TELSMITH

Mineral Processing Handbook

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TELSMITH HANDBOOK

A handy reference book especially for Aggregate Producers and Mineral Processors. This book contains the latest specifications and essential information on aggregate and minerals production and handling equipment. It should be noted that various factors, such as engineering advances, physical properties of raw materials, method of feeding and operating the equipment, moisture and physical conditions in material at the time of processing, attitude and other conditions will affect the equipment ratings as published and may yield results not exactly in accord with published data.

Tenth Edition
Second Printing
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Printed in U.S.A.

A PREFACE TO THE TENTH EDITION …

The worldwide acceptance and popularity of the Telsmith Handbook since its inception in 1953 dictates that we must keep it accurate and up-to-date in its concept.

This tenth edition has some information not contained in earlier editions along with some deletions and revisions to keep the handbook as accurate as possible.

Whether your interest is in a single unit, or a completely integrated processing plant, Telsmith Engineering experience in producing aggregate and mining machinery of all types insures profitable production of high grade material.

All along the processing line, Feeders, Grizzlies, Crushers, Scalpers, Classifiers, Washing Plants, Sizing Screens, Conveyors, Telsmith Equipment is processing material for all phases of industry.

Feel free to consult Telsmith skilled engineering services whenever you have questions or comments.

It is our sincere hope this handbook will help you in selecting, operating and maintaining our quality product line, thus assuring profits in your operation.

TELSMITH, INC.
Mequon, Wisconsin
An Astec Company

TELSMITH FEEDERS

Telsmith Feeders are used for holding and regulating surge loads and to promote a steady supply to maximize production in processing plants. These feeders are offered in four types to match material size, feed rate requirements, location and if fed from truck, shovel, loader, or mounted under a surge bin.

DATA REQUIRED FOR SELECTING A FEEDER

1. Tons per hour to be handled, including maximum and minimum.
2. Weight per cubic foot (bulk density) of the material.
3. Distance material is to be conveyed.
4. Height material is to be raised.
5. Space limitations.
6. Method of loading feeder.
7. Characteristics of material.
8. Type of machine to be fed.

PROCEDURE FOR SELECTING A FEEDER

STEP 1. Select a type of feeder from Table 1, Page 7.

STEP 2. Select feeder width. The width may be dictated by the machine to be fed, i.e., a jaw crusher with a certain receiving opening, or by the size of the hopper opening to be used. Feeder width may also be determined by the maximum lump size in the feed, or by a desired depth of material and conveying speed.*†

STEP 3. Check capacity of feeder selected against the data in Tables 2A, B, C & D, pages 7 thru 10.

STEP 4. Determine HP required from Tables in Section for Feeder selected in STEP 1.

* depth of 100 lbs./ ft.^{3} material may be found by:

$$D = \frac{50 \times TPH}{w \times FPM}$$

D = depth in inches

TPH = tons per hour

FPM = feet per minute material is moved

W = net width of feeder in inches

† Do not use the above chart for Belt Feeder capacities.

APPLICATION OF FEEDERS TABLE – 2A

DUTY	RECOMMENDED TYPE
Truck dumping or direct loading by Dozer, Shovel or Dragline. Maximum lump size not to exceed 75 percent of feeder width.	Super Heavy-Duty Apron Feeder with manganese flights.
Under hopper or bin, handling non-abrasive material. Maximum lump size not to exceed 75 percent of feeder width.	Super Heavy-Duty Apron Feeder with pressed steel flights.
Truck dumping or direct loading by Dozer, Shovel or Dragline. Maximum lump size not to exceed 75 percent of feeder width.	Heavy-Duty Apron Feeder
Under hopper or bin, handling non-abrasive material. Maximum lump size not to exceed 30 percent of feeder width.	Heavy-Duty Apron Feeder
Under Primary Crusher to protect belt conveyor.	Vibrating Feeder or Grizzly Feeder.
Under bins, hoppers or storage piles. Maximum lump size not to exceed 30 percent of feeder width.	Belt Feeder
Under large Primary Crushers.	Heavy-Duty Apron Feeders

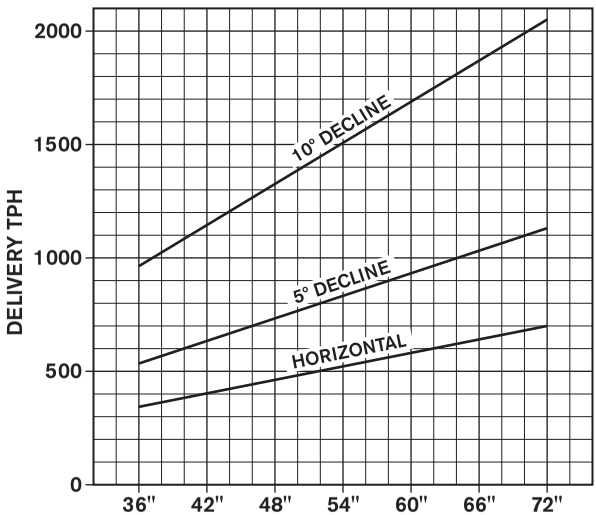
APRON FEEDER CAPACITIES – PER HOUR – TABLE 2B

Flight Speed FPM	Standard and Heavy Duty Feeders								XHD (Extra Heavy Duty Feeders)					
	30"		36"		42"		48"		48"		60"		72"	
	Yds^3	Tons	Yds^3	Tons	Yds^3	Tons	Yds^3	Tons	Yds^3	Tons	Yds^3	Tons	Yds^3	Tons
10	55	74	80	108	109	147	143	192	143	192	222	300	320	432
15	83	112	120	162	164	222	214	289	214	289	333	450	480	648
20	110	148	160	216	218	294	284	384	284	384	444	600	640	864
24*	133	180	192	259	262	354	343	460	343	460	533	720	768	1,037
25	138	186	200	270	273	369	357	482	357	482	555	750	800	1,080
30	165	223	240	324	327	442	427	577	427	577	666	900	960	1,296
35	193	260	280	378	382	516	500	673	500	673	777	1,050	1,120	1,512
40	220	296	320	432	436	588	572	768	572	768	888	1,200	1,280	1,728
50									711	961	1,110	1,500	1,600	2,160
60									854	1,154	1,332	1,800	1,920	2,592

* Standard speed that will be furnished unless otherwise specified.

NOTE: Capacities based on continuous operation at flight speed shown with a bed depth of about $^1/_2$ flight width and 100 lbs./ft^3 material and .8 Feeding Factor to compensate for voids, resistance to flow, etc. Capacities will vary with material characteristics. For speeds above or below standard consult factory.

VIBRATING FEEDERS AND GRIZZLY FEEDERS AT STANDARD MOUNTING ANGLES

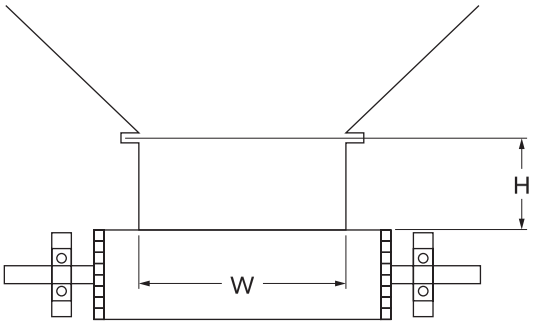


Delivery rates for Vibrating Feeders
Table 2C

NOTES:

1. Throw, Speed and Material Flowability combine to give estimated travel speeds of 40 FPM @ 0°; 65 FPM @ 5°; 120 FPM @ 10°.
2. 12" Bed Depth assumed at discharge of feeder or at beginning of Grizzly Bars, if used.
3. Material is 100 lb. per Ft^3, Tons are 2000 lb.
4. Flowability, wt. per Ft^3, bed depth are variables.
5. Use Factor of 0.8 for rip-rap or clean large stone.
6. Use Factor of 0.7–0.9 for Primary Crusher.
7. Variable Speed Drive may reduce capacity by 40% when feeder width is selected for largest stone or width of Primary Crusher.

CAPACITY OF BELT FEEDERS
BASIS – 100 LBS. PER FT.^{3} MATERIAL



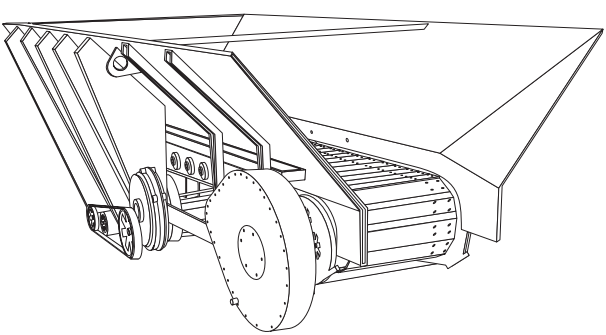
Capacity – TPH

Belt Feeder	H (highest)	Belt Speed – FPM					
		10	20	30	40	50	60
24" (W =18")	8	30	60	90	120	150	180
	9	34	68	101	135	169	203
	10	38	75	113	150	188	225
	11	41	83	124	165	206	248
	12	45	90	135	180	225	270
	13	49	98	146	195	244	293
	14	53	105	158	210	262	315
30" (W = 24")	8	40	80	120	160	200	240
	9	45	90	135	180	225	270
	10	50	100	150	200	250	300
	11	55	110	165	220	275	330
	12	60	120	180	240	300	360
	13	65	130	195	260	325	390
	14	70	140	210	280	350	420
36" (W = 30")	8	50	100	150	200	250	300
	9	56	113	169	225	281	338
	10	62	125	187	250	312	375
	11	69	137	206	275	344	412
	12	75	150	225	300	375	450
	13	81	162	244	325	406	487
	14	87	175	262	350	437	323

Table 2D

APRON FEEDERS

Apron feeders are used where extremely rugged machines handling large feed are required, but where no fines removal is needed or where fines are removed by a separate Vibrating Grizzly (see Pages 136–138). They are also used to handle muddy or sticky material. Normally located ahead of large, stationary primary crushers. They are sometimes used to collect material from the discharge of very large primary crushers where they absorb more impact than a rubber conveyor belt can economically withstand. These Apron Feeders can be equipped with standard ($1/2$" thick) fabricated pans (standard and heavy duty Feeders) or optional ($1\,1/4$" thick) fabricated pans (XHD Feeders only). They are available in widths of 30" to 72" and lengths of 9' to 50'. For more information, see Bulletin AF 102.



SPECIFICATIONS – CAPACITIES – APRON FEEDERS

Feeder Size	30"	36"	42"	48"	60"	72"
Length (Min. – Max. (Note 5))	9' – 21'	9' – 21'	9' – 21'	12' – 27'	15' – 30'	15' – 30'
Capacity – TPH at 24 FPM (Note 4)	180	259	354	460	720	1037
Horsepower Required for Standard Lengths (Note 2)						
9'	5	5	7 1/2	–	–	–
12'	5	5	10	15	–	–
15'	7 1/2	7 1/2	10	15	25	30
18'	7 1/2	10	15	20	25	40
21'	7 1/2	10	15	20	30	40
24'	–	–	–	20	30	40
27'	–	–	–	25	40	60
30'	–	–	–	–	50	60
Feeder Weight Min. Length – Lbs. (Note 3)	Note 1	Note 1	Note 1	Notes 1 & 2	Note 2	Note 2

NOTE 1. Standard and Heavy Duty Apron feeders furnished with 1/2" thick fabricated pans only.
NOTE 2. XHD feeders available with 1 1/4" (standard) thick fabricated steel pans.
NOTE 3. Horsepower ratings are based on normal operation with feeder mounted in horizontal position. For higher or lower speeds consult factory.
NOTE 4. Capacities shown are for continuous operation at 24 feet per minute flight speed with a depth of material about 1/2 of flight width.
NOTE 5. For longer lengths consult factory.

HORSEPOWER OF APRON FEEDERS

Total horsepower is calculated using the following formulas.

L = C/L to C/L of sprockets

W= Width in feet inside skirt boards

H = Height in feet of material bed

$^1/_2$ Pan Width = Normal
$^2/_3$ Pan Width = Maximum

s = 0.8 Slip Factor = Incline
s = 0.9 Slip Factor = Horizontal

M = Wt. per Ft.^{3} of Material

S = Speed in FPM

Total Load of Material = L × H × W × M

$$\frac{s \times W \times H \times M \times S}{33.3} = \text{Capacity in Tons per Hr.}$$

$$\frac{\text{Cap. (TPH)} \times 33.3}{W \times H \times M \times s} = S$$

⊗ Height = $^1/_2$ Width

Width of Pan	⊗ Skirt Board Friction / Ft.	Hopper Shear
30"	31#	1000#
36"	55#	2133#
42"	88#	4000#
48"	113#	4600#
60"	175#	5800#
72"	252#	7200#
84"	345#	8850#
96"	450#	10500#

Total Force P = (1) + (2) + (3)

(1) Wt. of Material Bed × Sin of Angle if Feeder is on an incline
(2) Skirt Board Frictions and Hopper Shear
(3) Friction Force on all bearings as given below

Wt. of Material Bed + $^1/_2$ Chain Weight = F. Lbs.

$$\text{(A) } F \times \frac{.25}{\text{Upper Idler Radius}} = A \text{ (Friction Force at Bearings)}$$

$$\text{(B) } ^1/_2 \text{ Chain Weight} \times \frac{.25}{\text{Lower Idler Radius}} = B \text{ (Friction at Lower Idler)}$$

(3) = A + B

HP Required

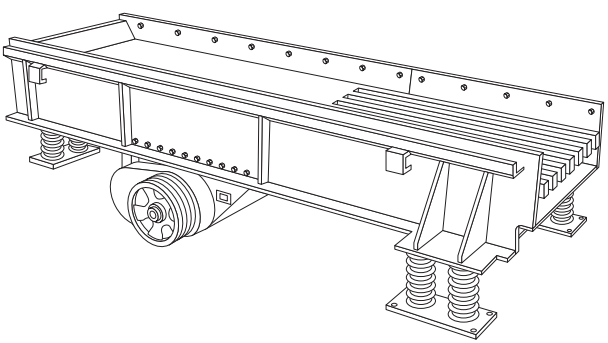
P = Total force, above (1) + (2) + (3)
S = Pan Speed in FPM

$$1.5 \times \frac{P \times S}{33{,}000} = HP$$

VIBRATING FEEDERS AND VIBRATING GRIZZLY FEEDERS

Vibrating Feeders are used where a compact feeder with variable speed control is required. Vibrating Grizzly Feeders have features similar to the Vibrating Feeder plus grizzly bars for separating fines from crusher feed. This feeder increases crushing plant production and reduces crusher liner wear because fines are bypassed around the primary crusher.

Both feeders are available in widths from 36" through 72" and 12' through 30' long. Grizzly sections are straight or stepped. The stepped version tumbles stone to the lower section thus offering more efficient scalping. For full description and illustrations, refer to Bulletin T301.



SPECIFICATIONS – CAPACITIES – VIBRATING FEEDERS AND GRIZZLY FEEDERS

STANDARD WIDTH	36" Wide		42" Wide		48" Wide				54" Wide			60" Wide			72" Wide			H.D. 66" Wide †
STANDARD LENGTH	14'	16'	14'	16'	14'	16'	18'	20'	18'	20'	22'	18'	20'	22'	18'	20'	22'	30'
Vibrating Feeder – Tot. Weight	6,910	8,145	7,390	8,260	7,765	9,340	19,000	20,400	20,175	21,700	23,225	21,350	22,600	24,300	24,350	24,750	25,850	–
Vibrating Grizzly Feeder w/5' Grizzly Section–Total Wt.	7,005	8,310	7,625	8,550	8,015	9,625	19,350	20,750	20,575	21,900	23,475	21,800	23,050	24,750	24,550	25,750	26,300	–
Vibrating Grizzly Feeder w/8' Step Grizzly Sec.–Tot. Wt.	–	8,900	–	9,270	–	11,240	–	–	20,965	–	–	23,200	–	–	–	–	–	–
Vibrating Grizzly Feeder w/9' Step Grizzly Sec.–Tot. Wt.	–	–	–	–	–	–	19,900	21,650	21,375	23,175	–	22,850	24,700	–	25,250	27,000	–	48,250
Vibrating Grizzly Feeder w/10' Step Grizzly Sec.–Tot. Wt.	–	–	–	–	–	–	–	–	–	–	23,775	–	–	25,300	–	–	28,000	–
Loading Hopper W/O Ext.–Width Loading Hopper With Ext.–Width	7'6" 13'6"	7'6" 13'6"	8'0" 14'0"	8'0" 14'0"	8'6" 14'6"	8'6" 14'6"	8'6" 14'6"	8'6" 14'6"	9'0" 15'0"	9'0" 15'0"	9'0" 15'0"	9'6" 15'6"	9'6" 15'6"	9'6" 15'6"	10'5" 16'5"	10'5" 16'5"	10'5" 16'5"	–
Loading Hopper W/O Ext.–Wt. Loading Hopper With Ext.–Wt.	13,210 20,200	14,625 22,225	14,850 22,775	16,085 25,100	17,825 27,450	19,875 30,750	21,865 34,450	24,050 38,575	–	–	–	24,545 36,325	26,900 40,675	29,575 44,750	27,475 38,875	30,125 43,525	33,125 47,875	–
Electric Motor – Horsepower	20	20	30	30	30	30	40	40	40/50	50	50	40/50	50	50	50/60	60	60	100
Capacity Range* Tons Per Hour	325- 975	325- 975	400- 1,150	400- 1,150	450- 1,325	450- 1,325	450- 1,325	450- 1,325	500- 1,500	500- 1,500	500- 1,500	575- 1,700	575- 1,700	575- 1,700	700- 2,050	700- 2,050	700- 2,050	1,000- 2,450
Feeder Speed R.P.M.	500 to 800																	750–850

* Lower capacity indicated is for feeder mounted horizontally
Higher capacity indicated is for feeder mounted on a 10° decline

† Extra Heavy Duty Feeder with four timed eccentric shafts. Pan down 5°, Grizzly section 8°.

SPECIFICATIONS – CAPACITIES – ELECTROMAGNETIC VIBRATING FEEDERS

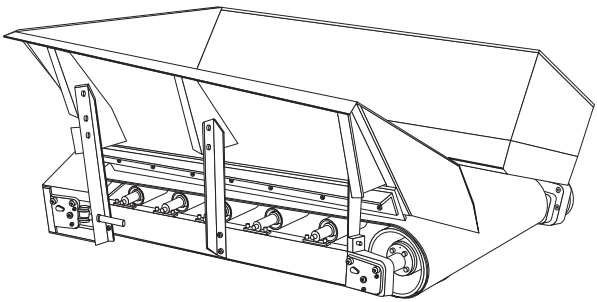
Width	16"	18"		24"	30"		36"		42"		48"		54"		60"		72"	84"
Length	36"	36"	42"	42"	42"	48"	54"	60"	60"	72"	60"	84"	72"	84"	78"	96"	84"	108"
Power Consumption Watts	450	470	550	950	1,410	1,410	2,200	1,880	2,350	2,820	3,300	3,760	2,900	4,700	3,300	5,640	4,600	5,000
Approximate Weight Lbs.	430	580	470	960	1,300	1,700	2,300	2,400	2,850	4,035	4,100	4,650	7,000	7,475	8,000	8,675	10,400	13,000
Capacity Approx. TPH	100	180	130	180	345	415	350	600	700	870	700	1,125	900	1,275	1,250	1,650	1,600	1,800

NOTES:

1. Power mount above or below deck available.
2. Capacities based on material weighing 100 Lbs. per foot^3.
3. Pan has 10° decline

BELT FEEDERS

Belt Feeders are normally used in sand & gravel operations under a hopper or trap with 6" maximum size feed. They have infinitely variable speed control for optimum plant feed rate. For more information, contact factory.



HORSEPOWER OF BELT FEEDERS

Base HP at 10 FPM Travel

18" × 4'-0" Standard Duty = 0.140
18" × 4'-6" Heavy Duty = 0.140
18" × 6'-6" Standard Duty = 0.186
24" × 4'-0" Standard Duty = 0.20
24" × 4'-6" Heavy Duty = 0.20
24" × 6'-6" Standard Duty = 0.282
30" × 5'-0" Heavy Duty = 0.330

HP per Ft. of Extra Length and per Ft. of Rise at 10 FPM Travel

Belt Width	Per Ft. of Length	Per Ft. of Rise
18"	0.008	0.025
24"	0.010	0.035
30"	0.015	0.065

The Above is HP at the Headshaft. Add 10% for Drive.

