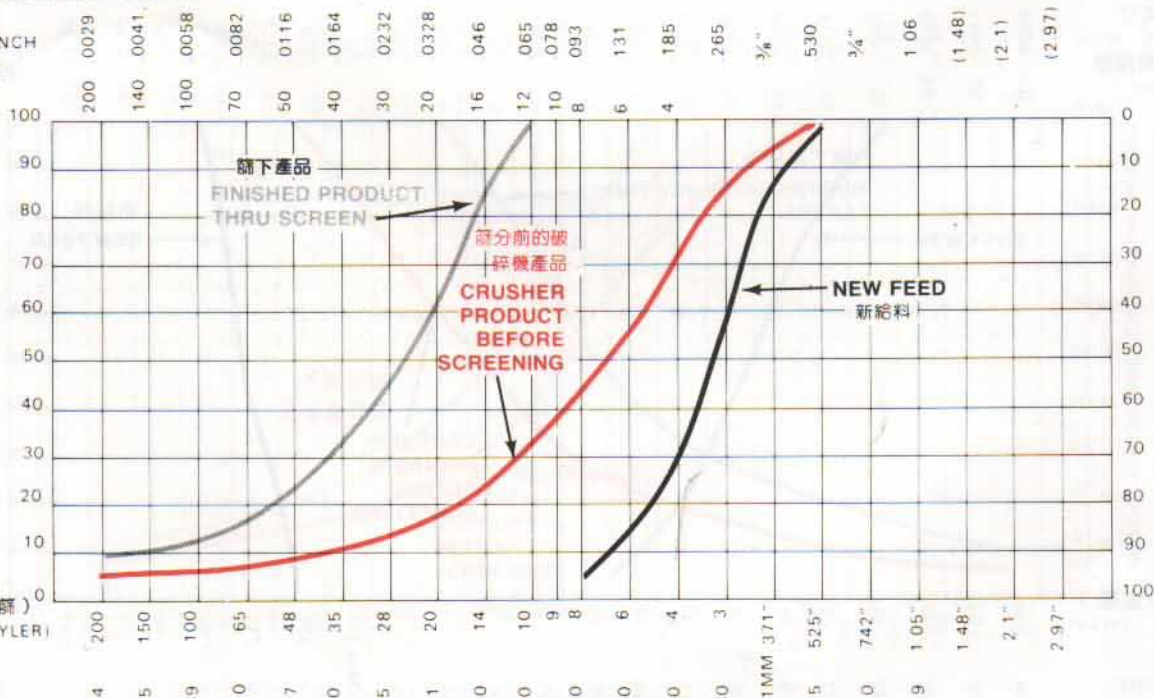
### 標準篩析

#### STANDARD SCREEN ANALYSIS

篩孔英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.

篩下累積重量百分比  
WEIGHT PERCENTAGE, CUMULATIVE PASSING

網目 (泰勒篩)  
MESH (TYLER)  
毫米  
MICRONS



低的沖擊速度使襯板磨損速度保持在最低水平。相對來說, 寬的排礦口也有助於生產正常瀝青灌封和屋頂板最大覆蓋厚度所必需的立方形砂。

The objective in crushing for granule production is to maintain a consistent cubical product without

creating excessive fines. The controlled reduction crushing action of Gyradisc crusher, provides an approximate granule yield of 50 to 65 per cent.

The low impact velocity keeps liner wear rates at a minimum. The relatively wide settings also contribute to the cubical shape of the granule necessary for proper asphalt embedding and maximum coverage on the shingle.

# 選礦業

## Mining Industry

向棒—球磨機給入均勻的物料可提高磨機的生產能力

磨機給料中含有部分粒度過大，與磨機介質尺寸不相稱的物料時，會降低磨機的效率。由於磨機內運轉因素間的平衡作用很微弱，使得想通過磨機自身調節解決這個問題的企圖無法奏效。

給料愈大愈硬，高效破碎所需的表面壓力愈大，為增大表面壓力，必須增大磨機介質的尺寸。介質增大降低了研磨細粒物料的機率，從而減小了磨機的產量。忽略這個問題是非常不利的，因為介質選擇不當影響破碎大顆粒物料；降低磨礦能力。大顆粒物料還隔開研磨介質，導致介質與小顆粒物料表面接觸機會減少，進一步降低了研磨能力。

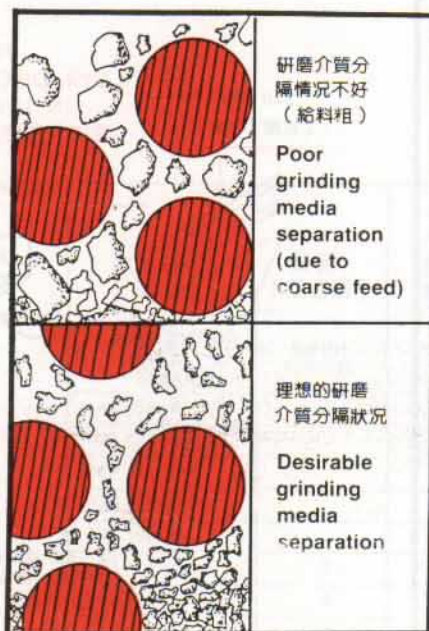
生產粒度均勻的磨機原料是達到最佳磨機生產能力的理想方法。

Uniform rod-ball mill feed increases grinding mill capacity

Mill feed which contains a portion of oversize particles which are disproportionate in size to the size of grinding media, greatly reduces grinding mill efficiency. Trying to correct this problem by making adjustments at the grinding mill is self defeating due to the fine balance between the operational factors in a mill.

The larger and harder the feed particle the more surface pressure that is required to efficiently break up the particle. To increase surface pressure it is necessary to increase the size of grinding media. Increasing the size of the media decreases the probability for grinding small particles and grinding capacity is reduced. Ignoring the problem is just as unproductive, since the media is incorrectly sized to efficiently break up the larger particles and grinding capacity is reduced. Also the larger particles spread the grinding media resulting in less surface contact with the smaller particles which only results in further reduction in grinding capacity.

The ideal solution is to produce a uniform sized feed for optimum grinding mill capacity.



研磨介質分離情況不好  
(給料粗)

Poor grinding media separation (due to coarse feed)

理想的研磨介質分離狀況

Desirable grinding media separation

用 Nordberg 破碎機生產磨機給料以獲得最佳的磨機性能。

生產細的磨機給料的優點早已被人們認識到了。通常在二段磨流程中，棒磨機的給料粒度為負 3/4"。當磨機給料的粒徑上限盡可能接近名義尺寸 3/4" 時，可提高棒磨機的效率。在閉路中工作的西蒙斯短頭型圓錐破碎機可滿足生產 3/4" 的磨機原料的要求。

增加棒磨機效率的一個典型例子是將磨機的給料粒度由 15% 的正 3/4" 降到 2% 的正 3/4" 時，棒磨機給料速度可增加 20%。棒間距的減少是增大生產能力的主要原因。

當篩孔細到 3/8" 時，西蒙斯短頭型圓錐破碎機用於閉路系統可實現高產量作業。破碎機和篩子的正常維修必須始終保持低費用運轉。生產負 1/2" 粒級或偶爾生產負 3/8" 粒級的磨機給料，受限於礦石的破碎特性，循環負荷粒徑及篩上循環負荷。對旋盤式破碎機來說，生產的磨機給料可全部通過 4 號篩。

對單段球磨機來說，原料粒徑範圍從軟礦的負 3/4" 粒級到某些硬礦石的 3 網目。經閉路系統中旋盤式破碎機處理前、後的球磨給料篩析如下表所示。請注意，使用旋盤式破碎機系統的磨機給料 100% 通過了 3 網目篩。另一方面，未經旋盤式破碎機系統破碎的球磨給料中有相當百分比不小於 3 網目。對典型單段負 1/2" 的球磨機給料的分析給出如下：

Nordberg crushers produce mill feed for optimum grinding mill performance

The advantages of producing a fine mill feed have been recognized for many years. Rod mill feed size in two stage grinding circuits is usually minus 3/4". Rod mill efficiency improves when the top size of a nominal 3/4" mill feed is kept as close to 3/4" as possible. Symons short head cone crushers operating in closed circuit will produce the 3/4" mill feed.