Example:

275 TPH with 5'-0" added length and 2'-0" rise use 30" × 5'0" belt feeder @ 50 FPM (table 2d page 11)
A 30" Feeder at 10 FPM = 55 TPH at0.330 HP
Add 0.015 HP × 5 Ft. for extra length = 0.075
Add 0.065 HP × 2 Ft. for rise = 0.130
For 10'-0" length and 2'-0" rise HP = 0.535 for 55 TPH
0.535 HP at 10 FPM ×5 = 2.675 HP at 50 FPM (Headshaft).

CRUSHERS

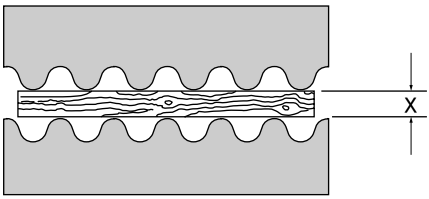
GENERAL NOTES ON CRUSHER SECTION

1. To secure the capacities specified, all feed to crushers should be smaller than the feed opening of the crusher in at least one dimension.
2. The horsepower required varies with the size of product being made, the capacity and the toughness of the rock or ore.
3. The capacities given are in tons of 2,000 lbs. and are based on crushing limestone weighing loose about 2,700 lbs. per yard^3 and having a specific gravity of 2.6. Wet, sticky and extremely hard or tough feeds will tend to reduce crusher capacities.
4. No crusher, when set at any given discharge opening, will make a product all of which will pass a screen opening of the same dimensions as the given discharge opening.

   The crusher discharge opening is measured as follows:
   Graysphere – closed side
   Jaw Crusher – when jaws are in closed position from peak to peak
   Gyratory Breaker – open side
   Intercone – closed side
   For close settings, all undersize material should be removed from the feed so as to eliminate packing and excessive wear.
5. **Where no rating is specified in the capacity table for any certain discharge opening, the crusher cannot be operated economically at that opening. For a setting finer than the minimum, consult factory.**
6. The minimum settings indicated for crushers is not necessarily applicable for each and every application.

NOTE ON CAPACITIES: All capacities shown are approximate and will vary with the physical properties of material, moisture content, feed method, and amount of fines.

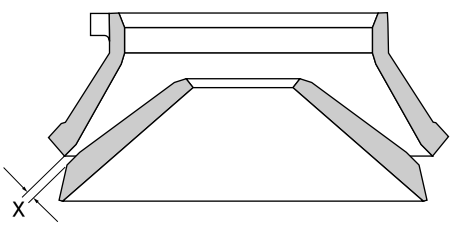
JAW CRUSHER DISCHARGE SETTINGS



"X" dimension equals Peak-To-Peak measurement.

To set the Closed Side Discharge Setting, use a wood block with the same width as the desired setting. It should be long enough to span most of the crusher's discharge area. The discharge setting is gauged with the opening in its closest position of the operating stroke.

GYRASPHERE CRUSHER DISCHARGE SETTINGS



"X" dimension equals Closed Side Discharge Opening.

To determine the Closed Side Setting (CSS) of a Gyrasphere Crusher lower, on a wire or heavy string, into the open side of the crushing chamber, a ball of clay or aluminum foil larger than the discharge chamber until the ball is at the lowest area of the crushing chamber. Hold the crusher's head and rotate the crusher drive until the ball has been compressed at least twice. The thickness of the ball at its thinnest dimension equals the CSS.

On crushers equipped with anti-spin, drop the clay ball or aluminum foil into the crushing chamber while the crusher is running.

TYPICAL AGGREGATE GRADATIONS

Quarry Medium, Hard Dry Limestone Percent Passing			**Sand & Gravel Pit** Coarse – 65% Gravel Fine – 65% Sand Percent Passing		
Coarse	Sieve Size	Fine	Coarse	Sieve Size	Fine
73.0	24"	100.0	87.0	6"	100.0
66.0	18"	93.1	84.0	5"	100.0
45.0	12"	75.0	81.0	4"	100.0
33.0	8"	63.0	76.0	3"	98.0
31.0	6"	48.0	69.0	2"	95.0
26.0	5"	38.0	64.0	1 1/2"	93.0
23.0	4"	29.0	58.0	1"	88.0
14.0	3"	19.0	53.0	3/4"	85.0
10.0	2"	16.0	47.0	1/2"	79.0
7.0	1 1/2"	13.0	42.0	3/8"	73.0
6.0	1"	11.0	35.0	1/4"	65.0
5.0	3/4"	9.0	31.0	4m	60.0
4.0	1/2"	8.0	24.0	8m	50.0
3.0	3/8"	7.0	16.0	16m	36.0
2.0	1/4"	6.0	10.0	30m	24.0
1.0	4m	5.0	4.0	50m	16.0
–	8m	4.0	3.0	100m	8.0

NOTE: These figures are for general information only. Final equipment selection must be based on actual site geological surveys.

INSTRUCTIONS FOR USING TELSMITH DATA SHEETS SHOWING SCREEN ANALYSIS OF PRODUCT FROM CRUSHERS

If it is desired to determine the approximate screen analysis of the product from Telsmith crushers, the following example, which is typical, can be used as a guide. Suppose you wish to determine the percentages of various sizes of rock in the product from a 10" × 30" Telsmith Jaw Crusher, when set with a 1" discharge opening. By referring to screen analysis, Page 27 and the curve indicated by the arrow pointing from 1" opening, you will note that all of the product from the crusher will pass a $1\frac{1}{2}$" square screen opening. On all of these sheets the vertical lines indicate the size of clear square screen openings and the horizontal lines indicate the percentage that will pass through these openings. Therefore 100% will pass a $1\frac{1}{2}$" square opening, 82% will pass a 1" square opening, 62% will pass a $\frac{3}{4}$" opening, 42% will pass a $\frac{1}{2}$" square opening and 12% will pass a 4 mesh opening.

Another way to list this information or to express the results of this analysis would be as follows:–

Retained on $1\frac{1}{2}$" square opening	0%
Passing $1\frac{1}{2}$" square opening and retained on 1" square opening	18%
Passing 1" square opening and retained on $\frac{3}{4}$"square opening	20%
Passing $\frac{3}{4}$"square opening and retained on $\frac{1}{2}$"square opening	20%
Passing $\frac{1}{2}$"square opening and retained on 4 mesh opening	26%
Passing 4 mesh opening	12%
Total	100%

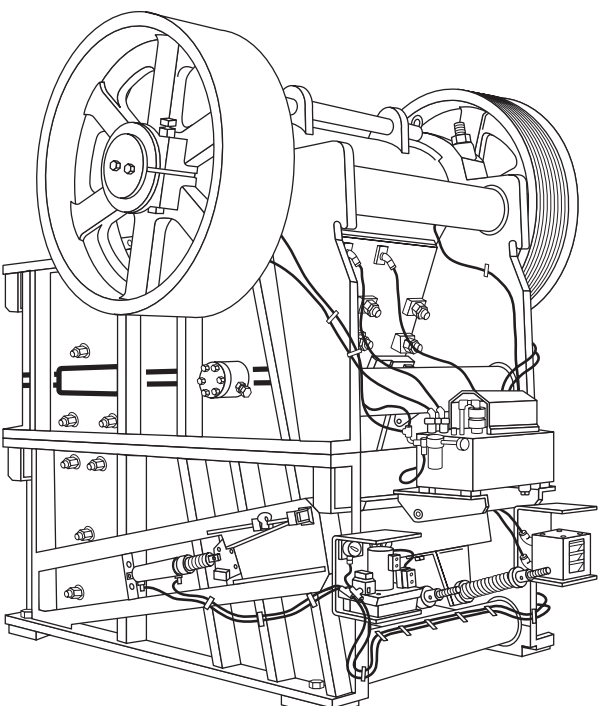
To obtain an analysis of the product from Telsmith Gyraspheres or Impact Crushers, the procedure is exactly the same.

THE FOLLOWING GRADATION CURVES ARE TYPICAL FOR CRUSHING QUARRY RUN HARD LIMESTONE:

NOTES:

JAW CRUSHERS

Telsmith Jaw Crushers are used to reduce run-of-mine ore, stone, or recyclable materials to smaller sizes for further processing. The Telsmith Jaw Crushers range in sizes from 10" × 16" through 55" × 66", to aid in accurate size selection. All models are single toggle, overhead eccentric roller bearing type with safe, fast hydraulic adjusting system. Grease lubrication is standard on sizes through 36" × 48", and optional on 44" × 48", 50" × 60" and 55" × 66". Circulating oil lube is optional on sizes from 15" × 38" through 36" × 48" and standard on 44" × 48", 50" × 60" and 55" × 66" sizes. This oil system includes pump, tank, filter and factory installation, etc. For full description and illustrations, refer to Bulletin T601.



SPECIFICATIONS – TELSMITH 10"×16" THRU 22"×50" OVERHEAD ECCENTRIC JAW CRUSHERS

SIZE	10"×16"	10"×21"	10"×30"	12"×36"	15"×24"	15"×38"	20"×36"	20"×44"	22"×50"
Net wt. of crusher – lbs. approx.	5,700	6,400	8,800	12,650	11,000	19,750	27,400	25,530	41,500
Export packed wt. – lbs. approx.	5,950	6,750	9,250	13,230	11,500	20,550	28,400	26,625	43,450
Export packed – $ft.^3$ approx.	115	130	170	185	165	360	500	675	900
HP required	15	20	25	50	40	60	100	100	125
Drive pulley dia. × face – inches	33 × 8.5	33 × 8.5	38 × 10.5	38 × 10.5	38 × 10.5	48 × 12.5	48 × 14.75	48.5 × 12.5	54 × 14.75
RPM	350	350	320	320	320	265	265	290	260

CAPACITY — TELSMITH 10"×16" THRU 22"×50" OVERHEAD ECCENTRIC JAW CRUSHERS

Size	10"×16"	10"×21"	10"×30"	12"×36"	15"×24"	15"×38"	20"×36"	20"×44"	22"×50"
Capacity – Tons Per Hour at Discharge Setting of:									
1/4"	6–8	7–10	13–20	–	–	–	–	–	–
1/2"	8–11	9–13	17–25	22–33	17–25	–	–	–	–
3/4"	9–13	12–16	20–29	25–38	21–30	38–57	45–85	65–115	–
1"	10–15	15–20	23–34	29–43	25–35	43–64	52–95	72–125	170–250
1 1/4"	12–18	17–23	26–38	33–48	27–40	48–72	58–105	80–135	175–266
1 1/2"	14–20	19–26	29–43	36–54	30–45	53–79	64–115	90–151	180–283
2"	17–25	22–33	35–52	43–65	37–55	57–86	75–135	110–168	210–315
2 1/2"	–	–	–	50–75	43–65	67–100	85–155	123–192	230–343
3"	–	–	–	–	–	76–114	96–174	152–217	250–370
3 1/2"	–	–	–	–	–	85–128	108–192	167–243	270–405
4"	–	–	–	–	–	–	146–210*	183–267	290–440
5"	–	–	–	–	–	–	165–250*	212–316	330–475

* Capacity with short toggle (Optional). Capacities shown are based on conditions listed in general notes on Pages 18-19. Capacities are listed for jaws in closed position and measured peak-to-peak.

SPECIFICATIONS — TELSMITH 25"×40" THRU 55"×66" OVERHEAD ECCENTRIC JAW CRUSHERS

SIZE	25"×40"	30"×42"	30"×55"	36"×48"	38"×58"	40"×50"	44"×48"	50"×60"	55"×66"
Net wt. of crusher — lbs. approx.	35,500	44,600	58,000	91,500	108,000	42,000	125,900	190,000	217,000
Export packed wt. — lbs. approx.	36,500	46,000	59,150	93,100	109,500	44,000	126,900	192,000	220,000
Export packed — $ft.^3$ approx.	575	900	1,000	1,100	1,600	1,600	1,616	2,100	2,800
HP required	125	150	200	200	250	150	250	300	350
Drive pulley dia. × face — inches	54×14.75	60×14.75	55 × 12.6	66 × 16	66 × 16	54×14.75	72 × 17	78 × 23	78 × 23
RPM	260	255	280	230	260	260	225	225	225

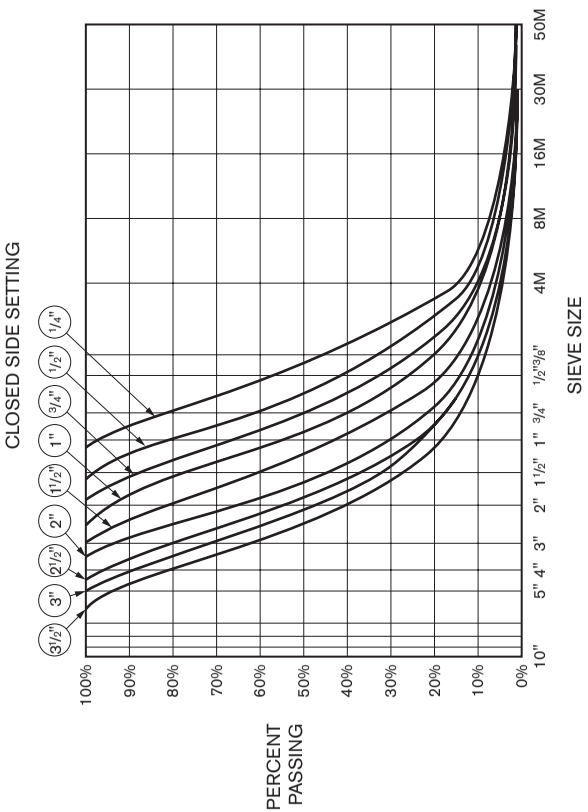
CAPACITY – TELSMITH 25"×40" THRU 55"×66" OVERHEAD ECCENTRIC JAW CRUSHERS

Size	25"×40"	30"×42"	30"×55"	36"×48"	38"×58"	40"×50"†	44"×48"	50"×60"	55"×66"
Capacity – Tons Per Hour at Discharge Setting of:									
2"	–	–	–	–	–	–	–	–	–
2 1/2"	133–217	150–230	–	–	–	–	–	–	–
3"	148–237	167–252	–	–	–	–	–	–	–
3 1/2"	160–259	183–273	283–430	–	–	–	–	–	–
4"	178–282	197–319	300–460	290–435	390–600	–	–	–	–
5"	206–334	230–342	350–530	328–492	432–680	–	384–580	–	–
6"	234–389*	270–405*	390–600	362–547	500–735	–	443–655	548–785	–
7"	266–444*	310–505*	430–670	408–620	530–800	–	500–750	570–850	670–995
8"	–	–	–	438–660	575–890	–	540–810	625–940	720–1,080
9"	–	–	–	–	620–950	–	580–870	680–1,015	785–1,175
10"	–	–	–	–	–	–	620–930	745–1,120	857–1,282
11"	–	–	–	–	–	–	660–980	840–1,190	938–1,410
12"	–	–	–	–	–	–	700–1,030	925–1,260	1,045–1,565
13"	–	–	–	–	–	–	–	995–1,330	1,170–1,750
14"	–	–	–	–	–	–	–	1,065–1,400	1,310–1,950
17"	–	–	–	–	–	750–1,120	–	–	–
18"	–	–	–	–	–	770–1,160	–	–	–
19"	–	–	–	–	–	800–1,200	–	–	–
20"	–	–	–	–	–	830–1,250	–	–	–
21"	–	–	–	–	–	870–1,300	–	–	–
22"	–	–	–	–	–	900–1,350	–	–	–

* Capacity with short toggle (Optional). † Option with 18" spacer for min. opening of 1" is available. Capacities shown are based on conditions listed in general notes on Pages 18-19. Capacities are listed for jaws in closed position and measured peak-to-peak The 40"×50" crusher is an extended frame version of the 22"×50" crusher.

TELSMITH JAW CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT

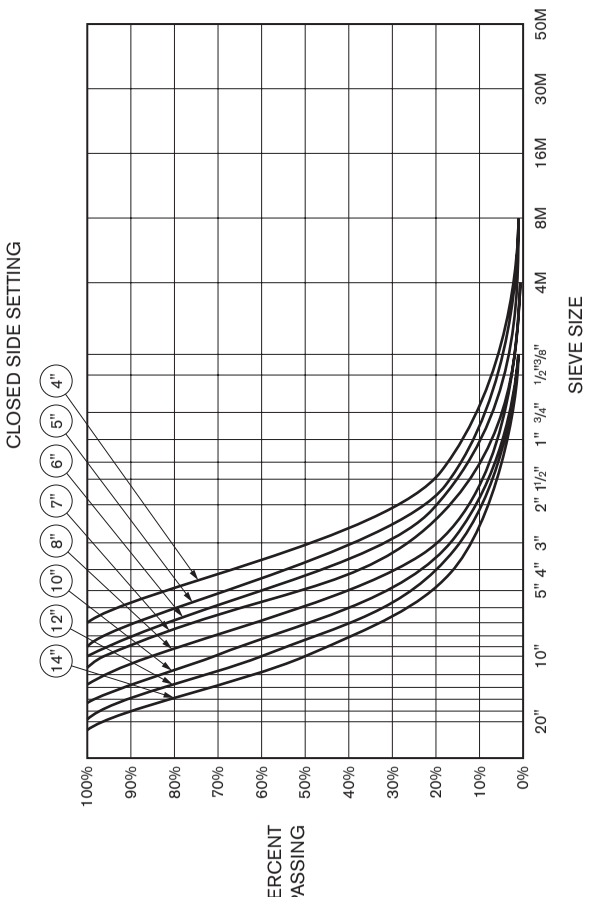


SCREEN ANALYSIS OF PRODUCT FROM TELSMITH JAW CRUSHER (OPEN CIRCUIT)

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	1/4"	1/2"	3/4"	1"	1 1/2"	2"	2 1/2"	3"	3 1/2"	US	mm	Decimal
6"	150.0	6.00									100	6"	150.0	6.00
5"	125.0	5.00							100	100	95	5"	125.0	5.00
4 1/2"	112.5	4.50		(% Passing)					98	95	89	4 1/2"	112.5	4.50
4"	100.0	4.00							96	89	82	4"	100.0	4.00
3 1/2"	90.0	3.50						100	89	82	73	3 1/2"	90.0	3.50
3"	75.0	3.00					100	93	82	72	62	3"	75.0	3.00
2 1/2"	63.0	2.50				100	95	81	69	60	52	2 1/2"	63.0	2.50
2"	50.0	2.00			100	97	80	65	55	47	41	2"	50.0	2.00
1 1/2"	37.5	1.50		100	88	80	63	48	39	33	28	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25	100	93	78	70	56	40	33	29	24	1 1/4"	31.5	1.25
1"	25.0	1.00	98	82	68	55	43	28	25	24	18	1"	25.0	1.00
3/4"	19.0	0.75	80	62	50	38	30	22	18	18	14	3/4"	19.0	0.75
1/2"	12.5	0.50	60	42	33	25	19	14	12	12	10	1/2"	12.5	0.50
3/8"	9.5	0.375	41	30	27	19	13	11	9	9	8	3/8"	9.5	0.375
4M	4.75	0.187	15	12	11	9	7	6	5	6	5	4M	4.75	0.187
8M	2.36	0.094	8	7	6	5	5	3	3	4	3	8M	2.36	0.094
16M	1.18	0.047	4	3	3	3	2	2	2	2	2	16M	1.18	0.047
30M	0.60	0.023	2	2	2	2	1	1	1	1	1	30M	0.60	0.023
50M	0.30	0.012	1	1	1	1						50M	0.30	0.012

NOTE: Screen analysis is based on curve shown on page 28.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH JAW CRUSHER (OPEN CIRCUIT)