A typical example of increased rod mill efficiency is when the mill feed is reduced from 15 percent plus 3/4" to 2 percent plus 3/4" resulting in a rod mill feed rate increase of 20 percent. A reduction in rod spreading is the principal reason for the increased capacity.

Closed circuit crushing in Symons short head cone crushers is practical in large tonnage operations when screen openings as fine as 3/8" are used. Proper maintenance of crushers and screens must be maintained to continue a low cost operation. Producing a ball mill feed below 1/2" or occasionally 3/8" is limited by the crushing characteristics of the ore, the size of the circulating loads, and the circulating loads effect on screening. With the Gyradisc crusher, mill feeds all passing 4 mesh is possible.

In single stage ball mill grinding, the feed size ranges from minus 3/4" for soft ores to 3 mesh on some of the harder ores. A sieve analysis of ball mill feed before and after passing through a typical Gyradisc crusher operating in a closed circuit is shown in the adjoining chart. Note that the ball mill feed using the Gyradisc crusher circuit has 100% passing 3 mesh. On the other hand, the ball mill feed without passing through the Gyradisc crusher circuit has a considerable percentage of material in and above plus 3 mesh.

An examination of a typical single stage minus 1/2" ball mill feed shows the following gradation:

篩上累積百分比  
Cumulative per cent retained

| 篩子規格<br>(泰勒篩網目)            | 單段球磨<br>給料百分比                             | 旋盤式破碎機<br>系統生產的球<br>磨機給料                            |
|----------------------------|-------------------------------------------|-----------------------------------------------------|
| SIEVE SIZE<br>(TYLER MESH) | PRESENT SINGLE<br>STAGE BALL<br>MILL FEED | BALL MILL FEED<br>USING GYRADISC<br>CRUSHER CIRCUIT |
| .525 in. (13mm)            | 4                                         |                                                     |
| .371 in. (9mm)             | 16                                        |                                                     |
| 3                          | 33                                        |                                                     |
| 4                          | 45                                        | 18                                                  |
| 6                          | 53                                        | 30                                                  |
| 8                          | 60                                        | 40                                                  |
| 10                         | 66                                        | 49                                                  |
| 14                         | 71                                        | 57                                                  |
| 20                         | 75                                        | 63                                                  |
| 28                         | 77                                        | 66                                                  |
| 35                         | 80                                        | 70                                                  |
| 48                         | 83                                        | 75                                                  |
| 65                         | 85                                        | 78                                                  |
| 100                        | 87                                        | 81                                                  |
| 150                        | 89                                        | 84                                                  |
| 200                        | 90                                        | 85                                                  |

世界上愈來愈多的先進的礦山公司已認識到了使用旋盤式破碎機生產磨機給料的優點。

A growing number of the world's progressive mining companies are realizing the advantages of operating Gyradisc crushers in mill feed production.



# 球磨機給料

## Ball mill feed

給料: 硫化鉬礦  
產品: 球磨機給料

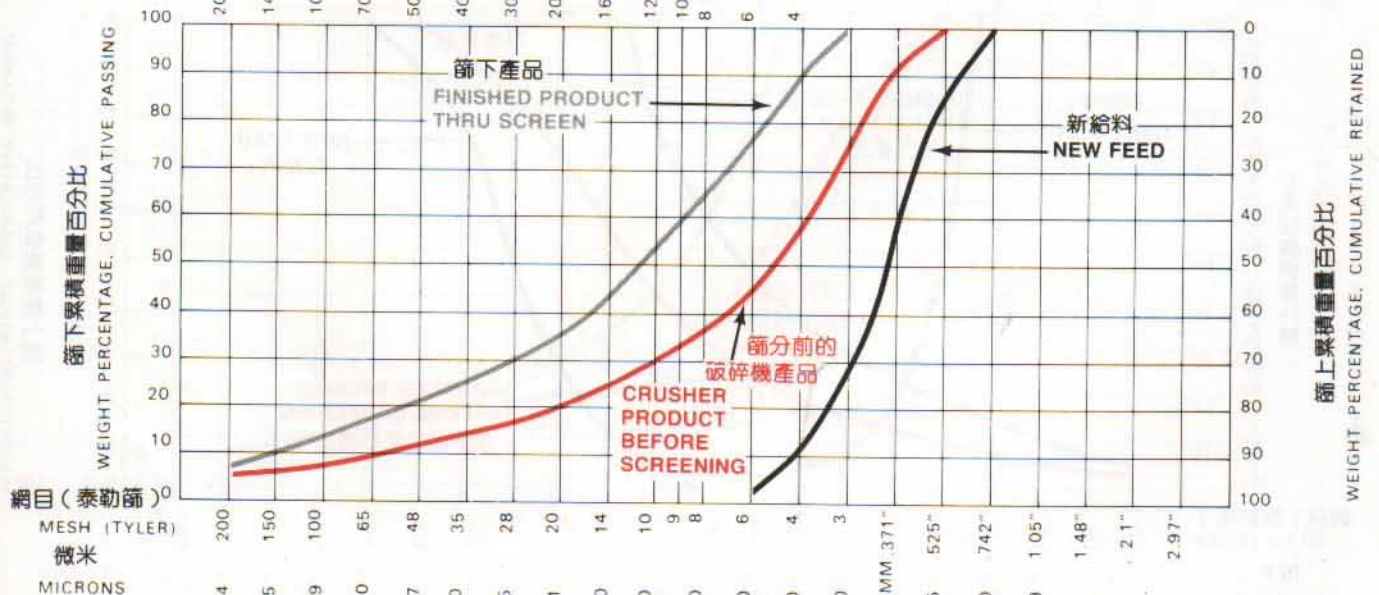
Feed: copper ore  
Product: ball mill feed

| 篩孔尺寸<br>(英寸)<br>SIEVE SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH<br>(TYLER) | 美國標準篩號<br>U.S. NO. | 篩下累積百分數<br>CUMULATIVE PER CENT PASSING |                                                      |                                            |
|----------------------------------------|--------------------------------|--------------------|----------------------------------------|------------------------------------------------------|--------------------------------------------|
|                                        |                                |                    | 新給料<br>NEW FEED                        | 篩分前的<br>破碎機產品<br>CRUSHER PRODUCT<br>BEFORE SCREENING | 通過篩分的成品<br>FINISHED PRODUCT<br>THRU SCREEN |
| 1.48 (38mm)                            |                                |                    |                                        |                                                      |                                            |
| 1.06 (27mm)                            |                                |                    |                                        |                                                      |                                            |
| .742 (19mm)                            |                                |                    | 1                                      |                                                      |                                            |
| .525 (13mm)                            |                                |                    | 18                                     | 1                                                    |                                            |
| .371 (9mm)                             |                                |                    | 49                                     | 8                                                    |                                            |
| .263 (7mm)                             | 3                              |                    | 74                                     | 26                                                   |                                            |
| .185 (5mm)                             | 4                              | 4                  | 90                                     | 42                                                   | 11                                         |
| .131 (3mm)                             | 6                              | 6                  | 97                                     | 54                                                   | 26                                         |
| .093 (2mm)                             | 8                              | 8                  |                                        | 62                                                   | 37                                         |
| .065 (1.6mm)                           | 10                             | 12                 |                                        | 69                                                   | 47                                         |
| .046 (1mm)                             | 14                             | 16                 |                                        | 74                                                   | 55                                         |
| .0328 (.833mm)                         | 20                             | 20                 |                                        | 79                                                   | 63                                         |
| .0232 (.589mm)                         | 28                             | 30                 |                                        | 83                                                   | 69                                         |
| .0164 (.416mm)                         | 35                             | 40                 |                                        | 85                                                   | 74                                         |
| .0116 (.294mm)                         | 48                             | 50                 |                                        | 87                                                   | 78                                         |
| .0082 (.208mm)                         | 65                             | 70                 |                                        | 89                                                   | 82                                         |
| .0058 (.147mm)                         | 100                            | 100                |                                        | 92                                                   | 86                                         |
| .0041 (.104mm)                         | 150                            | 140                |                                        | 94                                                   | 90                                         |
| .0029 (.073mm)                         | 200                            | 200                |                                        | 96                                                   | 94                                         |