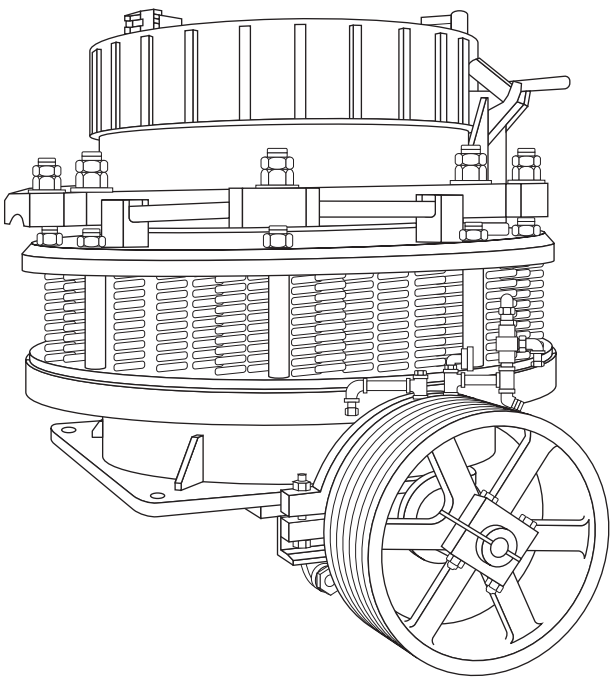
Sieve Designation Standard			Closed Side Setting								Sieve Designation Standard		
US	mm	Decimal	4"	5"	6"	7"	8"	10"	12"	14"	US	mm	Decimal
21"	533.0	21.00								100	21"	533.0	21.00
20"	508.0	20.00							100	98	20"	508.0	20.00
18"	457.0	18.00		(% Passing)					98	91	18"	457.0	18.00
16"	406.0	16.00						100	92	84	16"	406.0	16.00
14"	356.0	14.00						93	85	74	14"	356.0	14.00
13"	330.0	13.00					100	89	79	69	13"	330.0	13.00
12"	305.0	12.00					95	85	73	64	12"	305.0	12.00
11"	279.0	11.00				100	90	78	66	57	11"	279.0	11.00
10"	254.0	10.00			100	97	85	70	60	51	10"	254.0	10.00
9"	229.0	9.00		100	98	91	78	63	53	44	9"	229.0	9.00
8"	200.0	8.00		98	91	85	70	56	46	39	8"	200.0	8.00
7"	175.0	7.00	100	91	81	76	60	49	40	32	7"	175.0	7.00
6"	150.0	6.00	92	81	71	65	50	40	33	27	6"	150.0	6.00
5"	125.0	5.00	80	69	60	51	40	31	26	21	5"	125.0	5.00
4 1/2"	112.5	4.50	73	62	53	45	35	26	23	18	4 1/2"	112.5	4.50
4"	100.0	4.00	66	55	46	39	30	22	19	16	4"	100.0	4.00
3 1/2"	90.0	3.50	58	47	39	33	25	20	17	14	3 1/2"	90.0	3.50
3"	75.0	3.00	49	39	32	27	20	17	15	12	3"	75.0	3.00
2 1/2"	63.0	2.50	39	31	26	22	17	14	12	10	2 1/2"	63.0	2.50
2"	50.0	2.00	28	23	20	17	14	11	10	8	2"	50.0	2.00
1 1/2"	37.5	1.50	21	17	15	12	10	9	7	6	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25	17	14	12	10	8	7	6	5	1 1/4"	31.5	1.25
1"	25.0	1.00	14	11	10	7	7	6	5	4	1"	25.0	1.00
3/4"	19.0	0.75	11	9	7	5	5	4	4	3	3/4"	19.0	0.75
1/2"	12.5	0.50	7	6	5	3	3	2	2	2	1/2"	12.5	0.50
3/8"	9.5	0.375	4	4	3	2	2	1	1	1	3/8"	9.5	0.375
4M	4.75	0.187	2	2	1	1	1				4M	4.75	0.187
8M	2.36	0.094	1	1							8M	2.36	0.094

NOTE: Screen analysis is based on curve shown on page 30.

NOTES:

GYRASPHERE CRUSHERS – SERIES “D”

Gyrasphere (Cone Type) Crushers are used for secondary and tertiary crushing. They are capable of producing a large percentage of product in the desired sizes with a minimum oversize or excessive fines. Telsmith Series “D” Gyrasphere Crushers are made in 24", 36", 48" and 66" sizes in standard and fine crusher models. Feed openings can vary from $2^1/_2$" to 15" in capacities of 4 to 455 TPH. For full description and illustrations, refer to Bulletin 274C.



SPECIFICATIONS – SERIES "D" GYRASPHERE CRUSHERS – STYLE S

SIZE	24 S	245 S	36 S w/Sp. Rel.	36 S w/Hyd. Rel.	367 S w/Sp. Rel.	367 S w/Hyd. Rel.	48 S w/Sp. Rel.	48 S w/Hyd. Rel.	489 S w/Sp. Rel.	489 S w/Hyd. Rel.	66 S w/Hyd. Rel.	6614 S w/Hyd. Rel.
HP Required	30	30	75	75	75	75	150	150	150	150	250	300
Crusher Flywheel RPM	725	725	600	600	600	600	525	525	525	525	500	500
Sheave P. Dia. & Number & Type of Belts	24"–4C	24"–4C	28"–6D	28"–6D	28"–6D	28"–6D	34"–8D	34"–8D	34"–8D	34"–8D	40"–8E	40"–8E
Shipping Weight Lbs.	9,800	10,000	24,250	23,350	25,000	23,935	43,500	41,225	44,000	42,290	98,000	98,000
Weight Boxed for Export	10,000	10,200	24,750	23,850	25,450	24,385	44,600	43,325	45,900	44,200	99,600	99,600
Cu. Contents Export Boxed Ft.^{3}	160	160	340	355	340	355	650	670	650	670	1,330	1,330

CAPACITIES — SERIES "D" GYRASPHERE CRUSHERS — STYLE S

SIZE	24 S (2 Ft.)		245 S (2 Ft.)	36 S (3 Ft.)			367 S (3 Ft.)	48 S (4 Ft.)			489 S (4 Ft.)	66 S (5 1/2 Ft.)		6614 S (5 1/2 Ft.)
Type of Bowl	Coarse	Medium	Coarse	Ex. Coarse	Coarse	Medium	Coarse	Ex. Coarse	Coarse	Medium	Coarse	Coarse	Medium	Coarse
Feed Opening "A" Open Side	3 1/4"	2 1/2"	4 5/8"	7 1/8"	4 7/8"	4 1/2"	7 3/4"	8 1/2"	7 1/2"	5 7/8"	10"	11"	9"	15"
"B" Closed Side	2 3/4"	1 7/8"	4 1/8"	6 1/4"	4"	3 3/4"	6 3/4"	7 1/2"	6 1/2"	4 3/4"	9"	10"	8"	14"
Recommended Minimum Discharge Opening "C"	3/8"	1/4"	1/2"	3/4"	1/2"	3/8"	3/4"	3/4"	3/4"	1/2"	1"	1"	3/4"	1 1/2"
Capacities in Tons Per Hour at Indicated Discharge Opening "C". Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.[3]														
1/4"	–	17	–	–	–	–	–	–	–	–	–	–	–	–
3/8"	22	22	–	–	–	36	–	–	–	–	–	–	–	–
1/2"	27	27	27	–	41	41	–	–	–	85	–	–	–	–
5/8"	32	32	32	–	56	56	–	–	–	110	–	–	–	–
3/4"	37	37	37	71	71	71	71	135	135	135	–	–	200	–
7/8"	42	42	42	77	77	77	77	155	155	155	–	–	235	–
1"	47	47	47	83	83	83	83	170	170	170	170	275	275	–
1 1/4"	53	53	53	89	89	89	89	185	185	185	185	320	320	–
1 1/2"	–	–	–	105	105	105	105	200	200	200	200	365	365	365
2"	–	–	–	110	110	110	110	215	215	215	215	410	410	410
2 1/2"	–	–	–	–	–	–	–	–	–	–	230	455	455	455

NOTES: 1. All capacities based on data shown in general notes, Pages 18-19.
2. Capacities of Style S Gyraspheres are based on OPEN CIRCUIT crushing – one pass through the crusher.

SPECIFICATIONS – SERIES "D" GYRASPHERE CRUSHERS – STYLE FC

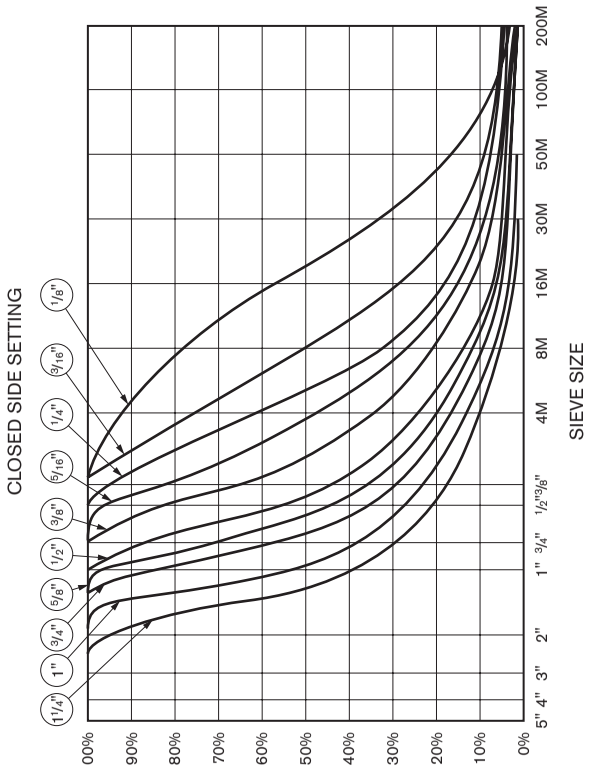
SIZE	24 FC	36 FC w/Sp. Rel.	36 FC w/Hyd. Rel.	48 FC w/Sp. Rel.	48 FC w/Hyd. Rel.	66 FC w/Hyd. Rel.
HP Required	40	100	100	200	200	300
Crusher Flywheel RPM	725	600	600	525	525	530
Sheave P. Dia. & Number & Type of Belts	24"–4C	28"–7D	28"–7D	34"–10D	34"–10D	40"–8E
Shipping Weight Lbs.	10,000	25,000	24,030	44,500	42,195	98,000
Weight Boxed for Export Lbs.	10,200	25,750	24,780	45,600	43,295	99,600
Cu. Contents Export Boxed $Ft.^3$	160	340	355	650	670	1,330

CAPACITIES – SERIES "D" GYRASPHERE CRUSHERS – STYLE FC

SIZE		24 FC (2 Ft.)			36 FC (3 Ft.)			48 FC (4 Ft.)			66 FC (5 1/2 Ft.)		
Type of Bowl		Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening	"D" Open Side	2 1/2"	1 3/4"	1 5/16"	3"	2"	1 3/4"	4 1/8"	3"	2 1/4"	5 3/4"	4 1/2"	3"
	"E" Closed Side	1 7/8"	1 1/8"	1/2"	2"	1 1/8"	3/4"	3"	1 7/8"	1"	4"	2 1/2"	1 1/8"
Recommended Minimum Discharge Opening "F"		1/4"	3/16"	1/8"	5/16"	1/4"	3/16"	3/8"	5/16"	1/4"	1/2"	3/8"	3/8"
Capacities in Tons Per Hour at Indicated Discharge Opening "F". Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.[3]													
1/8"				4									
3/16"			8	8			20						
1/4"		10	10	10		32	32			50			
3/8"		14	14	14	42	42	42	80	80	80		140	140
1/2"		20	20	20	52	52	52	105	105	105	180	180	180
5/8"		25	25	25	62	62	62	130	130	130	215	215	215
3/4"		30	30	30	72	72	72	155	155	155	250	250	250
7/8"					80	80	80	180	180	180	280	280	280
1"					95	95	95	205	205	205	310	310	310

NOTES: 1. All capacities based on data shown in general notes, Page 18-19.
2. Capacities of Style FC Gyraspheres are based on CLOSED CIRCUIT crushing – net finished product.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 24S, 245S & 24FC GYRASPHERE CRUSHER

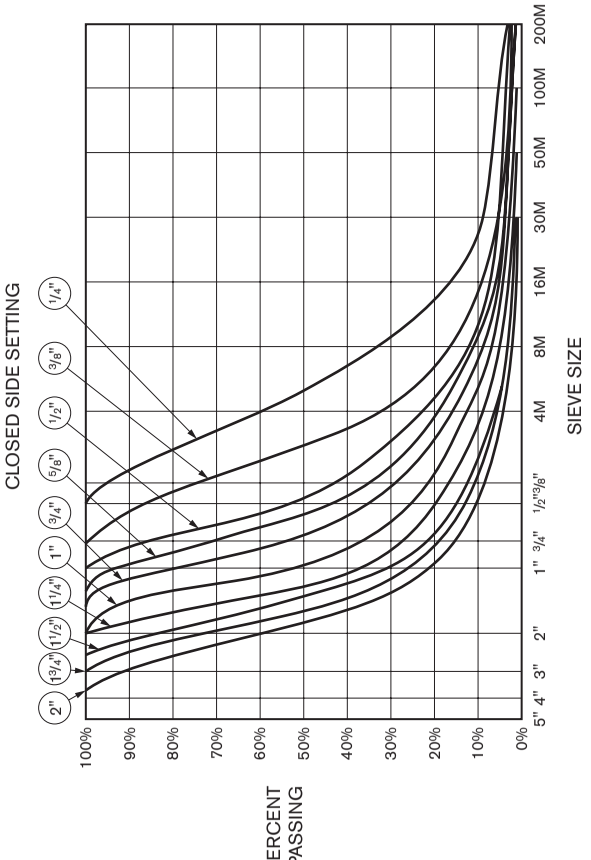
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	US	mm	Decimal
2 1/2"	63.0	2.50										100	2 1/2"	63.0	2.50
2"	50.0	2.00			(% Passing)						100	94	2"	50.0	2.00
1 1/2"	37.5	1.50									98	75	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25							100	100	80	50	1 1/4"	31.5	1.25
1"	25.0	1.00						100	97	86	53	37	1"	25.0	1.00
3/4"	19.0	0.75				100	100	87	72	57	38	30	3/4"	19.0	0.75
1/2"	12.5	0.50			100	96	83	56	45	35	27	21	1/2"	12.5	0.50
3/8"	9.5	0.375	100	100	93	77	60	41	34	28	22	17	3/8"	9.5	0.375
4M	4.75	0.187	92	76	61	47	34	24	20	16	13	10	4M	4.75	0.187
8M	2.36	0.094	77	50	32	27	21	14	12	10	7	5	8M	2.36	0.094
16M	1.18	0.047	57	28	18	15	12	7	6	5	3	2	16M	1.18	0.047
30M	0.60	0.023	32	15	11	9	7	5	4	4	2	1	30M	0.60	0.023
50M	0.30	0.012	17	9	7	6	5	4	3	3	1		50M	0.30	0.012
100M	0.15	0.006	7	6	6	5	4	3	2	2			100M	0.15	0.006
200M	0.075	0.003	3	5	4	3	2	1	1	1			200M	0.075	0.003

NOTES:
1. Screen Analysis is based on curves shown on page 38.
2. For recommended minimum and maximum discharge openings, and capacities see page 35 and 37.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 36 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 36S, 367S & 36FC GYRASPHERE CRUSHER

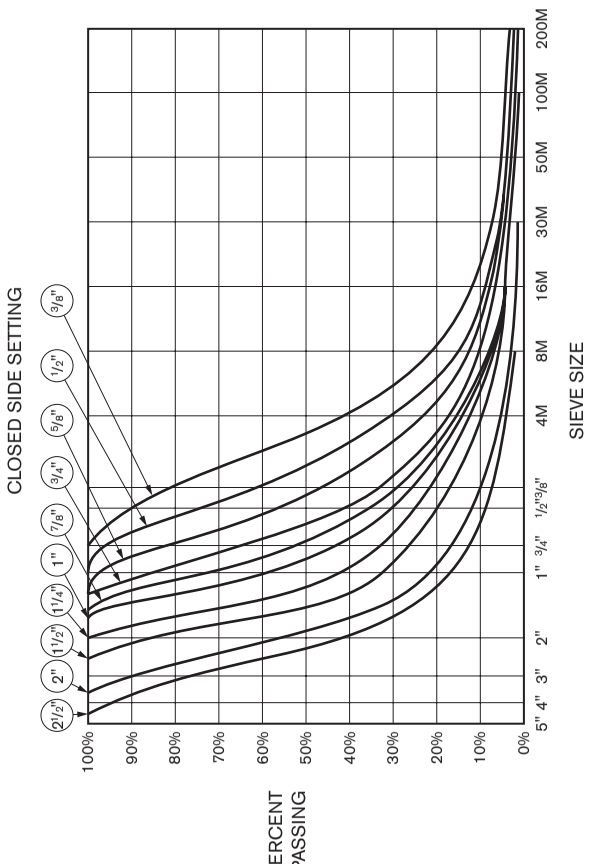
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting										Sieve Designation Standard		
US	mm	Decimal	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	90	3"	75.0	3.00
2 1/2"	63.0	2.50								100	93	79	2 1/2"	63.0	2.50
2"	50.0	2.00						100	100	85	72	59	2"	50.0	2.00
1 1/2"	37.5	1.50					100	95	75	59	48	38	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	98	75	54	44	36	29	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	79	53	38	30	26	21	1"	25.0	1.00
3/4"	19.0	0.75		100	84	69	55	36	28	22	19	15	3/4"	19.0	0.75
1/2"	12.5	0.50	100	87	55	43	35	26	20	15	13	11	1/2"	12.5	0.50
3/8"	9.5	0.375	93	70	40	33	28	21	16	12	10	8	3/8"	9.5	0.375
4M	4.75	0.187	60	32	23	19	16	12	9	6	6	5	4M	4.75	0.187
8M	2.36	0.094	34	17	13	11	9	7	5	3	3	3	8M	2.36	0.094
16M	1.18	0.047	16	9	7	6	5	4	3	2	2	2	16M	1.18	0.047
30M	0.60	0.023	9	5	5	5	4	3	2	1	1	1	30M	0.60	0.023
50M	0.30	0.012	6	4	4	3	3	2	1				50M	0.30	0.012
100M	0.15	0.006	5	3	3	2	2	1					100M	0.15	0.006
200M	0.075	0.003	3	2	1	1	1						200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 40.
2. For recommended minimum and maximum discharge openings, and capacities see page 35 and 37.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 48 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT

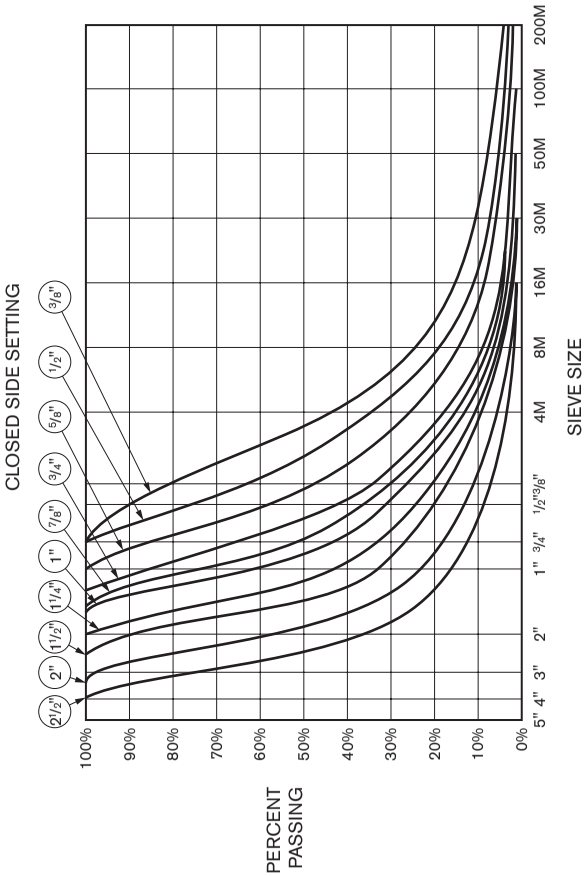


SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 48S, 489S & 48FC GYRASPHERE CRUSHER
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	2"	2 1/2"	US	mm	Decimal
4 1/2"	112.5	4.50										100	4 1/2"	112.5	4.50
4"	100.0	4.00			(% Passing)						100	92	4"	100.0	4.00
3 1/2"	90.0	3.50									99	88	3 1/2"	90.0	3.50
3"	75.0	3.00									90	76	3"	75.0	3.00
2 1/2"	63.0	2.50								100	77	60	2 1/2"	63.0	2.50
2"	50.0	2.00						100	100	87	56	44	2"	50.0	2.00
1 1/2"	37.5	1.50					100	98	75	53	35	28	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25			100	100	93	81	55	40	28	22	1 1/4"	31.5	1.25
1"	25.0	1.00		100	98	85	73	58	42	32	22	17	1"	25.0	1.00
3/4"	19.0	0.75	100	96	83	64	52	43	33	26	17	13	3/4"	19.0	0.75
1/2"	12.5	0.50	90	75	57	41	35	30	25	20	12	9	1/2"	12.5	0.50
3/8"	9.5	0.375	77	58	44	31	27	24	20	16	9	7	3/8"	9.5	0.375
4M	4.75	0.187	41	30	23	17	15	14	12	10	5	4	4M	4.75	0.187
8M	2.36	0.094	21	15	13	10	8	8	7	5	3	2	8M	2.36	0.094
16M	1.18	0.047	11	9	7	6	4	4	4	4	2		16M	1.18	0.047
30M	0.60	0.023	7	5	5	4	3	3	3	3	1		30M	0.60	0.023
50M	0.30	0.012	5	4	4	3	2	2	2	2			50M	0.30	0.012
100M	0.15	0.006	4	3	3	2	1	1	1	1			100M	0.15	0.006
200M	0.075	0.003	3	2	2	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 42.
2. For recommended minimum and maximum discharge openings, and capacities see page 35 and 37.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 66S, 6614S & 66FC GYRASPHERE CRUSHER