### 標準篩析

#### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



# 球磨機給料

## Ball mill feed

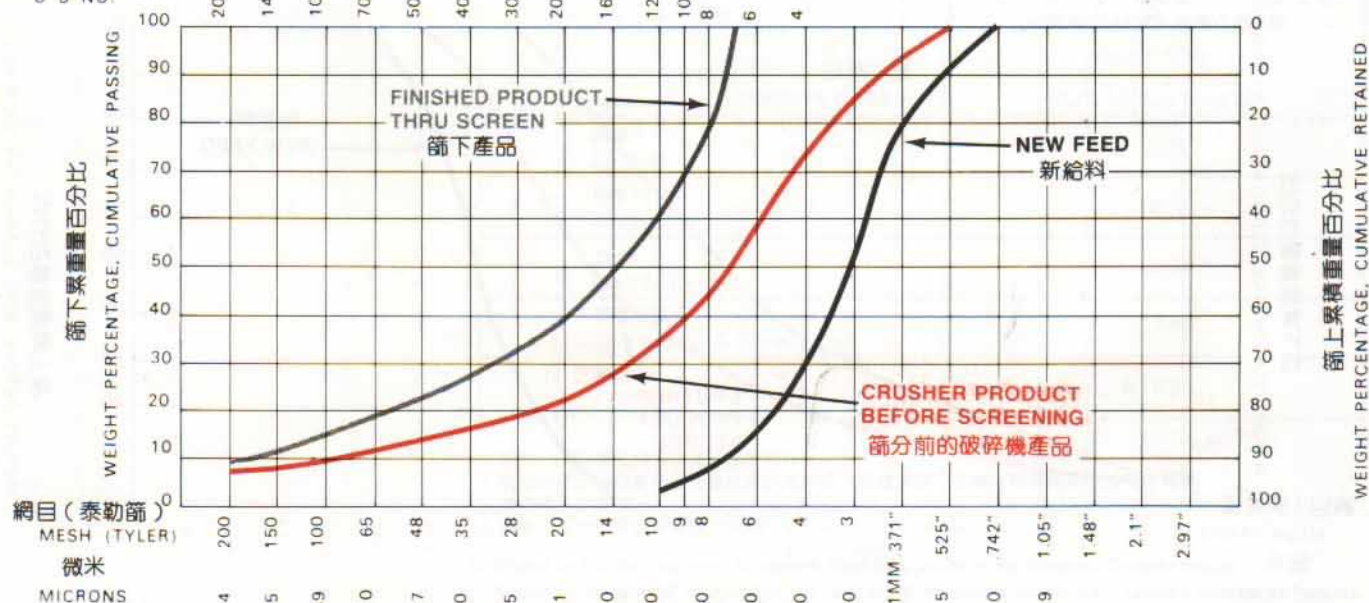
給料: 鐵礦石  
產品: 球磨機給料

Feed: iron ore  
Product: ball  
mill feed

| 篩孔尺寸<br>(英寸)<br>SIEVE<br>SIZE<br>(INCHES) | 網目<br>(泰勒篩)<br>MESH<br>(TYLER) | 美國標準<br>篩號<br>U.S.<br>NO. | 篩下累積百分數<br>CUMULATIVE PER CENT RETAINED |                                                            |                                                      |
|-------------------------------------------|--------------------------------|---------------------------|-----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                                           |                                |                           | 新給料<br>NEW<br>FEED                      | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| 1.48 (38mm)                               |                                |                           |                                         |                                                            |                                                      |
| 1.06 (27mm)                               |                                |                           |                                         |                                                            |                                                      |
| .742 (19mm)                               |                                |                           | 1                                       |                                                            |                                                      |
| .525 (13mm)                               |                                |                           | 8                                       |                                                            |                                                      |
| .371 (9mm)                                |                                |                           | 21                                      | 8                                                          |                                                      |
| .263 (7mm)                                | 3                              |                           | 49                                      | 16                                                         |                                                      |
| .185 (5mm)                                | 4                              | 4                         | 72                                      | 27                                                         |                                                      |
| .131 (3mm)                                | 6                              | 6                         | 84                                      | 42                                                         |                                                      |
| .093 (2mm)                                | 8                              | 8                         | 92                                      | 55                                                         | 19                                                   |
| .065 (1.6mm)                              | 10                             | 12                        | 97                                      | 65                                                         | 39                                                   |
| .046 (1mm)                                | 14                             | 16                        |                                         | 72                                                         | 52                                                   |
| .0328 (.833mm)                            | 20                             | 20                        |                                         | 77                                                         | 59                                                   |
| .0232 (.589mm)                            | 28                             | 30                        |                                         | 81                                                         | 65                                                   |
| .0164 (.416mm)                            | 35                             | 40                        |                                         | 85                                                         | 70                                                   |
| .0116 (.294mm)                            | 48                             | 50                        |                                         | 87                                                         | 75                                                   |
| .0082 (.208mm)                            | 65                             | 70                        |                                         | 90                                                         | 80                                                   |
| .0058 (.147mm)                            | 100                            | 100                       |                                         | 92                                                         | 85                                                   |
| .0041 (.104mm)                            | 150                            | 140                       |                                         | 94                                                         | 89                                                   |
| .0029 (.073mm)                            | 200                            | 200                       |                                         | 96                                                         | 92                                                   |

### 標準篩析 STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



# Capacity Table

給料: 銅礦

產品: 球磨機給料

Feed: moly-sulphide ore

Product: ball

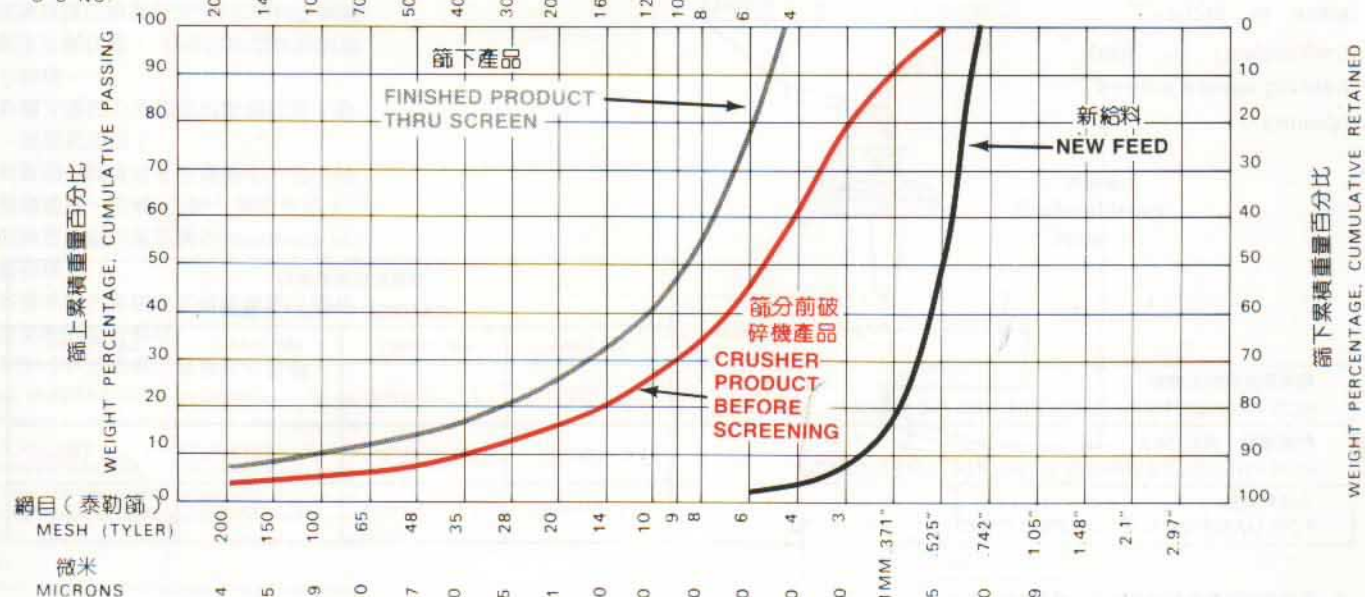
mill feed

| 篩孔尺寸<br>(英寸)              | 網目<br>(泰勒篩)     | 美國標準篩號      | 篩下累積百分數<br>CUMULATIVE PER CENT RETAINED |                                                            |                                                      |
|---------------------------|-----------------|-------------|-----------------------------------------|------------------------------------------------------------|------------------------------------------------------|
|                           |                 |             | 新給料                                     | 篩分前的<br>破碎機產品<br>CRUSHER<br>PRODUCT<br>BEFORE<br>SCREENING | 通過篩分<br>的成品<br>FINISHED<br>PRODUCT<br>THRU<br>SCREEN |
| SIEVE<br>SIZE<br>(INCHES) | MESH<br>(TYLER) | U.S.<br>NO. | NEW<br>FEED                             |                                                            |                                                      |
| 1.48 (38mm)               |                 |             |                                         |                                                            |                                                      |
| 1.06 (27mm)               |                 |             |                                         |                                                            |                                                      |
| .742 (19mm)               |                 |             |                                         |                                                            |                                                      |
| .525 (13mm)               |                 |             | 47                                      | 1                                                          |                                                      |
| .371 (9mm)                |                 |             | 81                                      | 7                                                          |                                                      |
| .263 (7mm)                | 3               |             | 91                                      | 21                                                         |                                                      |
| .185 (5mm)                | 4               | 4           | 97                                      | 36                                                         |                                                      |
| .131 (3mm)                | 6               | 6           | 99                                      | 51                                                         | 19                                                   |
| .093 (2mm)                | 8               | 8           |                                         | 62                                                         | 42                                                   |
| .065 (1.6mm)              | 10              | 12          |                                         | 71                                                         | 55                                                   |
| .046 (1mm)                | 14              | 16          |                                         | 77                                                         | 64                                                   |
| .0328 (.833mm)            | 20              | 20          |                                         | 83                                                         | 73                                                   |
| .0232 (.589mm)            | 28              | 30          |                                         | 86                                                         | 78                                                   |
| .0164 (.416mm)            | 35              | 40          |                                         | 89                                                         | 83                                                   |
| .0116 (.294mm)            | 48              | 50          |                                         | 92                                                         | 88                                                   |
| .0082 (.208mm)            | 65              | 70          |                                         | 93                                                         | 89                                                   |
| .0058 (.147mm)            | 100             | 100         |                                         | 95                                                         | 92                                                   |
| .0041 (.104mm)            | 150             | 140         |                                         | 96                                                         | 94                                                   |
| .0029 (.073mm)            | 200             | 200         |                                         | 97                                                         | 95                                                   |

## 標準篩析

### STANDARD SCREEN ANALYSIS

篩孔 英寸  
OPENING, INCH  
美國標準篩號  
U.S. NO.



# 破碎腔

## Crushing cavity

構成旋盤式破碎機破碎腔的破碎機襯板由裝在調整套上的襯板和裝在軀體或主軸部上的下襯板組成。由於給料和產品範圍很廣，腔形結構能夠改變是旋盤式破碎機成功的重要因素。

按給料和產品的要求，右圖中標定為B的喉部開口受襯板正常磨損的影響。每轉的破碎比為開口邊尺寸“C”與開口邊喉部開口“B”之比。標定為“A”的閉口邊排礦口通常在1/4"到1/2"之間，即使在閉路中生產8號篩篩下產品時，也是如此。

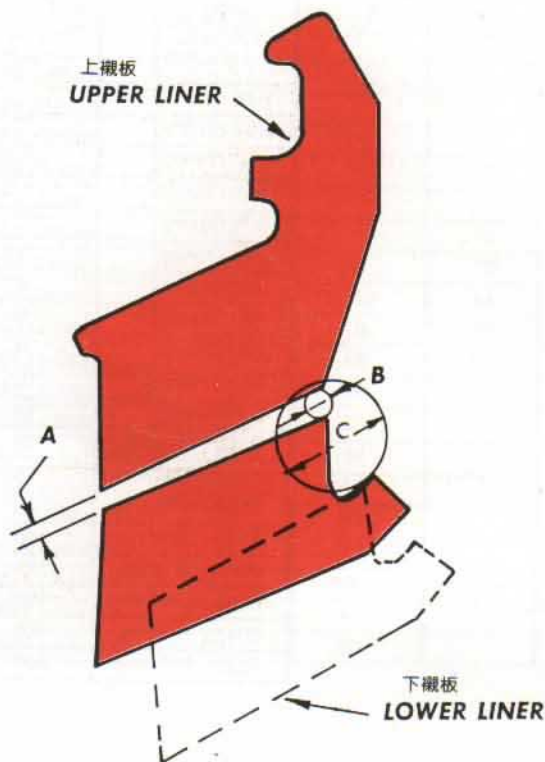
當給料粒度粗到38mm至100mm並要求生產4號篩篩上粗集料時，喉部開口“B”應改成允許足夠體積的物料進入研磨帶以達到設計功率。這種作業方式排礦口不大於25mm。參見下表。

推薦最大給料粒度，單位英寸(毫米)  
—100%通過方形篩孔

The crusher liners which comprise the Gyradisc cavity design are made up of an upper liner which is assembled to the bowl and a lower liner which is mounted on the head or main shaft assembly. Due to the wide range of feed and product requirements, the availability of variations in cavity design becomes an important factor in a successful Gyradisc operation.

Based on the feed and product requirements the throat opening designed as "B" in the diagram to the right is effected by the proper grinding of the liners. The reduction ratio per gyration is shown by comparing the open side dimension "C" with the closed side throat opening "B". The closed side setting designated as "A" is normally between 1/4" and 1/2" even when producing fine products in closed circuit below U.S. No. 8.

With coarse feed in the range of 1 1/2" to 4" and for coarse aggregate requirements above U.S. No. 4 the throat opening "B" would be modified to permit entry of the feed into the attrition zone in sufficient volume to draw the design horsepower. This type of operation requires settings up to 1". Refer to the table below.



Maximum  
recommended feed  
sizes in inches  
(millimeters) — 100%  
passing square screen  
opening

|                                                               | 旋盤式破碎機規格<br>GYRADISC CRUSHER SIZE |               |               |               |
|---------------------------------------------------------------|-----------------------------------|---------------|---------------|---------------|
|                                                               | 36" (900)                         | 48" (1200)    | 66" (1650)    | 84" (2100)    |
| 開路產品或成形物料<br>FOR PRODUCTS IN OPEN CIRCUIT OR SHAPING MATERIAL | 1 1/2" (38mm)                     | 2" (51mm)     | 3" (76mm)     | 4" (102mm)    |
| 閉路產品 (負0.250)<br>FOR PRODUCTS (MINUS 0.250) IN CLOSED CIRCUIT | 1 1/4" (32mm)                     | 1 1/2" (38mm) | 2" (51mm)     | 3" (76mm)     |
| 人造標準砂<br>FOR MANUFACTURED SPEC SAND                           | 3/4" (19mm)                       | 1" (25mm)     | 1 1/4" (32mm) | 1 1/2" (38mm) |