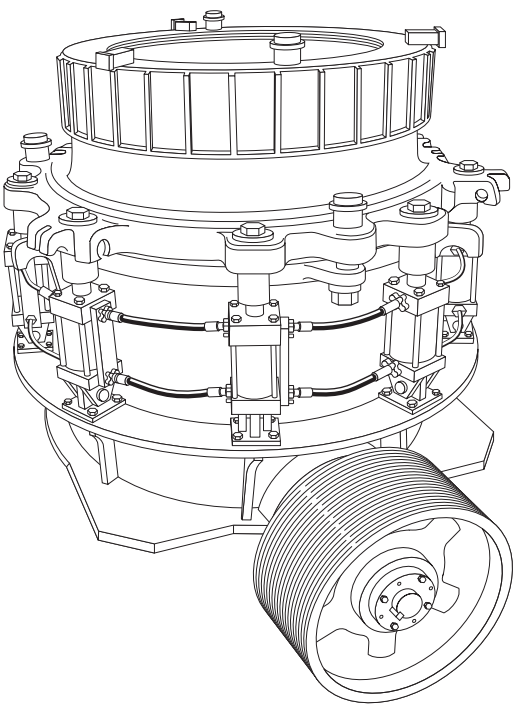
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	2"	2 1/2"	US	mm	Decimal
4"	100.0	4.00										100	4"	100.0	4.00
3 1/2"	90.0	3.50									100	91	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						97	74	3"	75.0	3.00
2 1/2"	63.0	2.50								100	79	53	2 1/2"	63.0	2.50
2"	50.0	2.00						100	100	88	55	35	2"	50.0	2.00
1 1/2"	37.5	1.50					100	98	75	54	35	24	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25			100	100	92	81	56	41	29	20	1 1/4"	31.5	1.25
1"	25.0	1.00		100	99	85	72	61	42	33	23	16	1"	25.0	1.00
3/4"	19.0	0.75	100	98	84	63	51	44	33	26	18	13	3/4"	19.0	0.75
1/2"	12.5	0.50	90	75	56	42	35	30	24	19	13	9	1/2"	12.5	0.50
3/8"	9.5	0.375	76	59	44	32	27	24	19	16	10	7	3/8"	9.5	0.375
4M	4.75	0.187	43	33	25	17	15	13	11	9	5	3	4M	4.75	0.187
8M	2.36	0.094	24	19	14	8	7	6	4	4	2	1	8M	2.36	0.094
16M	1.18	0.047	15	10	8	4	4	3	2	2	1		16M	1.18	0.047
30M	0.60	0.023	10	7	4	3	3	2	1	1			30M	0.60	0.023
50M	0.30	0.012	7	5	3	2	2	1					50M	0.30	0.012
100M	0.15	0.006	5	4	2	1	1						100M	0.15	0.006
200M	0.075	0.003	4	3	1								200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 44.
2. For recommended minimum and maximum discharge openings, and capacities see page 35 and 37.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

GYRASPHERE CRUSHER – SERIES “H”

“H” Series Gyrasphere (cone type) crushers are used for secondary and tertiary crushing. These crushers have been developed using the expertise and experience gained over more than 65 years of producing high quality cone type crushers. This expertise combined with modern materials and technology including computer aided design (CAD) data has resulted in these dependable, high capacity crushers. Feed openings are available from $3^1/_2$" to 11" in capacities from 175 to 1010 TPH. For full descriptions and illustrations, refer to Bulletin T403.



SPECIFICATIONS — SERIES "H" GYRASPHERE CRUSHERS — STYLE S & FC

SIZE	44S	44 FC	52S	52 FC	57S	57 FC	68S	68 FC
HP Required	200	200	250	300	300	300	400	500
Crusher Flywheel RPM	677	677	600	600	710	710	565	565
Sheave P. Dia. & Numbers & Type of Belts	24"–10C	24"–10C	33"–10D	33"–10D	33"–10D	33"–10D	40"–8-8V	10"–8-8V
Shipping Weight Lbs.	31,200	31,200	47,900	47,900	66,000	66,000	109,000	109,000
Weight Boxed for Export Lbs.	31,850	31,850	48,900	48,900	67,500	67,500	111,200	112,000
Cu. Contents Export Boxed $Ft.^3$	670	670	770	770	1,190	1,190	1,475	1,475

CAPACITIES – SERIES "H" GYRASPHERE CRUSHERS – STYLE S

SIZE		44S			52S			57S			68S		
Type of Bowl		Extra Coarse	Coarse	Medium	Ex. Coarse	Coarse	Medium	Ex. Coarse	Coarse	Medium	Ex. Coarse	Coarse	Medium
Feed Opening	Open Side	7"	5 7/8"	4 7/8"	8 1/8"	7 3/8"	5 1/2"	10 3/4"	9"	9"	11 1/4"	10 1/2"	8 7/8"
	Closed Side	5 1/2"	4 1/4"	3 1/2"	6 1/2"	5 3/4"	3 3/4"	9 1/8"	8 1/2"	7 5/8"	10 1/2"	8 3/4"	7"
Recommended Minimum Discharge Opening*		1"	3/4"	1/2"	1"	3/4"	5/8"	1"	7/8"	3/4"	1 1/4"	1"	3/4"
Capacities in Tons Per Hour at Indicated Discharge Opening. Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.^{3}													
1/2"		–	–	180	–	–	–	–	–	–	–	–	–
5/8"		–	–	215	–	–	240	–	–	–	–	–	–
3/4"		–	235	235	–	270	270	–	–	395	–	–	555
1"		265	265	265	330	330	330	475	475	475	–	630	630
1 1/4"		300	300	300	380	380	380	510	510	510	695	695	695
1 1/2"		340	340	340	430	430	430	570	570	570	750	750	750
2"		390	390	390	500	500	500	665	665	665	925	925	925
2 1/2"		–	–	–	–	–	–	–	–	–	1,010	1,010	1,010

NOTES: 1. All capacities based on data shown in general notes, Pages 18-19.

2. Capacities of Style S Gyraspheres are based on OPEN CIRCUIT crushing – one pass through the crusher.

* The minimum setting for each bowl is not necessarily applicable for each and every installation.

CAPACITIES – SERIES "H" GYRASPHERE CRUSHERS – STYLE FC

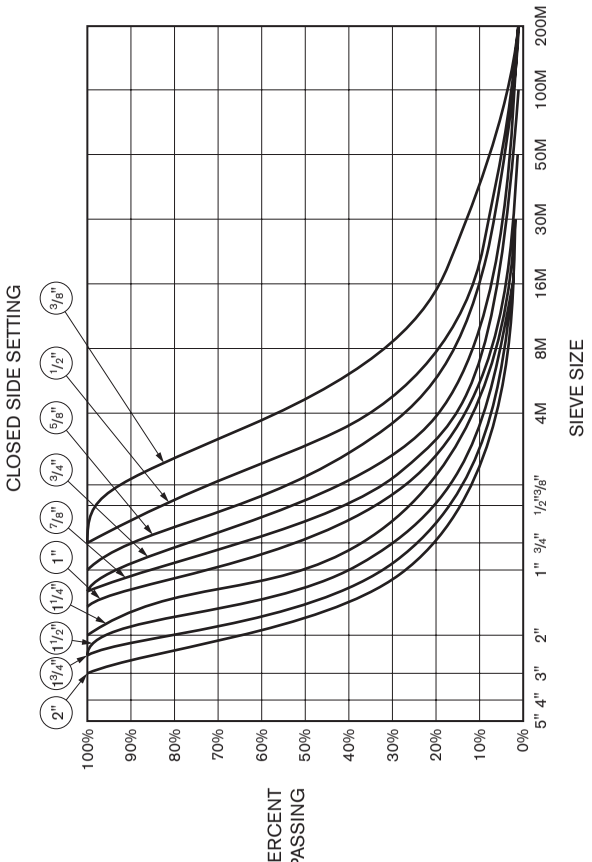
SIZE		44 FC			52 FC			57 FC			68 FC		
Type of Bowl		Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening	Open Side	4 1/4"	3 3/4"	3 1/2"	5"	4 1/2"	4"	6"	4 1/4"	3 3/8"	6 5/8"	4 7/8"	3 3/8"
	Closed Side	2 5/8"	2 1/4"	1 3/4"	3 1/2"	2 7/8"	2 1/4"	4 3/8"	2 5/8"	1 3/4"	5"	3 1/8"	1 5/8"
Recommended Minimum Discharge Opening*		5/8"	1/2"	3/8"	5/8"	1/2"	3/8"	3/4"	5/8"	1/2"	7/8"	5/8"	3/8"
Capacities in Tons Per Hour at Indicated Discharge Opening. Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.^{3}													
3/8"		–	175	175	–	–	200	–	–	–	–	–	490
1/2"		180	180	180	–	235	235	–	–	350	–	–	530
5/8"		210	210	210	265	265	265	–	390	390	–	570	570
3/4"		235	235	235	300	300	300	435	435	435	–	610	610
1"		290	290	290	365	365	365	520	520	520	690	690	690
1 1/4"		–	–	–	–	–	–	–	–	–	765	765	765

NOTES: 1. All capacities based on data shown in general notes, Pages 18-19.

2. Capacities of Style FC Gyraspheres are based on total thru-put and are based on CLOSED CIRCUIT crushing – assuming normal screen efficiency.

* The minimum setting for each bowl is not necessarily applicable for each and every installation.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 44S & 44FC GYRASPHERE CRUSHER

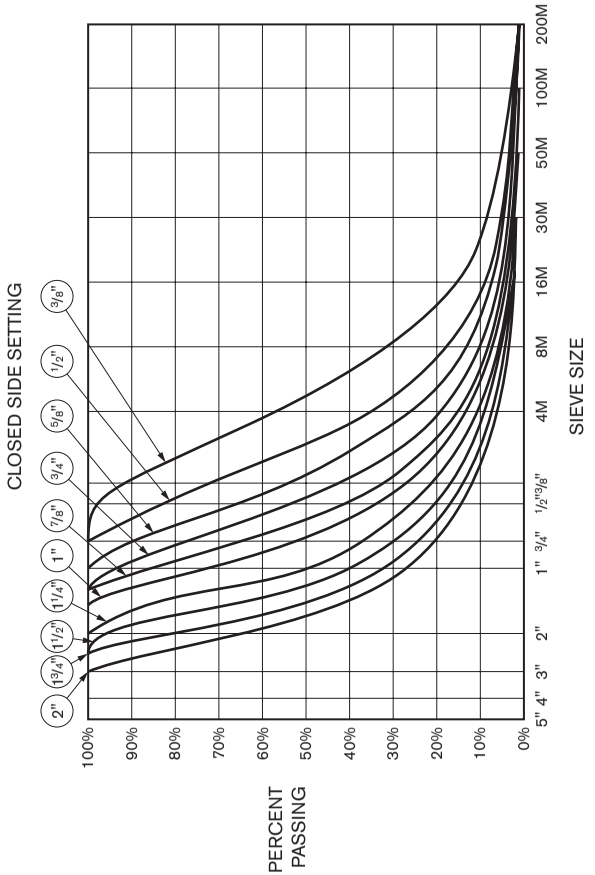
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3"	75.0	3.00									100	100	3"	75.0	3.00
2 1/2"	63.0	2.50			(% Passing)					100	99	83	2 1/2"	63.0	2.50
2"	50.0	2.00							100	96	79	62	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	87	66	51	43	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	99	91	69	53	41	35	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	72	51	40	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	51	37	29	24	21	3/4"	19.0	0.75
1/2"	12.5	0.50	98	82	65	52	41	34	26	20	17	14	1/2"	12.5	0.50
3/8"	9.5	0.375	88	67	50	39	30	25	20	16	13	12	3/8"	9.5	0.375
4M	4.75	0.187	57	35	26	19	15	13	12	9	7	6	4M	4.75	0.187
8M	2.36	0.094	31	19	16	11	9	7	7	5	4	4	8M	2.36	0.094
16M	1.18	0.047	19	11	10	7	6	3	4	2	2	2	16M	1.18	0.047
30M	0.60	0.023	13	8	7	5	4	2	2	1	1	1	30M	0.60	0.023
50M	0.30	0.012	8	5	5	3	2	1	1				50M	0.30	0.012
100M	0.15	0.006	4	3	3	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 50.
2. For recommended minimum and maximum discharge openings, and capacities see page 48 and 49.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 52 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



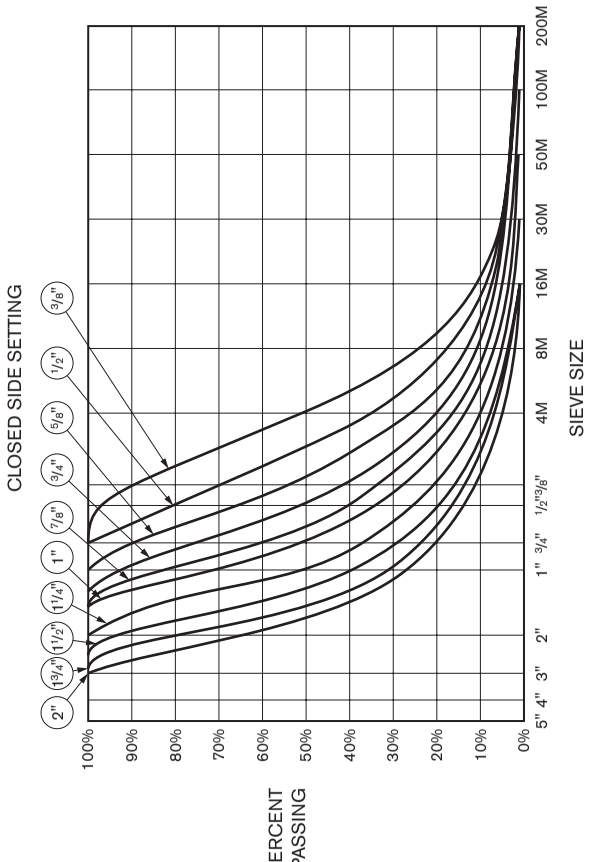
SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 52S & 52FC GYRASPHERE CRUSHER

AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	99	83	2 1/2"	63.0	2.50
2"	50.0	2.00							100	96	79	62	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	87	66	51	43	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	99	91	69	53	41	35	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	72	51	40	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	51	37	29	24	21	3/4"	19.0	0.75
1/2"	12.5	0.50	98	82	65	52	41	34	26	20	17	14	1/2"	12.5	0.50
3/8"	9.5	0.375	88	67	50	39	30	25	20	16	13	12	3/8"	9.5	0.375
4M	4.75	0.187	57	35	26	19	15	13	10	9	7	6	4M	4.75	0.187
8M	2.36	0.094	31	18	13	10	8	7	5	5	4	4	8M	2.36	0.094
16M	1.18	0.047	15	9	7	6	5	3	2	2	2	2	16M	1.18	0.047
30M	0.60	0.023	8	5	5	4	3	2	1	1	1	1	30M	0.60	0.023
50M	0.30	0.012	5	3	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	3	2	1	1	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 52.
2. For recommended minimum and maximum discharge openings, and capacities see page 48 and 49.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

SCREEN ANALYSIS OF CRUSHER PRODUCT



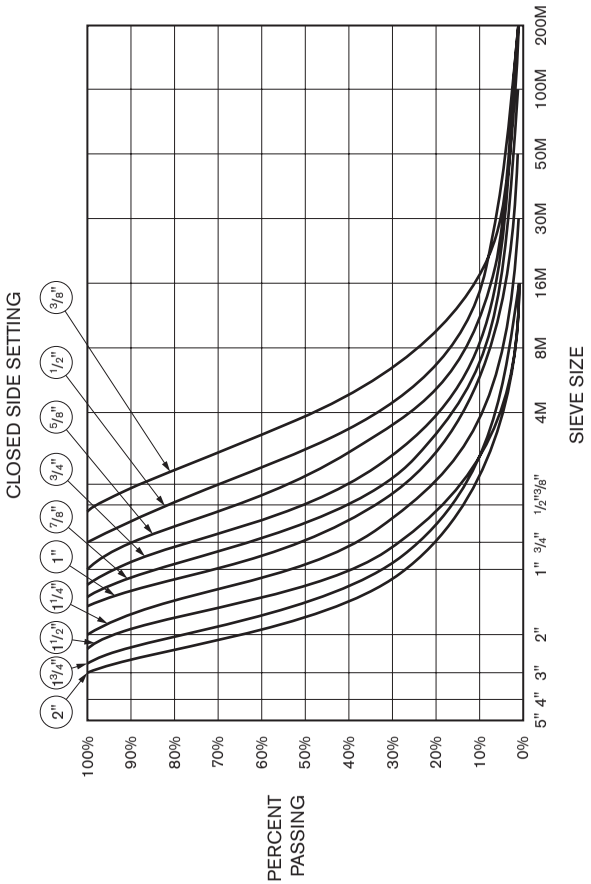
SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 57S & 57FC GYRASPHERE CRUSHER

AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	97	85	2 1/2"	63.0	2.50
2"	50.0	2.00							100	93	76	63	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	85	66	51	41	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	97	89	68	52	40	32	1 1/4"	31.5	1.25
1"	25.0	1.00			100	93	82	71	52	39	30	25	1"	25.0	1.00
3/4"	19.0	0.75	100	100	89	75	62	51	37	28	23	19	3/4"	19.0	0.75
1/2"	12.5	0.50	97	81	66	50	40	34	25	19	16	13	1/2"	12.5	0.50
3/8"	9.5	0.375	84	65	51	38	31	26	19	15	12	10	3/8"	9.5	0.375
4M	4.75	0.187	50	34	26	20	16	13	9	7	6	5	4M	4.75	0.187
8M	2.36	0.094	24	17	13	10	8	6	4	3	3	2	8M	2.36	0.094
16M	1.18	0.047	11	8	7	6	5	3	2	1	1	1	16M	1.18	0.047
30M	0.60	0.023	5	5	5	4	3	2	1				30M	0.60	0.023
50M	0.30	0.012	3	3	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	2	2	2	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 54.
2. For recommended minimum and maximum discharge openings, and capacities see page 48 and 49.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 68S & 68FC GYRASPHERE CRUSHER

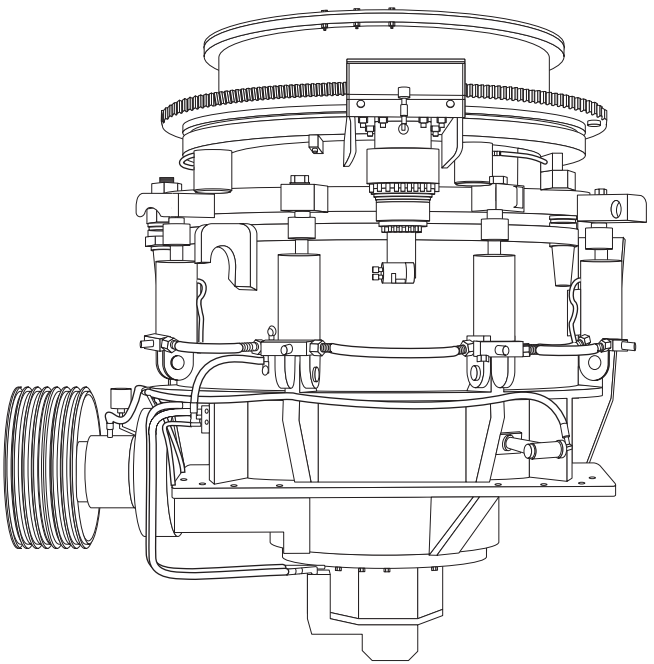
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	97	87	2 1/2"	63.0	2.50
2"	50.0	2.00							100	94	77	66	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	85	68	53	44	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	97	89	70	54	42	34	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	73	54	41	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	52	39	28	24	20	3/4"	19.0	0.75
1/2"	12.5	0.50	97	82	66	50	39	34	25	18	16	13	1/2"	12.5	0.50
3/8"	9.5	0.375	84	65	51	37	29	25	19	13	12	10	3/8"	9.5	0.375
4M	4.75	0.187	48	33	25	20	16	14	9	5	6	4	4M	4.75	0.187
8M	2.36	0.094	24	17	13	10	8	7	4	2	3	2	8M	2.36	0.094
16M	1.18	0.047	11	9	8	7	5	4	2	1	1	1	16M	1.18	0.047
30M	0.60	0.023	5	6	5	5	3	2	1				30M	0.60	0.023
50M	0.30	0.012	3	4	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	2	2	2	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 56.
2. For recommended minimum and maximum discharge openings, and capacities see page 48 and 49.
3. Capacities of style (S) gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of style (FC) gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH "SILVER BULLET" SERIES GYRASPHERE CRUSHER

The new "Silver Bullet" Series Gyrasphere Crushers incorporate all the rugged, dependable, high capacity features of previous Gyrasphere Models plus many new innovations, i.e., anti-spin head brake, hydraulic locking system, adjust under load feature, support bowl extraction/ insertion with rotate system and more. Presently manufactured in Models 38, 44, 52, 57 & 68 in both open and closed circuit crushing chamber configurations. For more information, contact factory.