注：在開路系統或給料很粗時破碎機通過能力降低

NOTE: CRUSHER THROUGHPUT WILL BE REDUCED WHEN OPERATING IN OPEN CIRCUIT OR WITH VERY COARSE FEED

# 生產能力表

## Capacity table

閉路系統的生產能力表

Capacity table based on closed circuit operation

| 旋盤式破碎機<br>規格<br><br>GYRADISC<br>CRUSHER<br>DESIGNATION |        | 動錐大<br>端直徑<br>英寸<br>(毫米)<br><br>HEAD<br>DIAM.<br>INCHES<br>(MILLI-<br>METERS) | 生產能力<br>——<br>破碎機總<br>通過能力<br>短噸 / 小時<br><br>CAPAC-<br>ITY<br>1<br>TOTAL<br>TPH<br>THRU<br>CRUSHER | 生產能力2 (篩下) 短噸 / 小時<br>CAPACITY 2 IN TONS (2000 LBS) PER HOUR (SCREEN UNDERSIZE) |                |                                                              |                                                              |                                                              |                                                                    |                                                                  |                                                                     |                                                     |
|--------------------------------------------------------|--------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------|--------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------|
|                                                        |        |                                                                               |                                                                                                    | 推薦的篩子規格<br>RECOMMENDED SCREEN SIZE                                              |                |                                                              |                                                              |                                                              |                                                                    |                                                                  |                                                                     |                                                     |
|                                                        |        |                                                                               |                                                                                                    | .375"<br>(9mm)                                                                  | .250"<br>(6mm) | 4號美國<br>標準篩<br>4網目<br>.185"<br>(5mm)<br>U.S. NO. 4<br>4 MESH | 6號美國<br>標準篩<br>6網目<br>.131"<br>(3mm)<br>U.S. NO. 6<br>6 MESH | 8號美國<br>標準篩<br>8網目<br>.093"<br>(2mm)<br>U.S. NO. 8<br>8 MESH | 12號美國<br>標準篩<br>10網目<br>.065"<br>(1.6mm)<br>U.S. NO. 12<br>10 MESH | 16號美國<br>標準篩<br>14網目<br>.046"<br>(1mm)<br>U.S. NO. 16<br>14 MESH | 20號美國<br>標準篩<br>20網目<br>.032"<br>(.833mm)<br>U.S. NO. 20<br>20 MESH | ASTM<br>C-33<br>標準砂<br>ASTM<br>C-33<br>SPEC<br>SAND |
| ENGLISH                                                | METRIC |                                                                               |                                                                                                    |                                                                                 |                |                                                              |                                                              |                                                              |                                                                    |                                                                  |                                                                     |                                                     |
| 36"                                                    | 900    | 36"                                                                           | 65-75                                                                                              | 60                                                                              | 50             | 35                                                           | 30                                                           | 23                                                           | 18                                                                 | 15                                                               | 10                                                                  | 20-25                                               |
| GD                                                     | GD     | (914mm)                                                                       |                                                                                                    | 4x12' SD                                                                        | 4x12' SD       | 4x14' SD                                                     | 5x14' DD                                                     | 5x14' DD                                                     | 6x14' DD                                                           | 6x20' DD                                                         | 6x20' DD                                                            |                                                     |
| 48"                                                    | 1200   | 48"                                                                           | 115-130                                                                                            | 105                                                                             | 80             | 55                                                           | 45                                                           | 40                                                           | 30                                                                 | 25                                                               | 17                                                                  | 34-40                                               |
| GD                                                     | GD     | (1219mm)                                                                      |                                                                                                    | 4x12' SD                                                                        | 5x14' SD       | 6x16' SD                                                     | 6x20' DD                                                     | 6x20' DD                                                     | 8x20' DD                                                           | 8x20' DD                                                         | 二台<br>2 Rec<br>6x16' DD                                             |                                                     |
| 66"                                                    | 1650   | 66"                                                                           | 190-210                                                                                            | 160                                                                             | 120            | 85                                                           | 70                                                           | 60                                                           | 45                                                                 | 40                                                               | 25                                                                  | 55-60                                               |
| GD                                                     | GD     | (1676mm)                                                                      |                                                                                                    | 5x12' SD                                                                        | 6x20' SD       | 8x20' SD                                                     | 二台<br>2 Rec<br>6x16' DD                                      | 二台<br>2 Rec<br>6x16' DD                                      | 二台<br>2 Rec<br>6x20' DD                                            | 三台<br>3 Rec<br>6x16' DD                                          | 二台<br>2 Rec<br>8x20' DD                                             |                                                     |
| 84"                                                    | 2100   | 84"                                                                           | 265-300                                                                                            | 250                                                                             | 180            | 130                                                          | 100                                                          | 90                                                           | 70                                                                 | 60                                                               | 40                                                                  | 80-70                                               |
| GD                                                     | GD     | (2134mm)                                                                      |                                                                                                    | 6x14' SD                                                                        | 8x20' SD       | 二台<br>2 Rec<br>6x20' SD                                      | 二台<br>2 Rec<br>6x20' DD                                      | 二台<br>2 Rec<br>6x20' DD                                      | 二台<br>2 Rec<br>8x20' DD                                            | 二台<br>2 Rec<br>8x20' DD                                          | 四台<br>4 Rec<br>6x16' DD                                             |                                                     |

表中給出的生產能力是以實際生產數據為基礎的，既非最大亦非最小。表中給的是堆比重為每立方英尺重100磅的物料的短噸數，且以給料具有適當配比如為條件，至少消耗推薦功率的80%，常用的給料粒度為負19mm但是也可接受負38mm的給料。

閉路排礦口範圍在6mm到12.5mm之間時，呈最佳生產狀態，排礦口與閉路系統篩孔尺寸無關。

影響生產能力的因素有給料粒度、易碎性、硬度和濕度。

計算篩分面積時要考慮表中“每小時破碎機通過量，短噸/小時”欄的數值。

如需要更細的產品請向 Nordberg Inc 和沈重諮詢。

用本樣本第九頁給出的破碎機產品篩析表確定推薦的篩分面積。

SD、DD分別表示單層和雙層篩。

Capacities shown are neither maximum nor minimum, and are based on results secured in actual practice. The figures shown apply to short tons of material weighing 100 pounds per cubic foot, and are based on a properly graded feed with the crusher consuming a minimum of 80% of the recommended horsepower. A feed size of minus 3/4" is typical, but a minus 1 1/2" feed can be readily accepted.

Optimum capacity is obtained with a closed side setting ranging between 3/4" and 1 1/2". The setting is not necessarily related to the closed circuit screen opening.

Factors which may affect capacity include, size of feed,

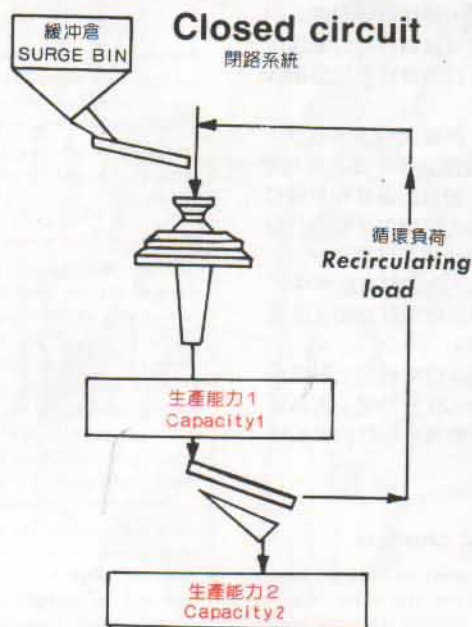
friability, toughness and moisture content.

Figures shown under column "TPH THRU CRUSHER" are included for calculating screen areas.

For finer product requirements, contact Nordberg Inc. and SHMP.

The recommended screening areas were determined using the crusher product screen analysis listed on page 9 of this bulletin.

SD and DD signifies single deck or double deck screen.



## 結構特點

### Design features

#### 36"及48"旋盤式破碎機

36"和48"旋盤式破碎機的工作原理，大部分零件和所破碎物料的性質相同。這類機器效率高，特別適合於中小型作業。結構緊湊，適於在移動式設備上使用。由於兩種機型結構相似，在48"旋盤式破碎機的剖視圖上給出了兩種機型的結構特點：

**1. 電動旋轉布料器** 將大、小塊物料徹底混合均勻，並以均勻穩定的料流繞着緩沖腔分布。

**2. 彈簧過載安全保險裝置** 與已證明是成功的西蒙斯圓錐破碎機的安全保險裝置一樣，在給料粒度過大，過載或過鐵時提供自動的、瞬時性的保護。彈簧將支承套牢牢地壓在機架上。如果發生過載或過鐵，超過彈簧的調定值，彈簧壓縮使調整套和支承套自動抬高而清理破碎腔。然後在彈簧力的作用下，調整套和支承套回到正常工作位置，恢復原先的排礦口，不需要操作者調整或注意。

**3. 液壓釋放鎖緊裝置** 小液壓缸用於快速方便地釋放鎖緊環，鎖緊環對支承套內的調整套起固定的作用。鎖緊環靠每一個液壓缸內彈簧的機械力牢牢地固定在正確位置上。液壓力超過彈簧的機械鎖緊力時，釋放調整套，使其能在支承套內轉動。

**4. 液壓調整** 兩個裝在支承套對邊的液壓推動缸靠與調整帽上一個水平的帶牙的環齒合來旋轉調整套調整排礦口。每次推動缸伸出將調整套推進一段，都使排礦口產生一特定變化。每次推動缸縮回時，棘爪式的鎖緊裝置即自動與調整帽上的豎直調整棒嚙合，使排礦口在下次調整前保持不變。因為推動缸每推出一排礦口都產生一特定的變化，操作者可以確知他希望得到的準確變化。無論何時均能進行完全精確的控制，並且能精確地作出襯板磨損的記錄。

**5. 平衡的結構** 所要求的基礎最小，從而使36"和48"旋盤式破碎機成為移動式設備的理想機器。機器的高度和重量也限制在滿足公路運輸的範圍內，使之可從一個工作現場運到另一個工作現場。

**6. 壓力潤滑系統** 向全部運轉零件，包括基本的保護性設備提供壓力油。成套的潤滑設備是通用的。

**7. 研磨元件** 靠背面接觸的上下襯板能自己鎖緊不需填料，更換方便。為滿足特殊的破碎要求，各種傳統設計的襯板也可訂貨。

#### 36" & 48" Gyradisc crushers

The 36" and 48" Gyradisc crushers are identical in operating principle, most components, and in the nature of material produced. These machines are highly efficient and ideally suitable for small and medium operations. Their compact design makes them perfect for portable in-

stallations. Because of the close design similarity, the design features of both machines are pointed out on the cutaway view of the 48" Gyradisc crusher pictured above.