SPECIFICATIONS — SILVER BULLET SERIES GYRASPHERE CRUSHERS

MODEL	38 SBS	44 SBS	52 SBS	57 SBS	68 SBS
HP Required	200	300	400	500	600
Crusher Flywheel RPM	780	677	600	710	565
Sheave P. Dia. & Numbers & Type of Belts	23.6 – 8/5V	23.6 – 8/5V	35.5 – 6/8V	35.5 – 8/8V	40.0 – 10/8V
Shipping Weight Lbs.*	29,800	36,000	53,000	76,000	112,000
Weight Boxed for Export Lbs.	30,600	37,880	54,975	77,500	114,820
Cu. Contents Export Boxed Ft.^{3}	750	805	1,110	1,570	2,350

* Weights include: lube system with A/O cooler, anti-spin option, hydraulic control unit, and typical crushing liners.

CAPACITIES – SILVER BULLET SERIES GYRASPHERE CRUSHERS – OPEN CIRCUIT CRUSHING

SIZE		38			44			52			57			68		
Type of Bowl		Extra Coarse	Med. Coarse	Med.	Extra Coarse	Coarse	Med.	Ex. Coarse	Coarse	Med.	Ex. Coarse	Coarse	Med.	Ex. Coarse	Coarse	Med.
Feed Opening	Open Side	5.8"	5.3"	4.8"	7"	$5\frac{7}{8}$"	$4\frac{7}{8}$"	$8\frac{1}{8}$"	$7\frac{3}{8}$"	$5\frac{1}{2}$"	$10\frac{3}{4}$"	9"	9"	$11\frac{1}{4}$"	$10\frac{1}{2}$"	$8\frac{7}{8}$"
	Closed Side	4.5"	3.9"	3.4"	$5\frac{1}{2}$"	$4\frac{1}{4}$"	$3\frac{1}{2}$"	$6\frac{1}{2}$"	$5\frac{3}{4}$"	$3\frac{3}{4}$"	$9\frac{1}{8}$"	$8\frac{1}{2}$"	$7\frac{5}{8}$"	$10\frac{1}{2}$"	$8\frac{3}{4}$"	7"
Recommended Minimum Discharge Opening*		$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{1}{2}$"	1"	$\frac{3}{4}$"	$\frac{1}{2}$"	1"	$\frac{3}{4}$"	$\frac{5}{8}$"	1"	$\frac{7}{8}$"	$\frac{3}{4}$"	$1\frac{1}{4}$"	1"	$\frac{3}{4}$"
Capacities in Tons Per Hour at Indicated Discharge Opening. Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.[3]																
$\frac{1}{2}$"		–	–	–	–	–	180	–	–	–	–	–	–	–	–	–
$\frac{5}{8}$"		–	–	125	–	–	215	–	–	240	–	–	–	–	–	–
$\frac{3}{4}$"		–	150	150	–	235	235	–	270	270	–	–	395	–	–	555
1"		170	170	170	265	265	265	330	330	330	475	475	475	–	630	630
$1\frac{1}{4}$"		205	205	205	300	300	300	380	380	380	510	510	510	695	695	695
$1\frac{1}{2}$"		235	235	235	340	340	340	430	430	430	570	570	570	750	750	750
2"		265	265	265	390	390	390	500	500	500	665	665	665	925	925	925
$2\frac{1}{2}$"		300	300	300	–	–	–	–	–	–	–	–	–	1,010	1,010	1,010

NOTES: 1. All capacities based on data shown in general notes, Pages 18-19.

2. Capacities of Gyraspheres are based on OPEN CIRCUIT crushing – one pass through the crusher.

* The minimum setting for each bowl is not necessarily applicable for each and every installation.

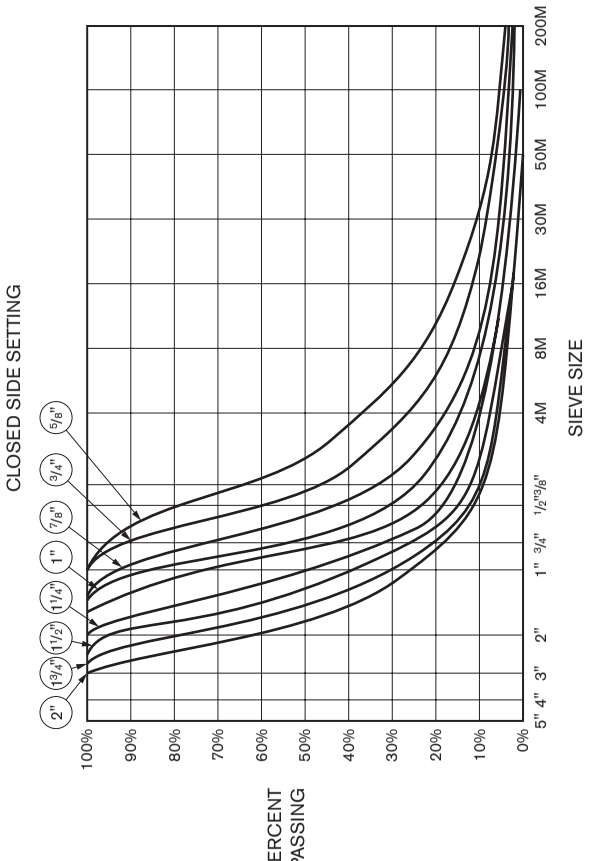
CAPACITIES — SILVER BULLET SERIES GYRASPHERE CRUSHERS — CLOSED CIRCUIT CRUSHING

SIZE		38			44			52			57			68		
Type of Bowl		Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening	Open Side	4 1/4"	3 3/4"	3 1/4"	4 1/4"	3 3/4"	3 1/2"	5"	4 1/2"	4"	6"	4 1/4"	3 3/8"	6 5/8"	4 7/8"	3 3/8"
	Closed Side	2 7/8"	2 1/4"	1 3/4"	2 5/8"	2 1/4"	1 3/4"	3 1/2"	2 7/8"	2 1/4"	4 3/8"	2 5/8"	1 3/4"	5"	3 1/8"	1 5/8"
Recommended Minimum Discharge Opening*		5/8"	1/2"	3/8"	5/8"	1/2"	3/8"	5/8"	1/2"	1/2"	3/4"	5/8"	1/2"	3/4"	5/8"	1/2"
Capacities in Tons Per Hour at Indicated Discharge Opening. Tons of 2000 Lbs. Material Weighing 100 Lbs. Ft.^{3}																
3/8"		–	–	115-140	–	–	150-195	–	–	–	–	–	–	–	–	–
1/2"		–	130-160	130-160	–	170-220	170-220	–	200-260	200-260	–	–	300-385	–	–	450-585
5/8"		155-190	155-190	155-190	200-260	200-260	200-260	225-290	225-290	225-290	–	330-430	330-430	–	485-625	485-625
3/4"		170-210	170-210	170-210	220-285	220-285	220-285	255-330	255-330	255-330	370-480	370-480	370-480	520-670	520-670	520-670
1"		205-255	205-255	205-255	270-350	270-350	270-350	310-400	310-400	310-400	440-575	440-575	440-575	585-760	585-760	585-760
1 1/4"		–	–	–	–	–	–	–	–	–	–	–	–	650-840	650-840	650-840
1 1/2"		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1 3/4"		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTES: 1. All capacities based on data shown in general notes, Pages 18-19.
2. Capacities of Gyraspheres are total throughput based on CLOSED CIRCUIT crushing.

* The minimum setting for each bowl is not necessarily applicable for each and every installation.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 38 GYRASPHERE CRUSHER

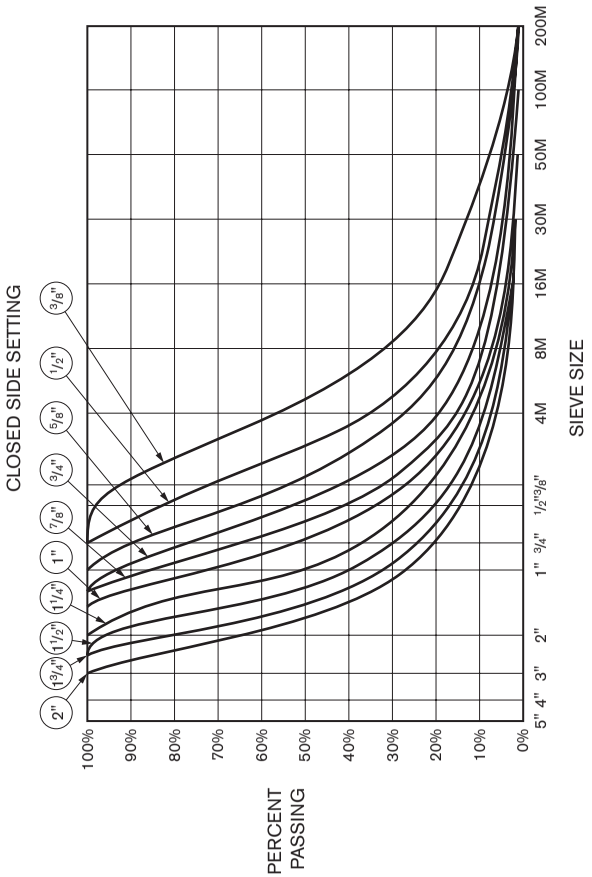
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3"	75.0	3.00								100	100	3"	75.0	3.00
2 1/2"	63.0	2.50		(% Passing)					100	99	83	2 1/2"	63.0	2.50
2"	50.0	2.00						100	96	79	62	2"	50.0	2.00
1 1/2"	37.5	1.50			100	100	100	87	66	51	43	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25			99	90	90	68	53	41	35	1 1/4"	31.5	1.25
1"	25.0	1.00	100	100	94	73	73	52	41	32	27	1"	25.0	1.00
3/4"	19.0	0.75	97	92	75	45	45	32	25	21	18	3/4"	19.0	0.75
1/2"	12.5	0.50	81	61	43	24	24	18	14	12	10	1/2"	12.5	0.50
3/8"	9.5	0.375	64	47	32	19	19	16	12	10	9	3/8"	9.5	0.375
4M	4.75	0.187	37	27	18	12	12	11	8	6	6	4M	4.75	0.187
8M	2.36	0.094	23	17	11	7	7	7	5	4	4	8M	2.36	0.094
16M	1.18	0.047	15	11	7	3	3	4	2	2	2	16M	1.18	0.047
30M	0.60	0.023	10	8	5	2	2	2	1	1	1	30M	0.60	0.023
50M	0.30	0.012	8	6	4	1	1	1				50M	0.30	0.012
100M	0.15	0.006	5	4	3							100M	0.15	0.006
200M	0.075	0.003	3	2	2							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 62.
2. For recommended minimum and maximum discharge openings, and capacities see pages 60 and 61.
3. Capacities of gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 44 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 44 GYRASPHERE CRUSHER

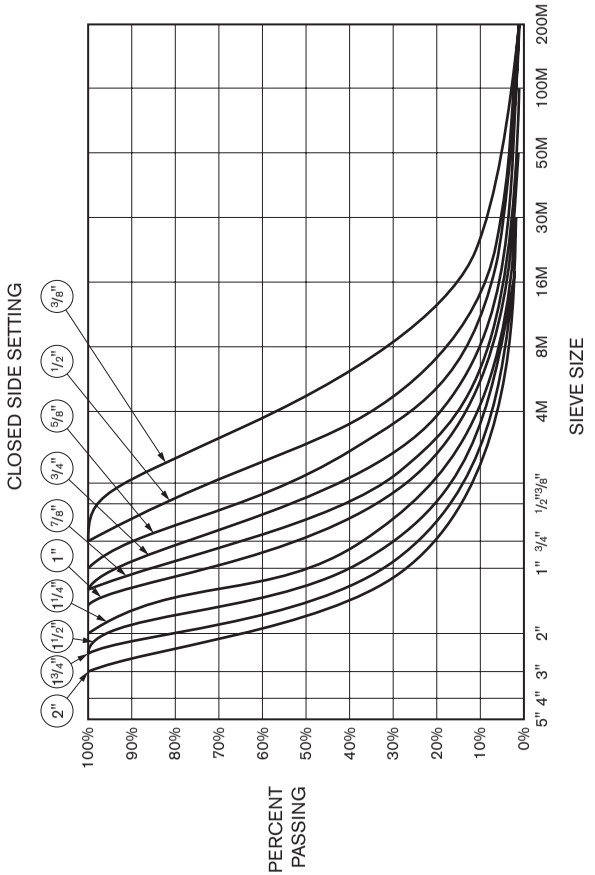
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3"	75.0	3.00									100	100	3"	75.0	3.00
2 1/2"	63.0	2.50			(% Passing)					100	99	83	2 1/2"	63.0	2.50
2"	50.0	2.00							100	96	79	62	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	87	66	51	43	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	99	91	69	53	41	35	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	72	51	40	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	51	37	29	24	21	3/4"	19.0	0.75
1/2"	12.5	0.50	98	82	65	52	41	34	26	20	17	14	1/2"	12.5	0.50
3/8"	9.5	0.375	88	67	50	39	30	25	20	16	13	12	3/8"	9.5	0.375
4M	4.75	0.187	57	35	26	19	15	13	12	9	7	6	4M	4.75	0.187
8M	2.36	0.094	31	19	16	11	9	7	7	5	4	4	8M	2.36	0.094
16M	1.18	0.047	19	11	10	7	6	3	4	2	2	2	16M	1.18	0.047
30M	0.60	0.023	13	8	7	5	4	2	2	1	1	1	30M	0.60	0.023
50M	0.30	0.012	8	5	5	3	2	1	1				50M	0.30	0.012
100M	0.15	0.006	4	3	3	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 64.
2. For recommended minimum and maximum discharge openings, and capacities see page 60 and 61.
3. Capacities of gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 52 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



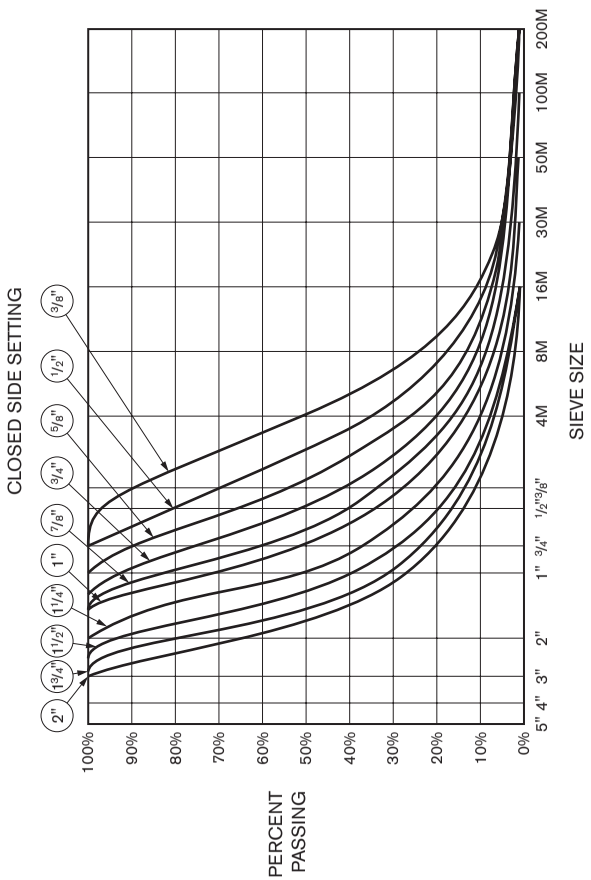
SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 52 GYRASPHERE CRUSHER

AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	99	83	2 1/2"	63.0	2.50
2"	50.0	2.00							100	96	79	62	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	87	66	51	43	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	99	91	69	53	41	35	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	72	51	40	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	51	37	29	24	21	3/4"	19.0	0.75
1/2"	12.5	0.50	98	82	65	52	41	34	26	20	17	14	1/2"	12.5	0.50
3/8"	9.5	0.375	88	67	50	39	30	25	20	16	13	12	3/8"	9.5	0.375
4M	4.75	0.187	57	35	26	19	15	13	10	9	7	6	4M	4.75	0.187
8M	2.36	0.094	31	18	13	10	8	7	5	5	4	4	8M	2.36	0.094
16M	1.18	0.047	15	9	7	6	5	3	2	2	2	2	16M	1.18	0.047
30M	0.60	0.023	8	5	5	4	3	2	1	1	1	1	30M	0.60	0.023
50M	0.30	0.012	5	3	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	3	2	1	1	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 66.
2. For recommended minimum and maximum discharge openings, and capacities see page 60 and 61.
3. Capacities of gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 57 GYRASPHERE CRUSHER

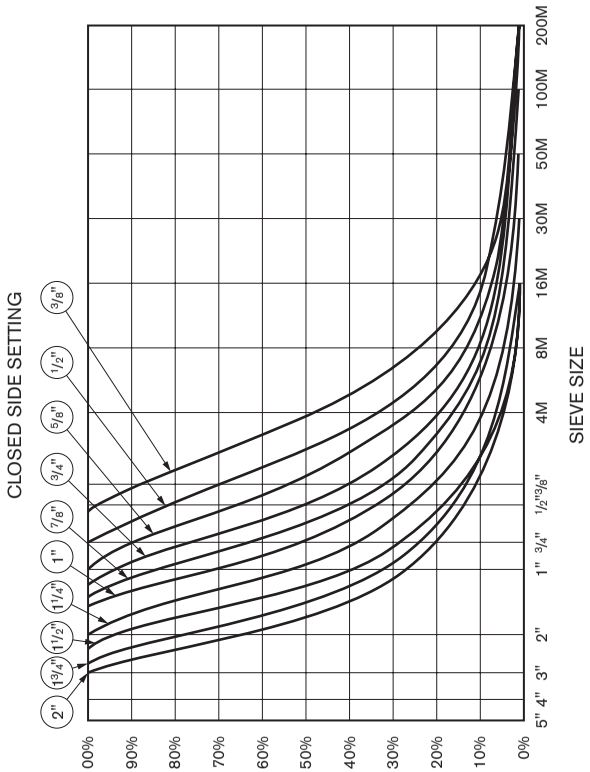
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	97	85	2 1/2"	63.0	2.50
2"	50.0	2.00							100	93	76	63	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	85	66	51	41	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	97	89	68	52	40	32	1 1/4"	31.5	1.25
1"	25.0	1.00			100	93	82	71	52	39	30	25	1"	25.0	1.00
3/4"	19.0	0.75	100	100	89	75	62	51	37	28	23	19	3/4"	19.0	0.75
1/2"	12.5	0.50	97	81	66	50	40	34	25	19	16	13	1/2"	12.5	0.50
3/8"	9.5	0.375	84	65	51	38	31	26	19	15	12	10	3/8"	9.5	0.375
4M	4.75	0.187	50	34	26	20	16	13	9	7	6	5	4M	4.75	0.187
8M	2.36	0.094	24	17	13	10	8	6	4	3	3	2	8M	2.36	0.094
16M	1.18	0.047	11	8	7	6	5	3	2	1	1	1	16M	1.18	0.047
30M	0.60	0.023	5	5	5	4	3	2	1				30M	0.60	0.023
50M	0.30	0.012	3	3	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	2	2	2	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 68.
2. For recommended minimum and maximum discharge openings, and capacities see page 60 and 61.
3. Capacities of gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