**1. Motorized rotating feed distributor** "homogenizes" the feed, thoroughly mixing large and small particles, and distributes it around the surge cavity in a uniform, steady stream.

**2. Spring loaded safety release** provides the same automatic, instantaneous protection against oversize, overload or tramp metal as has proved so successful on Symons cone crushers. The springs hold the adjustment ring firmly to the frame. If any overload or tramp iron passage occurs that exceeds the spring setting, the springs compress permitting the bowl and adjustment ring to automatically rise and the cavity is cleared. The springs then return the bowl and ring to their normal positions, restoring the original setting. No readjustment or attention by the operator is required.

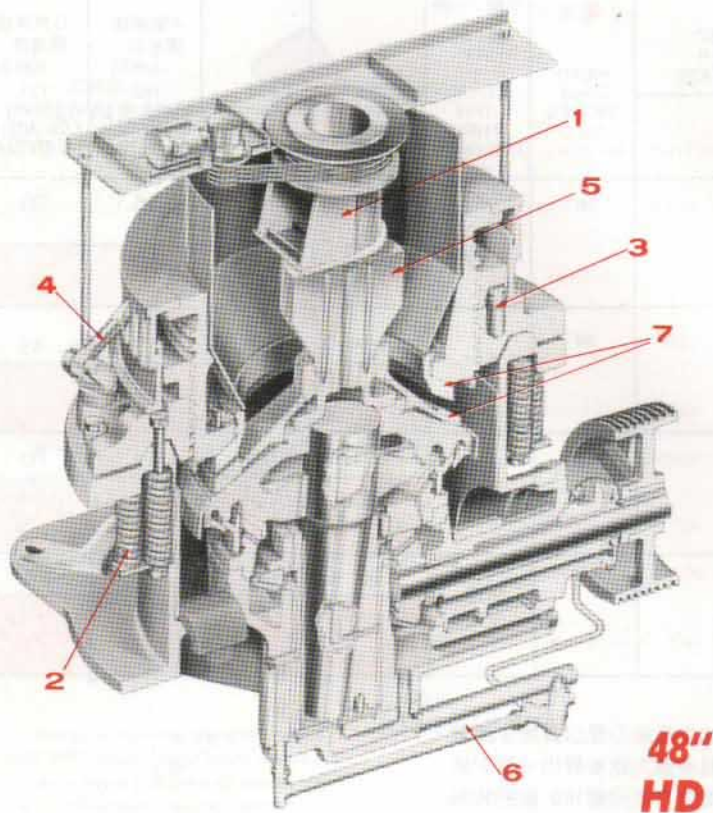
**3. Hydraulically released clamping** Small hydraulic cylinders are used for fast, easy release of the clamp ring, which secures the bowl within the adjustment ring. The clamp ring is held firmly in place by a mechanical force generated by springs inside each of the cylinders. Hydraulic power overcomes the mechanical clamping force of the springs, releasing the bowl, which can then be rotated in the adjustment ring.

**4. Hydraulic adjustment** Two hydraulic rams mounted on opposite sides of the adjustment ring change the setting by engaging a horizontal grooved ring on the adjustment cap, thereby rotating the bowl. Each ram extension advances the bowl by one increment, and each of these horizontal increments produces a specific change in setting. A ratchetype lock automatically engages the vertical adjustment bars on the cap after each retraction of the rams, positively holding the setting until another change is made. Since each extension of the ram results in a specific change in setting, the operator can determine the exact change he wishes to make. He has complete, precise control at all times, and can accurately keep track of liner wear.

**5. Balanced design** minimizes foundation requirements; makes the 36" and 48" Gyradisc crusher ideal for portable plants. The height and weight of these machines are well within the limits required for over-the-road transportation from job-site to job-site.

**6. Pressure lubrication system** provides positive flow to all moving parts. Basic protective equipment is included. Optional packaged lube system is also available.

**7. Attrition members** Upper and lower liners are self-tightening with ground back, and do not require backing. They are exceptionally easy to replace. Various types of custom engineered liners are available for specific crushing requirements.



## 66"和84"旋盤式破碎機

66"和84"旋盤式破碎機是所生產的四種型號破碎機中最大的。這兩個規格的機器是專為那些生產超細產品，生產能力要求高的用戶設計的。二者的結構特點可從66"旋盤式破碎機的剖視圖中看出。

**1. 彈簧過載安全保險裝置** 與已證明是成功的西蒙斯圓錐破碎機的安全保險裝置一樣，在給料粒度過大，過載或過鐵時提供自動的、瞬時性的保護。彈簧將支承套牢牢地壓在機架上。如果發生過載或過鐵，超過彈簧的調定值，彈簧壓縮使調整套和支承套自動抬高而清理破碎腔。然後在彈簧力的作用下，調整套和支承套回到正常工作位置，恢復原先的排礦口，不需要操作者調整或注意。

**2. 電動旋轉布料器** 將大、小塊物料徹底混合均勻，並以均勻穩定的料流繞着緩沖腔分布。

**3. 液壓調整** 兩個裝在支承套對邊的液壓推動缸靠與調整帽上一個水平的帶牙的環齒合來旋轉調整套調整排礦口。每次推動缸伸出將調整套推進一段，都使排礦口產生一特定變化。每次推動缸縮回時，棘爪式的鎖緊裝置即自動與調整帽上的豎直調整棒嚙合，使排礦口在下一調整前保持不變。因為推動缸每推出一調整排礦口都產生一特定的變化，操作者可以確知他希望得到的準確變化。無論何時均能進行完全精確的控制，並且能精確地作出襯板磨損的記錄。襯板磨損很小，很少調整排礦口的用戶可用搖桿轉動調整套。

**4. 研磨元件** 靠背面接觸的上下襯板能自己鎖緊不需填料，更換方便。為滿足特殊的破碎要求，各種傳動設計的襯板也可訂貨。

**5. 壓力潤滑系統** 向全部運轉零件，包括基本的保護性設備提供壓力油。成套的潤滑設備是通用的。

**6. 液壓控制鎖緊** 破碎作業期間，液壓鎖緊缸在鎖緊環上施加一恒定的向上的液壓力，將調整套鎖緊在支承套上。調整排礦口時，先卸掉鎖緊力，松開鎖緊環和調整套，調整套便可在支承套中轉動了。

**7. 可移性** 66"旋盤式破碎機的設計滿足公路運輸對高度和重量的限制，非常適合於在移動式設備上使用。平衡結構使結構上的要求降至最低而使破碎機適合於在移動設備上使用。

## 66" and 84" Gyradisc crushers

The 66" & 84" Gyradisc crushers are the largest of the four models built. These two machines are specifically designed for those operations requiring very high capacity production of extremely fine products. The design advantages of both machines are pointed out in the sectional view of the 66" Gyradisc crusher pictured below.

**1. Spring loaded safety release** provides the same automatic instantaneous protection against oversize, overload or tramp metal as has proved so successful on Symons cone crushers. The springs hold the adjustment ring firmly to the frame. If any overload or tramp iron passage occurs that exceeds the spring setting, the springs compress permitting the bowl and adjustment ring to automatically rise and the cavity is cleared. The springs then return the bowl and ring to their normal positions, restoring the original setting. No readjustment or attention by the operator is required.