TELSMITH NO. 68 GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 68 GYRASPHERE CRUSHER

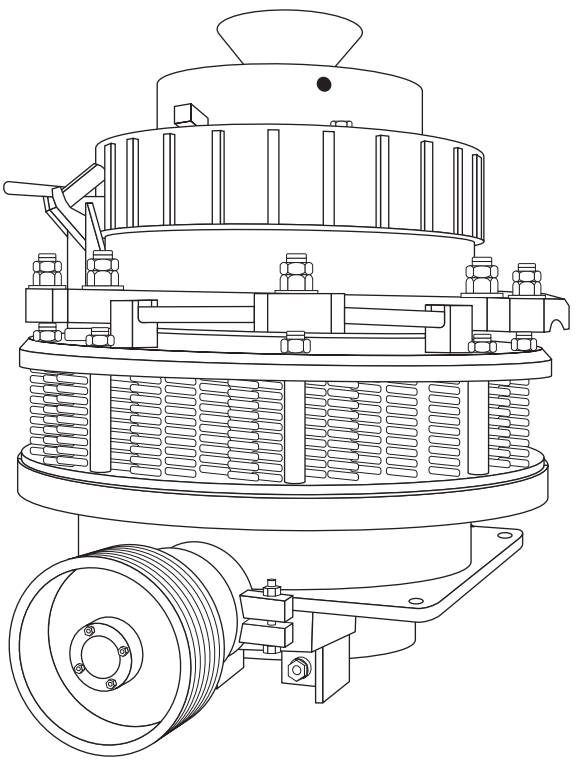
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting									Sieve Designation Standard		
US	mm	Decimal	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	2"	US	mm	Decimal
3 1/2"	90.0	3.50										100	3 1/2"	90.0	3.50
3"	75.0	3.00			(% Passing)						100	98	3"	75.0	3.00
2 1/2"	63.0	2.50								100	97	87	2 1/2"	63.0	2.50
2"	50.0	2.00							100	94	77	66	2"	50.0	2.00
1 1/2"	37.5	1.50					100	100	85	68	53	44	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25				100	97	89	70	54	42	34	1 1/4"	31.5	1.25
1"	25.0	1.00			100	94	84	73	54	41	32	27	1"	25.0	1.00
3/4"	19.0	0.75	100	100	90	76	63	52	39	28	24	20	3/4"	19.0	0.75
1/2"	12.5	0.50	97	82	66	50	39	34	25	18	16	13	1/2"	12.5	0.50
3/8"	9.5	0.375	84	65	51	37	29	25	19	13	12	10	3/8"	9.5	0.375
4M	4.75	0.187	48	33	25	20	16	14	9	5	6	4	4M	4.75	0.187
8M	2.36	0.094	24	17	13	10	8	7	4	2	3	2	8M	2.36	0.094
16M	1.18	0.047	11	9	8	7	5	4	2	1	1	1	16M	1.18	0.047
30M	0.60	0.023	5	6	5	5	3	2	1				30M	0.60	0.023
50M	0.30	0.012	3	4	3	3	2	1					50M	0.30	0.012
100M	0.15	0.006	2	2	2	2	1						100M	0.15	0.006
200M	0.075	0.003	1	1	1	1							200M	0.075	0.003

NOTES: 1. Screen Analysis is based on curves shown on page 70.
2. For recommended minimum and maximum discharge openings, and capacities see page 60 and 61.
3. Capacities of gyraspheres are based on open circuit crushing. (One pass through the crusher).
4. Capacity of gyraspheres are based on closed circuit crushing. (Percentages larger than discharge openings represent circulating load).

VFC CRUSHERS

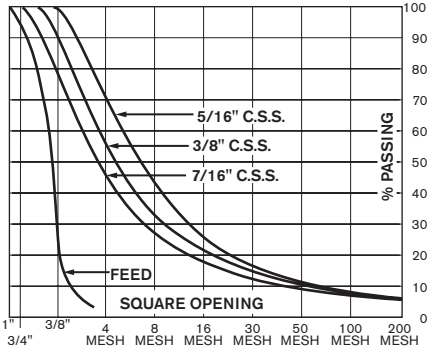
Telsmith VFC Crushers are built with either the “D” Style Frame (24, 36, 48 VFC) or the All Roller Bearing (1410 VFC) but use the attrition method of crushing, involving a suitably designed crushing chamber. With these machines, very small fractions can be produced. For full description and illustrations, see Bulletins 415 and 415.1.

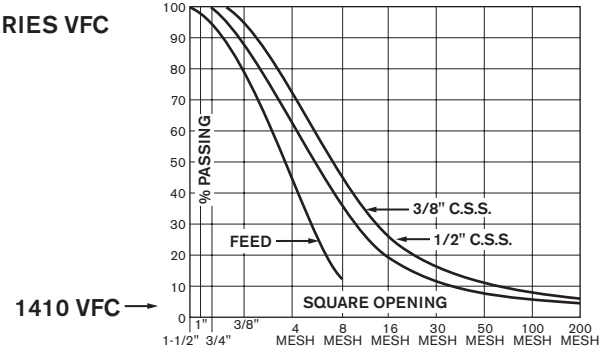


SPECIFICATIONS – STYLE "VFC" CRUSHERS

SIZE	24 VFC	36 VFC[1]	48 VFC[1]	1410 VFC	1410 VFC w/Hyd. Rel.
HP Required	50	100	200	250	250
Crusher Flywheel RPM	1,000	660	590	860	860
Sheave P. Dia. & Numbers & Type of Belts	24"–4C	28"–7D	34"–10D	28"–10D	28"–10D
Shipping Weight Lbs.	10,200	24,500	43,000	62,800	61,250
Weight Boxed for Export	10,400	25,100	43,600	64,300	62,750
Cu. Contents Export Boxed Ft.[3]	170	300	600	830	830
Capacities* S.T.P.H.	12 – 24	45 – 60	70 – 100	135 – 155	135 – 155

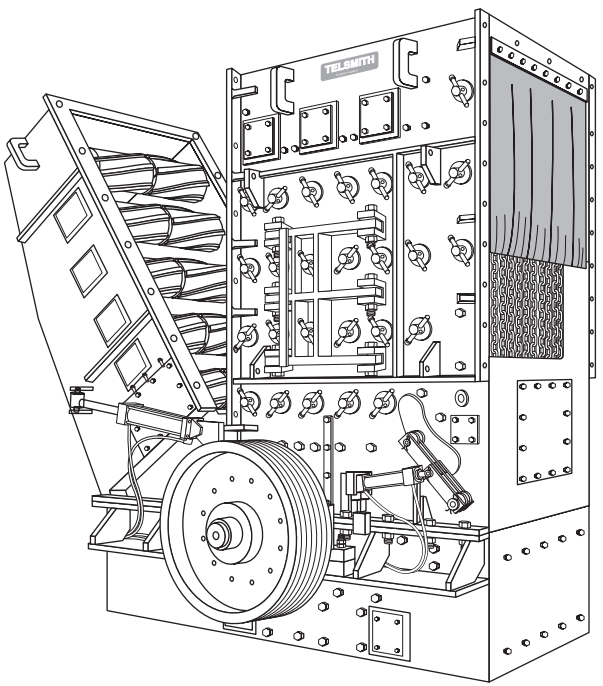
* Crusher throughput. VFC crusher capacities are influenced by moisture in feed as well as discharge opening and characteristics of feed material. Capacities given are for general guidance only. [1] Spring relief and hydraulic relief models weigh the same.





PRIMARY IMPACT CRUSHERS

Telsmith Primary single rotor impact crushers are made in three sizes. The 4246 is suitable for both portable and stationary installations. The 4856 and the 6071 are best suited for stationary installations. These crushers are used mainly in non-abrasive or extremely low abrasive materials. They produce an abundance of fines and a very cubical product. For more information, refer to Bulletin T500.



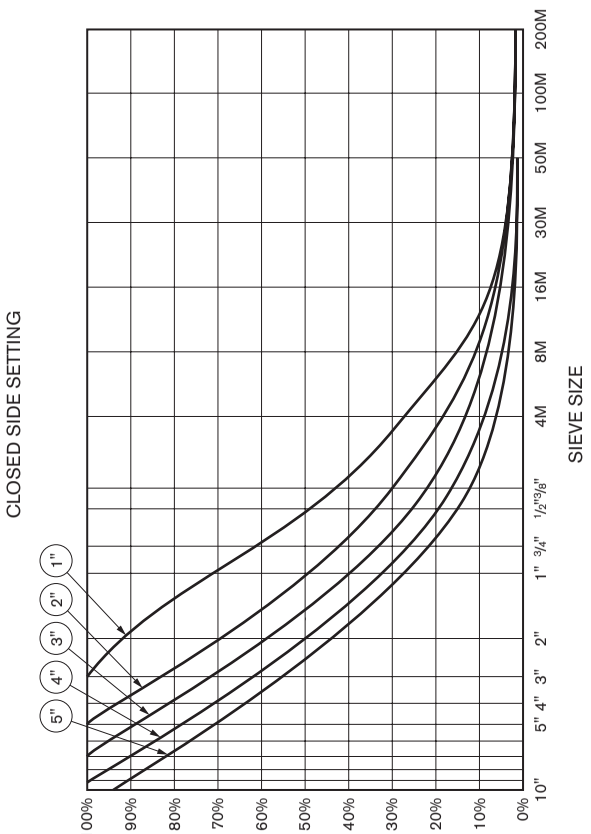
SPECIFICATIONS & CAPACITIES
PRIMARY IMPACT CRUSHERS

MODEL – (Note 1)	4246	4856	6071
Feed Opening Width × Height	46"×59 3/4"	56"×85"	71"×100 1/2"
Maximum Feed Size	36"	46"	56"
Weight Lbs.	59,500	94,200	195,000
Side Plate Thickness	1 1/4"	1 1/2"	2"
Capacity US TPH (Note 2)	250 – 600	600 – 1,100	1,000 – 2,100
Recommended Horsepower	300 – 500	400 – 700	800 – 1,500
RPM Range	480 – 770	420 – 670	330 – 540
Nominal Product Range	2"–5"	2"–6"	4"–8"
Crushing Chamber Volume	158 ft.^{3}	300 ft.^{3}	403 ft.^{3}
Discharge Opening Width × Length	46"×98"	56"×125"	71"×113"
Liner Thickness	1"	1 1/2"	1 1/2"
Liner Material	Manganese Steel & Abrasion Resistant Steel		

Note 1 Model designation includes four numbers. i.e., 4246, 4856, 6071. The first two numbers indicate the diameter of the rotor including the hammers. The second two numbers identify the feed opening width.

Note 2 Capacities shown are average for medium hard limestone and are to be used as a guide only. Actual capacity will vary with the nature and hardness of the feed, size and gradation, motor HP, operating speed, etc.

SCREEN ANALYSIS OF CRUSHER PRODUCT



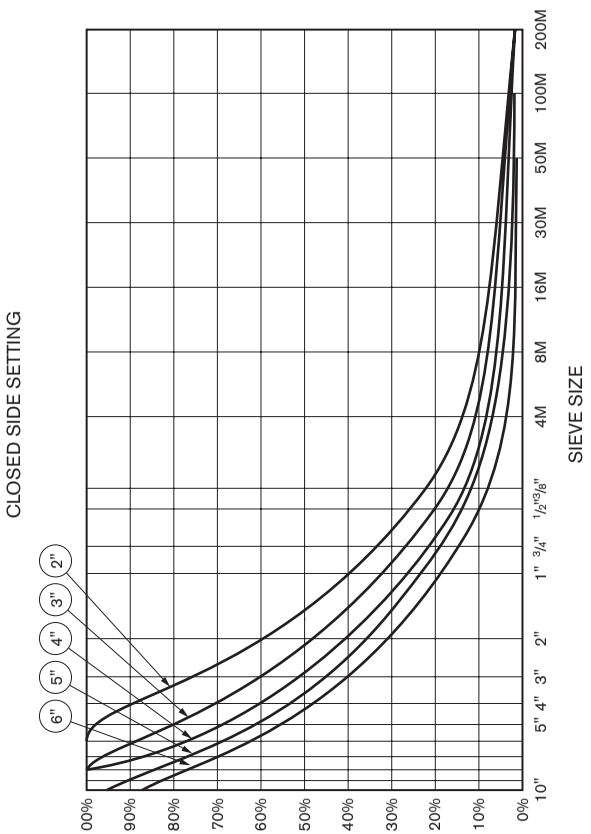
SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 4246 PRIMARY IMPACT CRUSHER

AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting				
US	mm	Decimal	1"	2"	3"	4"	5"
8"	200.0	8.00				96	88
7"	175.0	7.00	(% Passing)		100	90	83
6"	150.0	6.00			94	85	77
5"	125.0	5.00		100	89	79	71
4 1/2"	112.5	4.50		99	83	75	66
4"	100.0	4.00		94	80	70	63
3 1/2"	90.0	3.50		88	75	65	59
3"	75.0	3.00	100	83	70	61	55
2 1/2"	63.0	2.50	96	77	63	56	49
2"	50.0	2.00	93	70	58	50	44
1 1/2"	37.5	1.50	85	61	51	42	36
1 1/4"	31.5	1.25	80	55	47	38	32
1"	25.0	1.00	71	51	41	33	28
3/4"	19.0	0.75	62	44	35	28	22
1/2"	12.5	0.50	50	34	28	21	16
3/8"	9.5	0.375	43	27	23	15	11
4M	4.75	0.187	30	22	18	8	6
8M	2.36	0.094	15	13	10	5	4
16M	1.18	0.047	7	6	6	3	3
30M	0.60	0.023	4	4	5	2	2
50M	0.30	0.012	3	3	4	1	1
100M	0.15	0.006	2	2	2		
200M	0.075	0.003	1	1	1		

NOTE: Screen analysis is based on curve shown on page 76.

SCREEN ANALYSIS OF CRUSHER PRODUCT



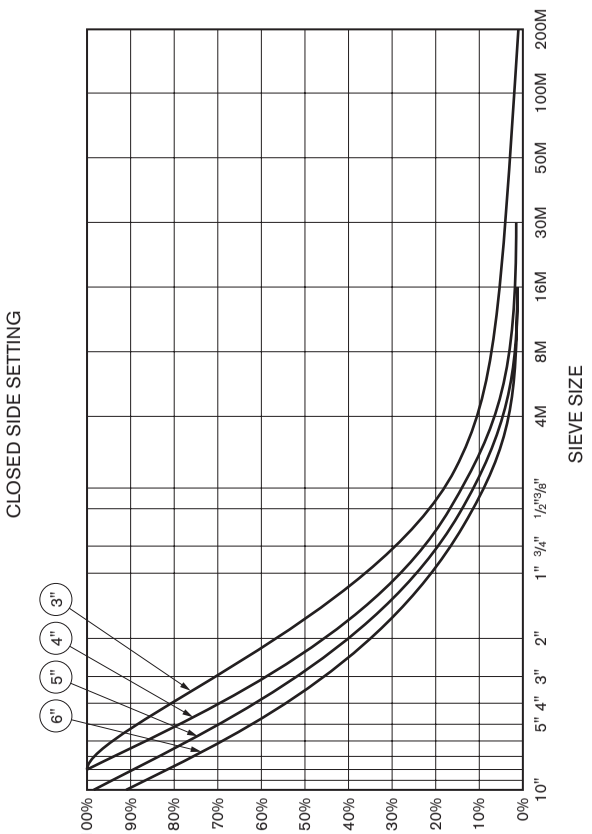
SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 4856 PRIMARY IMPACT CRUSHER

AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting				
US	mm	Decimal	2"	3"	4"	5"	6"
8"	200.0	8.00	(% Passing)	100	100	95	80
7"	175.0	7.00		97	83	73	64
6"	150.0	6.00	100	88	77	67	59
5"	125.0	5.00	99	79	69	60	53
4 1/2"	112.5	4.50	93	75	65	57	51
4"	100.0	4.00	87	70	60	53	48
3 1/2"	90.0	3.50	81	65	56	50	45
3"	75.0	3.00	74	60	51	46	41
2 1/2"	63.0	2.50	67	54	46	41	36
2"	50.0	2.00	60	49	41	38	32
1 1/2"	37.5	1.50	52	42	36	32	27
1 1/4"	31.5	1.25	48	38	32	29	22
1"	25.0	1.00	41	33	27	24	19
3/4"	19.0	0.75	34	28	23	19	15
1/2"	12.5	0.50	26	20	18	13	10
3/8"	9.5	0.375	21	16	13	10	8
4M	4.75	0.187	14	10	8	6	4
8M	2.36	0.094	10	9	7	5	3
16M	1.18	0.047	8	8	6	4	2
30M	0.60	0.023	6	5	4	3	1
50M	0.30	0.012	3	3	3	2	
100M	0.15	0.006	2	2	2	1	
200M	0.075	0.003	1	1	1		

NOTE: Screen analysis is based on curve shown on page 78.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH 6071 PRIMARY IMPACT CRUSHER

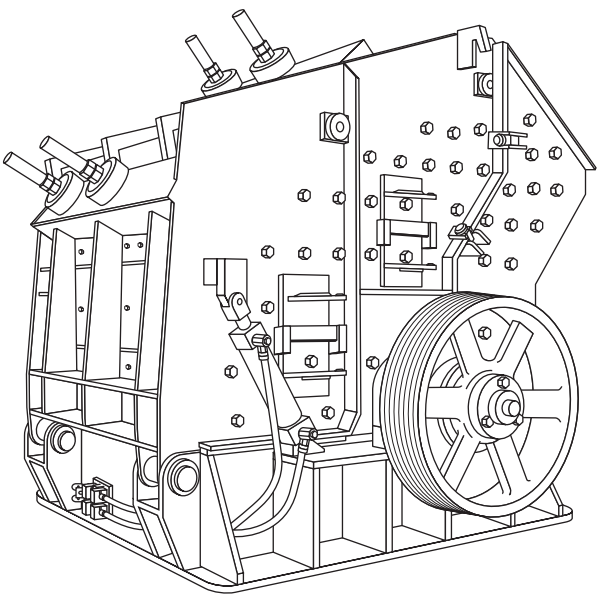
AT VARIOUS DISCHARGE OPENINGS, OPENING MEASURED ON CLOSED SIDE.

Sieve Designation Standard			Closed Side Setting			
US	mm	Decimal	3"	4"	5"	6"
8"	200.0	8.00	100	100	87	81
7"	175.0	7.00	98	94	82	76
6"	150.0	6.00	94	86	75	70
5"	125.0	5.00	88	79	68	63
4 1/2"	112.5	4.50	84	75	63	60
4"	100.0	4.00	80	70	57	55
3 1/2"	90.0	3.50	73	65	52	50
3"	75.0	3.00	68	59	47	46
2 1/2"	63.0	2.50	61	51	41	39
2"	50.0	2.00	56	45	38	35
1 1/2"	37.5	1.50	47	37	31	28
1 1/4"	31.5	1.25	42	33	28	25
1"	25.0	1.00	37	28	23	20
3/4"	19.0	0.75	30	22	19	16
1/2"	12.5	0.50	22	18	14	12
3/8"	9.5	0.375	17	14	11	9
4M	4.75	0.187	10	7	5	4
8M	2.36	0.094	7	3	2	2
16M	1.18	0.047	5	2	1	1
30M	0.60	0.023	4	1		
50M	0.30	0.012	3			
100M	0.15	0.006	2	(% Passing)		
200M	0.075	0.003	1			

NOTE: Screen analysis is based on curve shown on page 80.

HSI IMPACT CRUSHERS

Telsmith HSI Impact Crushers are designed for secondary crushing and for rubble recycle crushing. A high ratio of reduction and a very cubical product are obtained with these machines. They are built in six sizes with capacities from 80 to 660 TPH. For more information, see Bulletin T501.

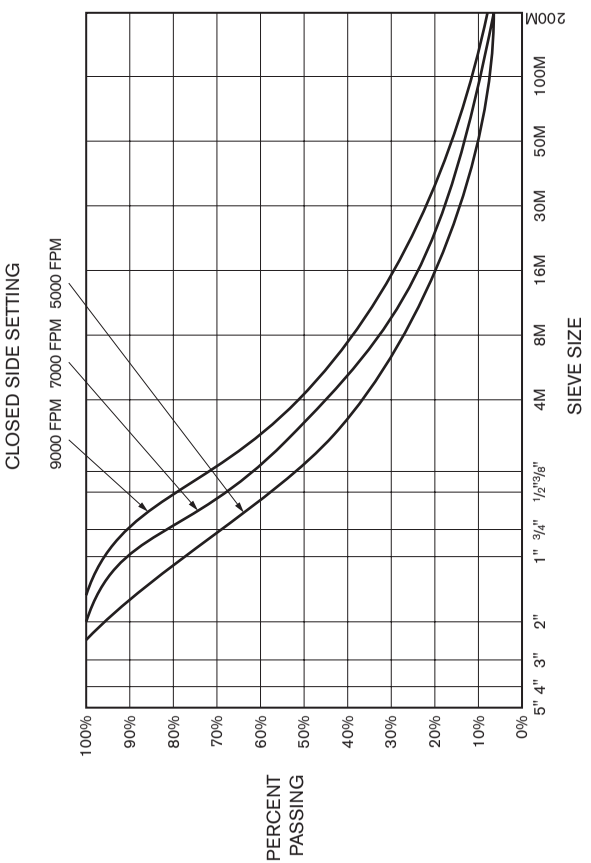


SPECIFICATIONS & CAPACITIES – HSI IMPACT CRUSHERS

MODEL	2421	3036	4230	5242	5252	5263
Capacity	35 – 50	75 – 100	80 – 120	55 – 170	110 – 230	190 – 320
Maximum Feed Size	5"	9"	12"	16"	16"	16"
Frame Plate	3/8"	3/8"	5/8"	5/8"	5/8"	5/8"
Side Liner	1/2"	1/2"	1 1/4"	1 1/4"	1 1/4"	1 1/4"
Curtain Liner	1"	1"	3"	3"	3"	3"
Material:						
Liner Plate	Chrome Iron Alloy / A.R. Steel.					
Hammer Bar	Chrome Iron Alloy – Standard.					
Hammer Bar Size	2 3/8"×6"×20"	3"× 8"× 36"	3"× 11"× 30"	5"× 14"× 21"	5"× 14"× 26"	5"× 14"× 21"
Number of Hammer Rows	2	2	4	4	4	4
Crusher Sheave Dia.	20.0	21.2	30.0	40.0	40.0	40.0
V-Belt Drive	4 – C	5 – 5V	4 – 8V	6 – 8V	8 – 8V	8 – 8V
HP Required	50	100	100	200	250	300
Total Weight	2,900	7,300	19,250	29,300	37,500	48,000

In applications where more than 300 HP is required, dual drives are recommended.
Model numbers refer to rotor diameter by rotor width.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF PRODUCT FROM TELSMITH HSI IMPACT CRUSHER

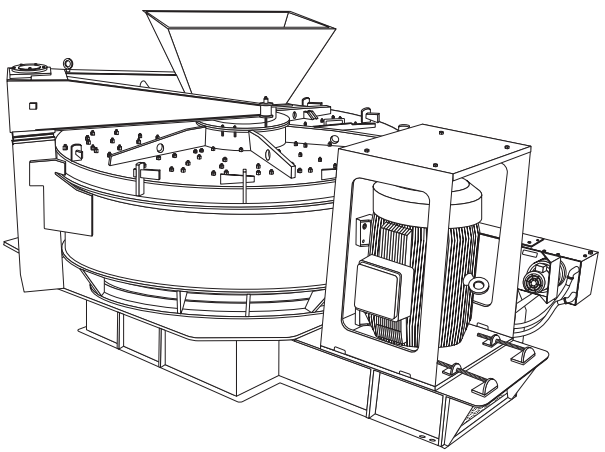
AT VARIOUS ROTOR SPEEDS WITH
APRON#1 at 3" CSS – APRON #2 at 1 1/2" CSS
8" × 3" FEED – LIMESTONE

Sieve Designation Standard			Closed Side Setting		
US	mm	Decimal	9000 FPM	7000 FPM	5000FPM
2 1/2"	63.0	2.50	(% Passing)		100
2"	50.0	2.00		100	94
1 1/2"	37.5	1.50	100	97	88
1 1/4"	31.5	1.25	98	94	83
1"	25.0	1.00	96	90	78
3/4"	19.0	0.75	90	80	70
1/2"	12.5	0.50	80	68	58
3/8"	9.5	0.375	70	60	49
4M	4.75	0.187	51	45	38
8M	2.36	0.094	39	32	28
16M	1.18	0.047	30	24	20
30M	0.60	0.023	22	19	14
50M	0.30	0.012	16	13	10
100M	0.15	0.006	11	10	7
200M	0.075	0.003	8	6	6

Gradations may vary widely based on apron settings, speed, feed gradations and moisture content.

VERTICAL SHAFT IMPACTOR (VSI)

The Vertical Shaft Impactors are built in 5 standard models, 3 autogeneous models and 3 semi-autogeneous models with capacities of 75 to 500 TPH. VSI crushers produce a very cubical product and precise gradation control. Ease of maintenance and low operating costs are additional benefits. For more information, request Bulletin VSI 103.



VERTICAL SHAFT IMPACTOR

Model	66	74	82	92	120	1500	2500	4500
Maximum feed size, inches (1)	2	3	3	5	6	$1^1/_2$	2	2
Minimum recommended closed circuit	4M	4M	4M	$^3/_8$"	$^3/_8$"	4M	4M	4M
Feed tube diameter, inches	8.5	$11^3/_8$	14.0	16.0	18.0	8.5	$11^3/_8$	16
Capacity effective crushing range, TPH (2)	75–125	150–250	250–400	300–450	300–500	125–175	250–300	400–500
Standard impeller table speed range, RPM	720–2,000	700–1,400	800–1,200	800–1,200	800–1,200	720–2,000	700–1,400	800–1,200
Recommended horsepower, electric	75–150	150–300	400–500	400–500	400–600	150	300	500
Table / anvil clearance, inches	10.4	8.8	8.7	11.75	14.75	–	–	–
Explosion chamber volume, inches^3	4,635	10,120	10,940	17,360	26,020	4,635	10,120	17,360
EV Models WK^2, Lbs.–Ft.^{2}	1,100	2,400	3,200	3,830	5,600	1,100	2,400	3,830
Approximate weight (electric), lbs.	13,200	18,000	24,000	29,100	32,100	13,200	18,000	29,100

(1) Max. feed size restriction can vary with regards to material density, crushability, elongation and impeller table speed or configuration.
(2) Feed size and throughput tonnage based on material weighing 100 lbs. per cubic foot.

VSI PRODUCTION CHARACTERISTICS

STANDARD – CRUSHING AVERAGE MATERIALS (LIMESTONE OR SOFT DOLOMITE)

Sieve Designation Standard			Secondary – Note 1			Tertiary and/or Quaternary – Note 2			Sieve Designation Standard		
			Model 120 (6" max. feed) –92 (5" max. feed)			Model 120–92–82–74 (3" max. feed)					
			Crusher Output			Crusher Output					
US	mm	Decimal	Max. Speed	80% of Max. Speed	50% of Max. Speed	Max. Speed	80% of Max. Speed	60% of Max. Speed	US	mm	Decimal
5"	125.0	5.00	(% Passing)		100	(% Passing)			5"	125.0	5.00
4"	100.0	4.00		100	99				4"	100.0	4.00
3"	75.0	3.00	100	99	97	100	100	100	3"	75.0	3.00
2"	50.0	2.00	96	91	86	98	98	98	2"	50.0	2.00
1 1/2"	37.5	1.50	90	81	70	95	95	94	1 1/2"	37.5	1.50
1 1/4"	31.5	1.25	86	77	63	–	–	–	1 1/4"	31.5	1.25
1"	25.0	1.00	78	68	52	87	85	83	1"	25.0	1.00
7/8"	22.0	0.875	74	64	48	–	–	–	7/8"	22.0	0.875
3/4"	19.0	0.75	68	56	40	79	74	69	3/4"	19.0	0.75
5/8"	15.75	0.625	62	51	36	–	–	–	5/8"	15.75	0.625
1/2"	12.5	0.50	53	42	30	68	60	52	1/2"	12.5	0.50
3/8"	9.5	0.375	44	34	24	57	49	40	3/8"	9.5	0.375
1/4"	6.25	0.25	35	27	19	46	37	28	1/4"	6.25	0.25
4M	4.75	0.187	29	24	16	37	29	20	4M	4.75	0.187
8M	2.36	0.094	17	15	11	26	20	14	8M	2.36	0.094
16M	1.18	0.047	14	13	8	17	13	9	16M	1.18	0.047
30M	0.60	0.023	10	9	6	11	8	6	30M	0.60	0.023
50M	0.30	0.012	7	6	4	7	5	4	50M	0.30	0.012
100M	0.15	0.006	5	4	3	5	4	3	100M	0.15	0.006
200M	0.075	0.003	3	2	2	4	3	2	200M	0.075	0.003

NOTES: 1. Feeds shown are typical gradations when following a primary jaw set at 3" to 4" or a primary impactor set at 2" to 3" and scalped at 1 1/2".

2. Typical feeds have been screened to remove product sized material and are initial 3" minus feed plus recirculating material. These tertiary and/or quartenary configurations are used to provide a dense graded material, emphasis on fines for base, asphalt material, sand supplement, etc.

Based upon material weighing 2,700 lbs. per yd^3. Capacities may vary as much as ±25% dependent upon methods of loading, characteristics and gradation of material, condition of equipment and other factors.

VSI PRODUCTION CHARACTERISTICS

STANDARD – CRUSHING AVERAGE MATERIALS (LIMESTONE OR SOFT DOLOMITE)

Sieve Designation Standard			Secondary – Note 1 Model 120–92–82–74–66 (2" max. feed)			Tertiary and/or Quaternary – Note 2 Model 120–92–82–74–66 (1" max. feed)			Sieve Designation Standard		
			Crusher Output			Crusher Output					
US	mm	Decimal	Max. Speed	80% of Max. Speed	60% of Max. Speed	Max. Speed	80% of Max. Speed	60% of Max. Speed	US	mm	Decimal
3"	75.0	3.00	(% Passing)			(% Passing)			3"	75.0	3.00
2"	50.0	2.00		100	100				2"	50.0	2.00
1 1/2"	37.5	1.50	100	99	98				1 1/2"	37.5	1.50
1"	25.0	1.00	94	92	90	100	100	100	1"	25.0	1.00
3/4"	19.0	0.75	85	81	78	99	96	95	3/4"	19.0	0.75
1/2"	12.5	0.50	73	67	60	90	85	80	1/2"	12.5	0.50
3/8"	9.5	0.375	62	54	46	78	70	62	3/8"	9.5	0.375
1/4"	6.25	0.25	49	41	33	63	52	40	1/4"	6.25	0.25
4M	4.75	0.187	40	32	24	52	41	30	4M	4.75	0.187
8M	2.36	0.094	27	21	15	33	23	15	8M	2.36	0.094
16M	1.18	0.047	18	14	10	21	16	10	16M	1.18	0.047
30M	0.60	0.023	12	10	7	15	11	7	30M	0.60	0.023
50M	0.30	0.012	8	6	5	10	8	5	50M	0.30	0.012
100M	0.15	0.006	6	5	4	6	5	4	100M	0.15	0.006
200M	0.075	0.003	4	4	3	4	4	3	200M	0.075	0.003

NOTES: 1. Feeds shown are typical gradations when following a primary jaw set at 3" to 4" or a primary impactor set at 2" to 3" and scalped at 1 1/2".

2. Typical feeds have been screened to remove product sized material and are initial 3" minus feed plus recirculating material. These tertiary and/or quartenary configurations are used to provide a dense graded material, emphasis on fines for base, asphalt material, sand supplement, etc.

Based upon material weighing 2,700 lbs. per yd^3. Capacities may vary as much as ±25% dependent upon methods of loading, characteristics and gradation of material, condition of equipment and other factors.

VSI PRODUCTION CHARACTERISTICS

AUTOGENOUS–CRUSHING ABRASIVE MATERIALS (BASALT, HARD LIMESTONE, GRAVEL/DOLOMITE)

Sieve Designation Standard			Crusher Output – Max. Speed		Sieve Designation Standard		
			Tertiary and/or Quaternary				
US	mm	Decimal	Model 1500, 2500, 4500 Fully Auto	Model 1500, 2500, 4500 Semi Auto	US	mm	Decimal
2"	50.0	2.00	(% Passing)	(% Passing)	2"	50.0	2.00
1 1/2"	37.5	1.50	100		1 1/2"	37.5	1.50
1 1/4"	31.0	1.25	99	100	1 1/4"	31.0	1.25
1"	25.0	1.00	95	96	1"	25.0	1.00
3/4"	19.0	0.75	90	90	3/4"	19.0	0.75
1/2"	12.5	0.50	70	76	1/2"	12.5	0.50
3/8"	9.5	0.375	56	58	3/8"	9.5	0.375
1/4"	6.25	0.25	38	45	1/4"	6.25	0.25
4M	4.75	0.187	31	37	4M	4.75	0.187
8M	2.36	0.094	22	25	8M	2.36	0.094
16M	1.18	0.047	15	17	16M	1.18	0.047
30M	0.60	0.023	11	13	30M	0.60	0.023
50M	0.30	0.012	8	8	50M	0.30	0.012
100M	0.15	0.006	6	5	100M	0.15	0.006
200M	0.075	0.003	4	3	200M	0.075	0.003

Based upon material weighing 2,700 lbs. per yd^3. Capacities may vary as much as ±25% dependent upon methods of loading, characteristics and gradation of material, condition of equipment and other factors.

GENERAL CRUSHER INFORMATION

The following pages list data pertaining to general as well as specialty, information for machinery not manufactured by Telsmith or for equipment no longer manufactured by Telsmith, but still in use.

SPECIFICATIONS – ROLLER BEARING GYRASPHERE CRUSHERS – STYLE S

MODEL	1110 S	1310 S	1510 S	1710 S	1900 S
HP Required	150	200	250	350	400
Crusher Flywheel RPM	892	810	787	660	647
Shipping Weight Lbs.	31,200	47,600	67,000	113,500	138,500
Weight Boxed for Export Lbs.	31,900	48,600	68,400	115,700	141,400
Cu. Contents Export Boxed Ft.^{3}	450	550	850	1275	1775

SPECIFICATIONS – ROLLER BEARING GYRASPHERE CRUSHERS – STYLE FC

MODEL	1110 FC	1310 FC	1510 FC	1710 FC	1900 FC
HP Required	150	200	250	350	400
Crusher Flywheel RPM	892	810	787	660	647
Shipping Weight Lbs.	31,300	47,900	67,200	115,000	140,000
Weight Boxed for Export Lbs.	32,000	48,900	68,600	117,200	142,900
Cu. Contents Export Boxed Ft.^{3}	450	550	850	1275	1775

CAPACITIES – 1110 GYRASPHERE CRUSHERS

MODEL	S				FC		
Type of Bowl	Extra Coarse	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening							
Open	6 3/8"	5 3/4"	5 1/8"	4 1/8"	4 3/8"	3 1/4"	2 7/8"
Closed	5 1/4"	4 3/4"	4 1/8"	3 1/8"	3 1/4"	2 1/8"	1 1/2"
Disch. Open. Min.*	5/8"	1/2"	7/16"	5/16"	5/16"	1/4"	3/16"
1/4"	–	–	–	–	–	60	55
3/8"	–	–	–	65	80	80	80
1/2"	–	90	90	90	105	105	105
5/8"	115	115	115	115	140	140	140
3/4"	140	140	140	140	170	170	170
7/8"	165	165	165	165	200	200	200
1"	190	190	190	190	–	–	–
1 1/4"	225	225	225	225	–	–	–
1 1/2"	260	260	260	260	–	–	–
1 3/4"	295	295	295	295	–	–	–
2"	330	330	330	330	–	–	–
2 1/4"	–	–	–	–	–	–	–
2 1/2"	–	–	–	–	–	–	–

Note on capacities – All capacities are approximate and will vary dependent on the type of material, moisture content, feed method and amount of fines.
* The minimum setting indicated for each bowl is not necessarily applicable for each and every installation.
Note 1: To secure the capacities specified, all feed to crushers should be smaller than the feed opening of the crusher in at least one dimension. Note 2: The horsepower required varies with the size of product being made, the capacity and the toughness of the rock or ore. Note 3: The capacities given are in tons of 2,000 lbs. and are based on crushing limestone weighing loose about 2,600 lbs. per yard^3 and having a specific gravity of 2.6. Wet sticky feeds will tend to reduce crusher capacities. Note 4: No crusher, when set at any given discharge opening, will make a product all of which will pass a screen opening of the same dimensions as the given discharge opening. The amount of oversize will vary with the character of the rock. The discharge opening of the Gyrasphere crusher is measured on the closed side. For close settings, all undersize material should be removed from the feed so as to eliminate packing and excessive wear.
Note 5: Where no rating is specified in the capacity table for any certain discharge opening, the crusher cannot be operated economically at that opening. For a product finer than the minimum setting, consult the factory. Note 6 – Capacities for S Style are **Open Circuit** – one pass through the crusher. Capacities for FC style are in **Closed Circuit** and indicate the amount of product smaller than the discharge setting – assuming normal screen efficiency.