**2. Motorized rotating feed distributor** "homogenizes" the feed, thoroughly mixing large and small particles, and distributes it around the surge cavity in a uniform, steady stream.

**3. Hydraulic adjustment.** Two hydraulic rams mounted on opposite sides of the adjustment ring change the setting by engaging a horizontal grooved ring on the adjustment cap, thereby rotating the bowl. Each ram extension advances the bowl by one increment, and each of these horizontal increments produces a specific change in setting. A ratchettype lock automatically engages the vertical adjustment bars on the cap after each retraction

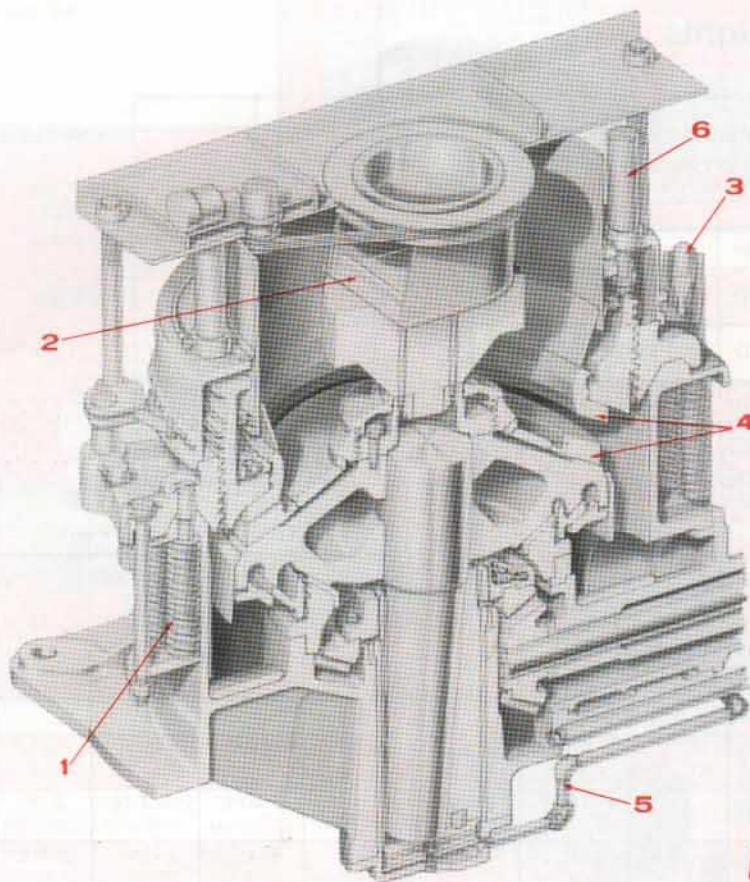
of the rams, positively holding the setting until another change is made. Since each extension of the ram results in a specific change in setting, the operator can determine the exact change he wishes to make. He has complete, precise control at all times, and can accurately keep track of liner wear. A swivel casting is available to rotate the bowl when there is minimal liner wear and few setting adjustments are required.

**4. Attrition members.** Upper and lower liners are self-tightening with ground back and do not require backing. They are exceptionally easy to replace. Various types of customengineered liners are available for specific crushing problems.

**5. Pressure lubrication system** provides positive flow to all moving parts. Basic protective equipment is included. Optional packaged lube system is also available.

**6. Hydraulically controlled clamping.** During crushing operations hydraulic lock posts provide a constant, upward, hydraulic force against the clamp ring, clamping the bowl in the adjustment ring. When a setting change is to be made, clamping pressure is removed, releasing the clamp ring and the bowl which then can be rotated in the adjustment ring.

**7. Portability.** Ideally suited for a portable plant, the 66" Gyradisc crusher is designed to meet the height and weight limitations required for over-the-road transportation. Balanced design minimizes the structural requirements and makes the crusher suitable for mobile units.



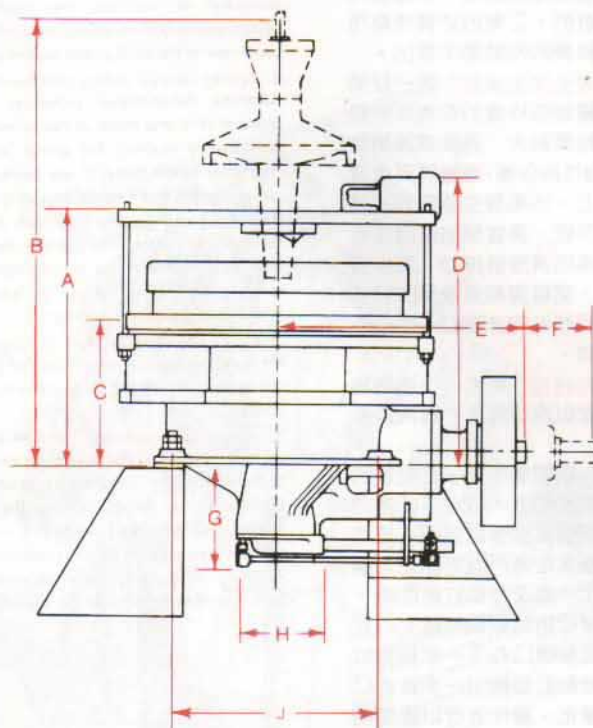
66"  
HD

# 技術參數

## Specifications

- 尺寸
- 功率
- 重量

- Dimensions
- Horsepower requirements
- Weights



| 旋盤式破碎機名稱<br>GYRADISC CRUSHER<br>DESIGNATION |              | 破碎錐<br>直徑<br>HEAD<br>DIAMETER | A                    | B                   | C                   |
|---------------------------------------------|--------------|-------------------------------|----------------------|---------------------|---------------------|
| 英制<br>ENGLISH                               | 公制<br>METRIC |                               |                      |                     |                     |
| 36" GD                                      | 900 GD       | 36"<br>(914mm)                | 6'-11½"<br>(2121mm)  | 11'-½"<br>(3366mm)  | 3'-5½"<br>(1051mm)  |
| 48" GD                                      | 1200 GD      | 48"<br>(1219mm)               | 8'-3¾"<br>(2537mm)   | 13'-3"<br>(4039mm)  | 4'-3½"<br>(1308mm)  |
| 66" GD                                      | 1650 GD      | 66"<br>(1676mm)               | 9'-9¼"<br>(2972mm)   | 12'-5¾"<br>(3804mm) | 5'-0¼"<br>(1543mm)  |
| 84" GD<br>HD                                | 2100 GD      | 84"<br>(2134mm)               | 11'-11½"<br>(3645mm) | 17'-6¾"<br>(5344mm) | 5'-10¾"<br>(1800mm) |

| 旋盤式破碎機名稱<br>GYRADISC CRUSHER<br>DESIGNATION |              | 破碎錐<br>直徑<br>HEAD<br>DIAMETER | D                   | E                  | F                  | G                     | H                  | J                  | 推薦電機功率<br>RECOMMENDED<br>HORSEPOWER<br>ELECTRIC | 重量<br>磅<br>WEIGHT<br>LBS. | 傳動轉速<br>COUNTER-<br>SHAFT<br>SPEED |
|---------------------------------------------|--------------|-------------------------------|---------------------|--------------------|--------------------|-----------------------|--------------------|--------------------|-------------------------------------------------|---------------------------|------------------------------------|
| 英制<br>ENGLISH                               | 公制<br>METRIC |                               |                     |                    |                    |                       |                    |                    |                                                 |                           |                                    |
| 36" GD                                      | 900 GD       | 36"<br>(914mm)                | 7'-4½"<br>(2238mm)  | 4'-8"<br>(1422mm)  | 2'-3"<br>(686mm)   | 1'-9½"<br>(546mm)     | 1'-9¼"<br>(540mm)  | 4'-4"<br>(1321mm)  | 100                                             | 24,400                    | 650                                |
| 48" GD                                      | 1200 GD      | 48"<br>(1219mm)               | 8'-8½"<br>(2654mm)  | 5'-5½"<br>(1664mm) | 2'-10½"<br>(876mm) | 2'-7 7/16"<br>(799mm) | 2'-3"<br>(686mm)   | 5'-9½"<br>(1765mm) | 200                                             | 58,800                    | 590                                |
| 66" GD                                      | 1650 GD      | 66"<br>(1676mm)               | 10'-8¾"<br>(3324mm) | 8'-1"<br>(2464mm)  | 3'-4½"<br>(1028mm) | 2'-7¼"<br>(793mm)     | 2'-7½"<br>(800mm)  | 7'-5"<br>(2260mm)  | 300                                             | 97,200                    | 540                                |
| 84" GD<br>HD                                | 2100 GD      | 84"<br>(2134mm)               | 12'-4¾"<br>(3775mm) | 9'-8½"<br>(2962mm) | 4'-5¼"<br>(1353mm) | 3'-4½"<br>(1029mm)    | 2'-11½"<br>(902mm) | 8'-2"<br>(2489mm)  | 400                                             | 168,000                   | 525                                |

# 型式 Models

旋盤式破碎機以最低的噸成本生產大量的細產品

旋盤式破碎機是專用於破碎的機器能經濟地從石頭、礫石、礦石和非金屬物料生產大量的立方形產品。旋盤式破碎機的給料粒度通常不大於 38mm，可生產出美國 30 號篩那樣細的立方形產品。

旋盤式破碎機不同於普通的圓錐破碎機，因為物料的破碎是由層壓破碎實現的。

該破碎原理利用了多層物料間沖擊和研磨的綜合作用。簡單地說，這一破碎原理使旋盤式破碎機的用戶在三個主要方面受益：

**生產費用低**——生產費用與優質產品噸位的比率非常低。通常旋盤式破碎機用於系統的第三段或第四段破碎。

**產品的均勻性**——產品始終為均勻的立方形。

**砂用襯板的磨損與維修**——物料在多層料塊中破碎使易損件的磨蝕最小。

## Gyradisc crushers

produce large quantities of fines at minimal cost per ton

Gyradisc Crushers are specialized reduction machines. They are designed to economically produce large quantities of cubical product from stone, gravel, ores and non-metallic minerals. The feed for Gyradisc Crushers usually has a top size not larger than 1½", from which a cubical product as fine as U.S. No. 30 is produced.

Gyradisc Crushers differ from conventional cone-type crushers because the comminution of material is achieved by a reduction process called **Interparticle Comminution**.

This principle of reduction utilizes a unique combination of impact and attrition of a multilayered mass of particles. Simply stated, this principle of reduction benefits Gyradisc Crusher users in three important ways:

**Low cost production** — Extremely low ratio of operating cost to tonnage of quality product. Gyradisc crushers are usually in the third or fourth stages of a crushing circuit.

**Uniformity of product** — Material produced is cubical in shape. Uniformity can be constantly maintained.

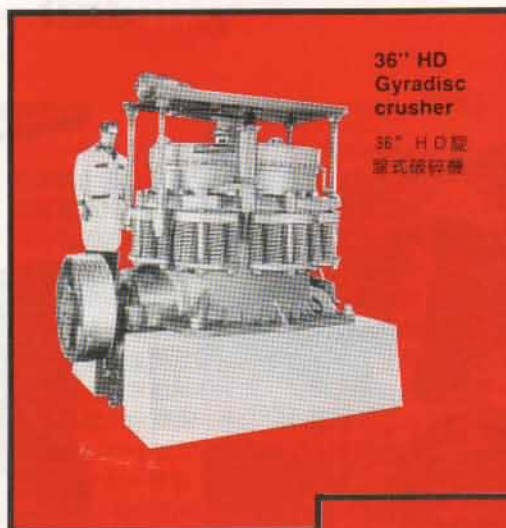
**Minimal liner wear and maintenance** — Feed particles are reduced in a multi-layered mass, resulting in minimum abrasion of the wear members.

## 現有型號

目前，旋盤式破碎機有四種規格——36" GD、48" GD、66" GD 和 84" GD。84" GD 包括重型和超重型。

## Models available

Gyradisc Crushers are available in four sizes — 36" GD, 48" GD, 66" GD, and 84" GD which is also available in Heavy Duty and Extra Heavy Duty models.



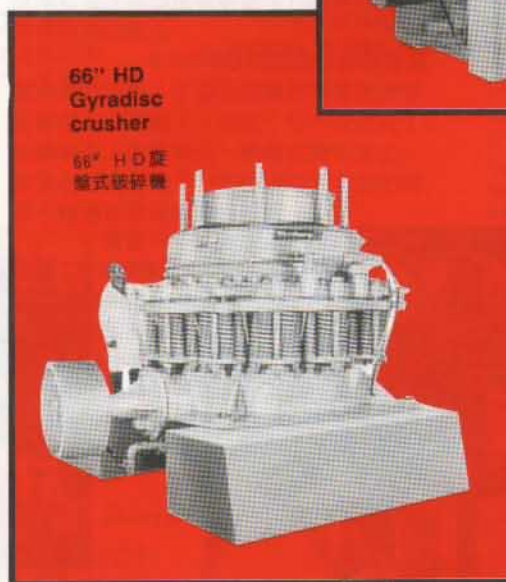
36" HD  
Gyradisc  
crusher

36" HD 旋  
盤式破碎機



48" HD  
Gyradisc  
crusher

48" HD 旋  
盤式破碎機



66" HD  
Gyradisc  
crusher

66" HD 旋  
盤式破碎機



84" Gyradisc  
crusher

84" 旋盤式破碎機

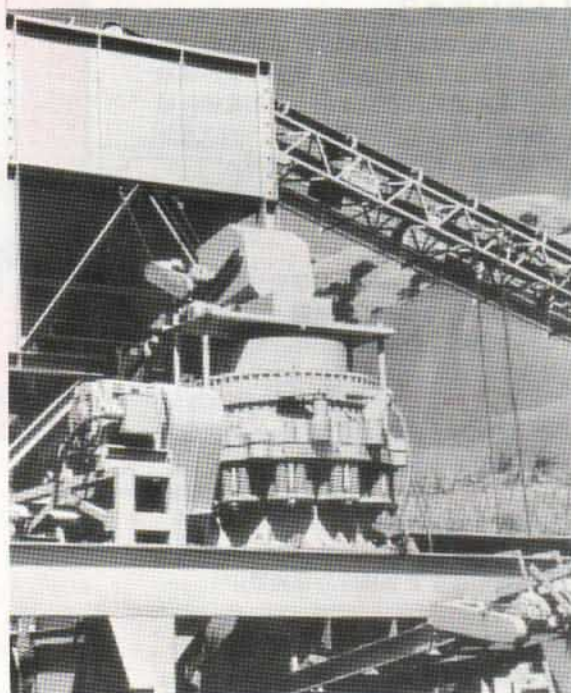
# 設備安裝現場

## Installations



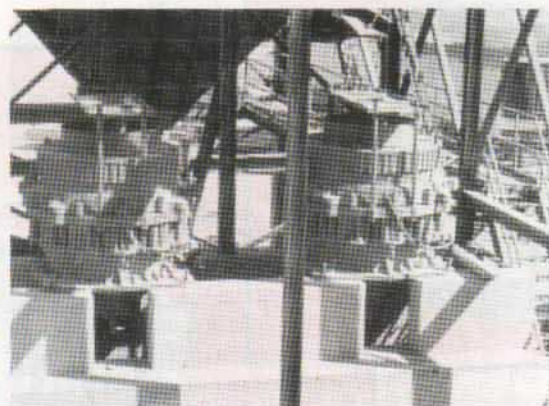
澳大利亞某現場安裝36" 旋盤式破碎機的台架。

A platform mounted 36" Gyradisc crusher operating at a plant site in Australia.



圖為加利福尼亞某現場裝在移動式設備上的48" 旋盤式破碎機。

A 48" Gyradisc crusher is installed on this mobile portable plant pictured operating at a site in California.



美國東部某制砂廠的二台48" 旋盤式破碎機和二台6' x 20' Nordberg GP篩。

Two 48" Gyradisc crushers and two 6' x 20' Nordberg GP screens are installed at this sand plant in the eastern United States.



美國西部各地使用的移動式制砂設備。由一台48" 旋盤式破碎機和一台 Nordberg 5' x 14' 雙層GP篩組合而成。

This portable sand plant combines a 48" Gyradisc crusher with a Nordberg 5' x 14' double deck GP screen operating at various locations in the western United States.