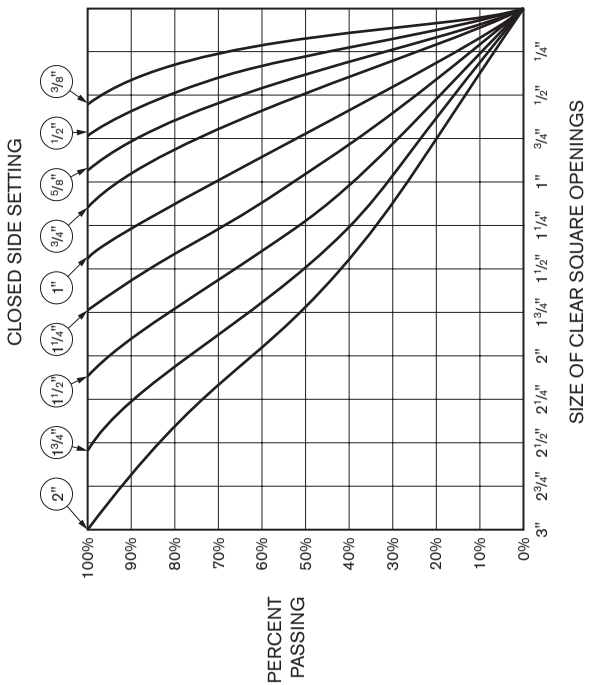
CAPACITIES – 1310 GYRASPHERE CRUSHERS

MODEL	S				FC		
Type of Bowl	Extra Coarse	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening							
Open	$7\frac{7}{8}$"	$7\frac{1}{8}$"	$6\frac{1}{4}$"	5"	5"	4"	$2\frac{7}{8}$"
Closed	$6\frac{7}{8}$"	6"	$5\frac{1}{4}$"	$3\frac{5}{8}$"	$3\frac{3}{4}$"	$2\frac{1}{2}$"	$1\frac{5}{16}$"
Disch. Open. Min.*	$\frac{3}{4}$"	$\frac{5}{8}$"	$\frac{1}{2}$"	$\frac{5}{16}$"	$\frac{5}{16}$"	$\frac{1}{4}$"	$\frac{1}{4}$"
$\frac{1}{4}$"	–	–	–	–	–	85	85
$\frac{3}{8}$"	–	–	–	90	115	115	115
$\frac{1}{2}$"	–	–	125	125	145	145	145
$\frac{5}{8}$"	–	155	155	155	175	175	175
$\frac{3}{4}$"	185	185	185	185	205	205	205
$\frac{7}{8}$"	215	215	215	215	235	235	235
1"	245	245	245	245	–	–	–
$1\frac{1}{4}$"	290	290	290	290	–	–	–
$1\frac{1}{2}$"	335	335	335	335	–	–	–
$1\frac{3}{4}$"	380	380	380	380	–	–	–
2"	425	425	425	425	–	–	–
$2\frac{1}{4}$"	–	–	–	–	–	–	–
$2\frac{1}{2}$"	–	–	–	–	–	–	–

Note on capacities – All capacities are approximate and will vary dependent on the type of material, moisture content, feed method and amount of fines.
* The minimum setting indicated for each bowl is not necessarily applicable for each and every installation.
Note 1: To secure the capacities specified, all feed to crushers should be smaller than the feed opening of the crusher in at least one dimension. Note 2: The horsepower required varies with the size of product being made, the capacity and the toughness of the rock or ore. Note 3: The capacities given are in tons of 2,000 lbs. and are based on crushing limestone weighing loose about 2,600 lbs. per yard^3 and having a specific gravity of 2.6. Wet sticky feeds will tend to reduce crusher capacities. Note 4: No crusher, when set at any given discharge opening, will make a product all of which will pass a screen opening of the same dimensions as the given discharge opening. The amount of oversize will vary with the character of the rock. The discharge opening of the Gyrasphere crusher is measured on the closed side. For close settings, all undersize material should be removed from the feed so as to eliminate packing and excessive wear.
Note 5: Where no rating is specified in the capacity table for any certain discharge opening, the crusher cannot be operated economically at that opening. For a product finer than the minimum setting, consult the factory. Note 6: Capacities for S Style are **Open Circuit –** one pass through the crusher. Capacities for FC style are in **Closed Circuit** and indicate the amount of product smaller than the discharge setting – assuming normal screen efficiency.

TELSMITH 1110 AND 1310 ROLLER BEARING GYRASPHERE CRUSHERS

SCREEN ANALYSIS OF CRUSHER PRODUCT



CAPACITIES – 1510 GYRASPHERE CRUSHERS

MODEL	S				FC		
Type of Bowl	Extra Coarse	Coarse	Medium	Fine	Coarse	Medium	Fine
Feed Opening							
Open	$9\frac{5}{16}$"	$8\frac{3}{8}$"	8"	$5\frac{1}{8}$"	$5\frac{1}{4}$"	$4\frac{1}{8}$"	3"
Closed	$7\frac{7}{8}$"	$6\frac{15}{16}$"	$6\frac{3}{4}$"	$3\frac{5}{8}$"	$3\frac{7}{8}$"	$2\frac{5}{8}$"	$1\frac{3}{8}$"
Disch. Open. Min.*	$\frac{15}{16}$"	$\frac{3}{4}$"	$\frac{9}{16}$"	$\frac{1}{2}$"	$\frac{1}{2}$"	$\frac{3}{8}$"	$\frac{1}{4}$"
$\frac{1}{4}$"	–	–	–	–	–	–	100
$\frac{3}{8}$"	–	–	–	–	–	145	145
$\frac{1}{2}$"	–	–	–	145	185	185	185
$\frac{5}{8}$"	–	–	190	190	225	225	225
$\frac{3}{4}$"	–	230	230	230	265	265	265
$\frac{7}{8}$"	–	270	270	270	305	305	305
1"	310	310	310	310	–	–	–
$1\frac{1}{4}$"	370	370	370	370	–	–	–
$1\frac{1}{2}$"	430	430	430	430	–	–	–
$1\frac{3}{4}$"	490	490	490	490	–	–	–
2"	550	550	550	550	–	–	–
$2\frac{1}{4}$"	610	610	610	610	–	–	–
$2\frac{1}{2}$"	670	670	–	670	–	–	–

* The minimum setting indicated for each bowl is not necessarily applicable for each and every installation, see notes 1–6, Page 94.

CAPACITIES – 1710 GYRASPHERE CRUSHERS

MODEL	S			FC		
Type of Bowl	Extra Coarse	Coarse	Medium	Coarse	Medium	Fine
Feed Opening						
Open	12"	9 7/8"	8 1/4"	6 1/4"	4 5/8"	3 1/4"
Closed	10 5/8"	8 3/8"	6 1/2"	4 5/8"	2 7/8"	1 1/2"
Disch. Open. Min.*	1 1/16"	7/8"	3/4"	1/2"	3/8"	1/4"
1/4"	–	–	–	–	–	140
3/8"	–	–	–	–	195	195
1/2"	–	–	–	240	240	240
5/8"	–	–	–	285	285	285
3/4"	–	–	280	330	330	330
7/8"	–	325	325	375	375	375
1"	370	370	370	420	420	420
1 1/4"	440	440	440	–	–	–
1 1/2"	510	510	510	–	–	–
1 3/4"	580	580	580	–	–	–
2"	650	650	650	–	–	–
2 1/4"	720	720	720	–	–	–
2 1/2"	820	820	820	–	–	–

Note on capacities: All capacities are approximate and will vary dependent on the type of material, moisture content, feed method and amount of fines.

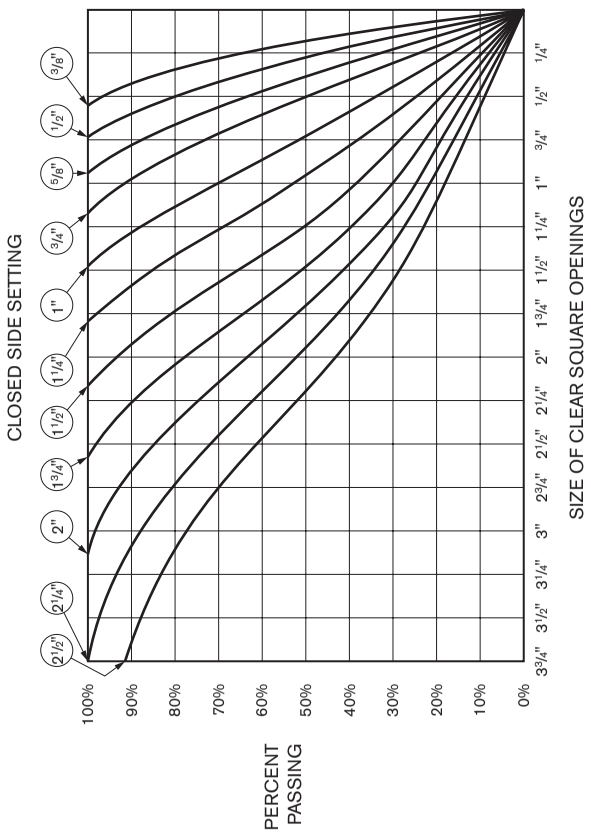
* The minimum setting indicated for each bowl is not necessarily applicable for each and every installation, see notes 1–6, Page 94.

CAPACITIES – 1900 GYRASPHERE CRUSHERS

MODEL	S			FC		
Type of Bowl	Extra Coarse	Coarse	Medium	Coarse	Medium	Fine
Feed Opening						
Open	13"	11 1/4"	9 3/8"	7"	5 7/16"	3 7/8"
Closed	11 1/2"	9 1/2"	7 1/2"	5 1/2"	3 1/2"	1 3/4"
Disch. Open. Max.	3 1/8"	3 3/16"	3 3/16"	3"	3"	2 15/16"
Min.*	1 1/8"	15/16"	3/4"	1/2"	3/8"	3/16"
1/4"	–	–	–	–	–	140
3/8"	–	–	–	–	245	245
1/2"	–	–	–	300	300	300
5/8"	–	–	–	355	355	355
3/4"	–	–	350	410	410	410
7/8"	–	–	400	465	465	465
1"	–	450	450	520	520	520
1 1/4"	575	575	575	–	–	–
1 1/2"	650	650	650	–	–	–
1 3/4"	725	725	725	–	–	–
2"	800	800	800	–	–	–
2 1/4"	875	875	875	–	–	–
2 1/2"	950	950	950	–	–	–

Note on capacities: All capacities are approximate and will vary dependent on the type of material, moisture content, feed method and amount of fines.
* The minimum setting indicated for each bowl is not necessarily applicable for each and every installation, see notes 1–6, Page 94.

SCREEN ANALYSIS OF CRUSHER PRODUCT

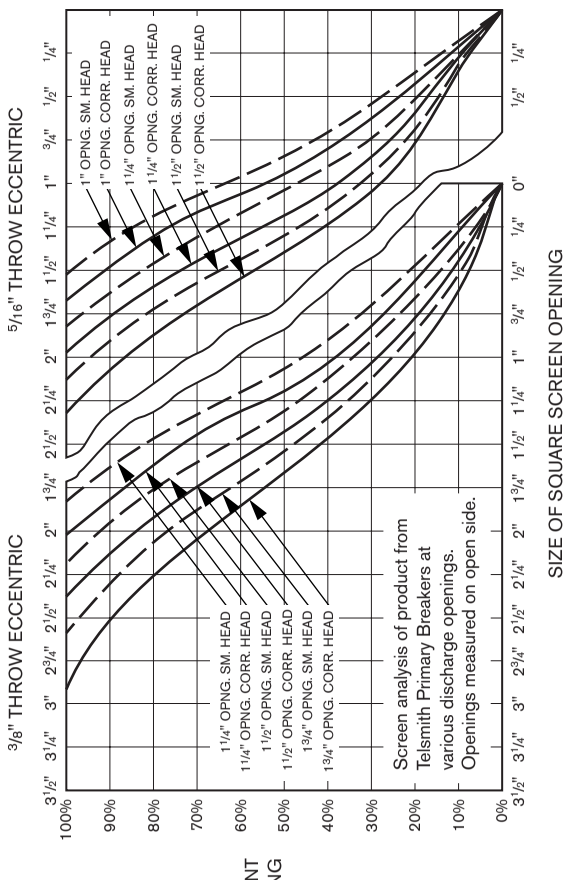


CAPACITIES – SPECIFICATIONS – TELSMITH PILLAR SHAFT GYRATORY CRUSHERS*

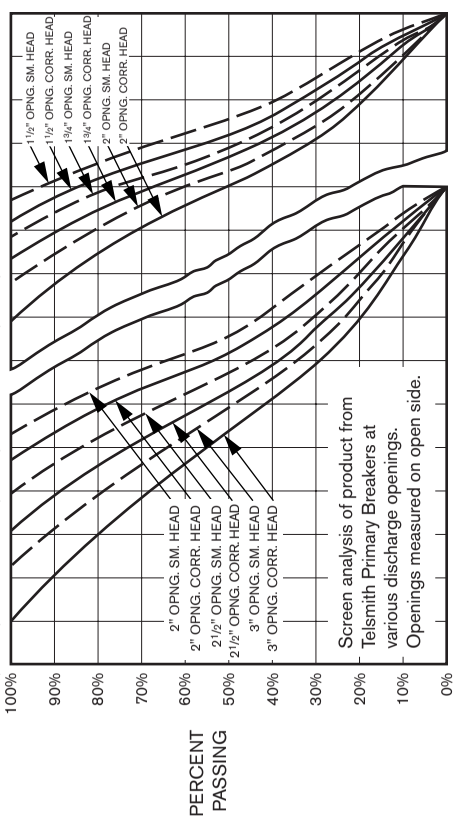
Number of Gyratory Breaker	8B	10B	13B	16B	20B	25B
Dimension of each receiving opening	8"×41"	10"×51"	13"×59"	16"×74"	20"×88"	25"×106"
Net wt. of crusher in lbs., approx.	12,500	19,000	29,000	44,500	62,500	108,000
Export packed wt., lbs. approx.	13,500	20,600	31,500	46,000	67,000	113,000
Export packed ft.^{3}, approx.	200	325	450	650	900	1500
Driving Sheave – Dia. × face × bore	20"×12"×2 7/8"	24"×12"×3 3/8"	30"×14"×3 3/8"	36"×16"×3 7/8"	40"×20"×3 7/8"	40"×24"×4 3/8"
RPM	750	700	560	500	440	480
Horsepower required	20–25	25–30	40–50	60–75	75–100	100–125
Hourly capacity…						
…w/ 1" discharge opening, tons	–	–	–	–	–	–
…w/ 1 1/4" discharge opening, tons	30–33	–	See Note 5, Page 18		–	–
…w/ 1 1/2" discharge opening, tons	33–36	38–44	–	–	–	–
…w/ 1 3/4" discharge opening, tons	36–40	44–50	–	–	–	–
…w/ 2" discharge opening, tons	–	50–57	70–80	–	–	–
…w/ 2 1/2" discharge opening, tons	–	–	80–90	120–135	–	–
…w/ 3" discharge opening, tons	–	–	90–100	135–145	200–220	–
…w/ 3 1/2" discharge opening, tons	–	–	–	145–160	220–250	330–365
…w/ 4" discharge opening, tons	–	–	–	–	250–280	365–400

All sizes have shim adjustment, except 20B and 25B which have plate adjustment.
Note 1: See general notes on capacities, Pages 18 & 19.
* Not in current production. Use for reference material.

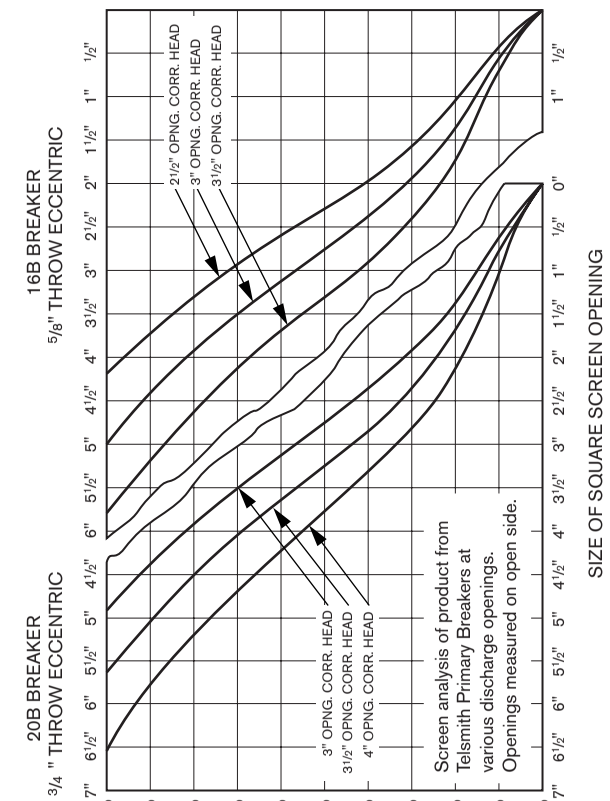
SCREEN ANALYSIS OF BREAKER PRODUCT



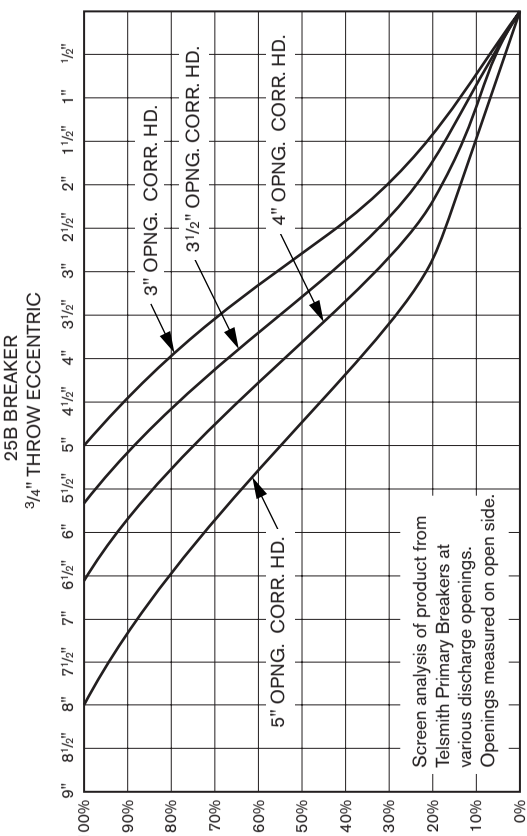
SCREEN ANALYSIS OF BREAKER PRODUCT



SCREEN ANALYSIS OF BREAKER PRODUCT



SCREEN ANALYSIS OF BREAKER PRODUCT



SPECIFICATIONS — CAPACITIES — TELSMITH INTERCONE CRUSHERS

Number of Intercone Crusher	18	28
Size of drive pulley, diameter × face	20"×8"	24"×10"
Speed of drive pulley, RPM	900	875
Width of feed opening	$2\frac{1}{4}$"	4"
Power required, HP	20–25	40–50
Shipping weight, lbs., approx.	3,600	10,500

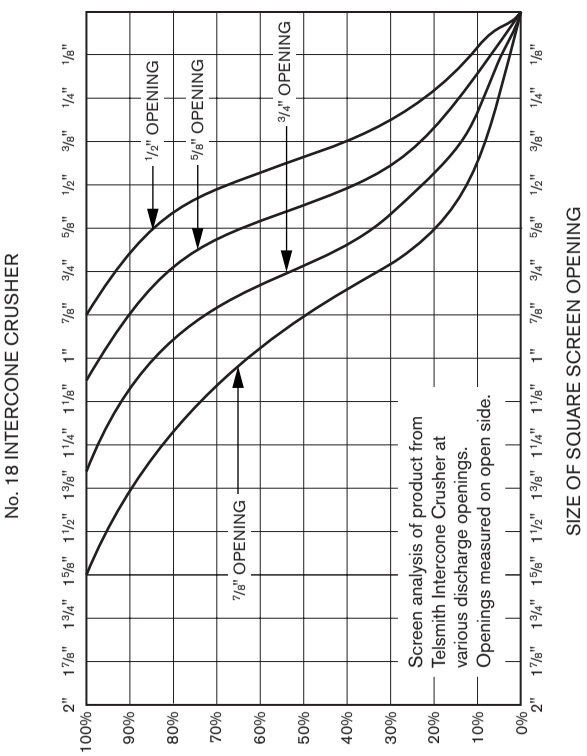
Hourly capacity…

…w/ $\frac{1}{2}$" discharge opening, tons	15–18	–
…w/ $\frac{5}{8}$" discharge opening, tons	17–21	–
…w/ $\frac{3}{4}$" discharge opening, tons	19–24	38–48
…w/ $\frac{7}{8}$" discharge opening, tons	21–26	44–56
…w/ 1" discharge opening, tons	–	50–62
…w/ $1\frac{1}{8}$" discharge opening, tons	–	56–68

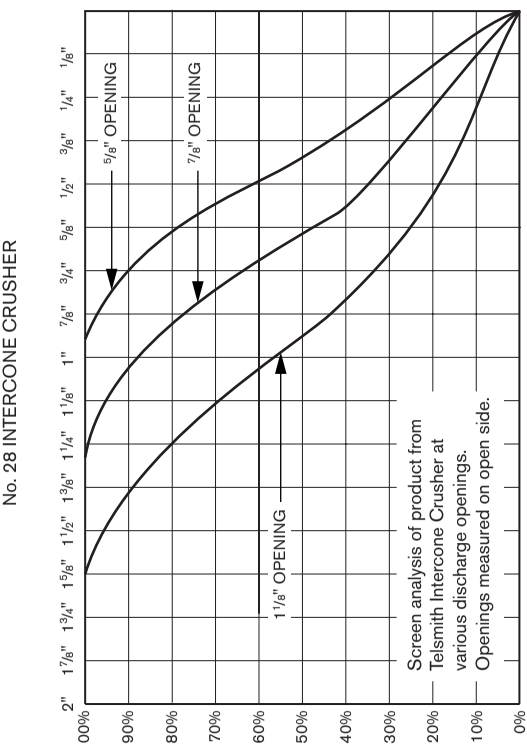
Note 1: See general notes on capacities, Pages 18 & 19.

Note 2: Intercone Crushers are not in current production. Use this data for reference material.

SCREEN ANALYSIS OF CRUSHER PRODUCT



SCREEN ANALYSIS OF CRUSHER PRODUCT

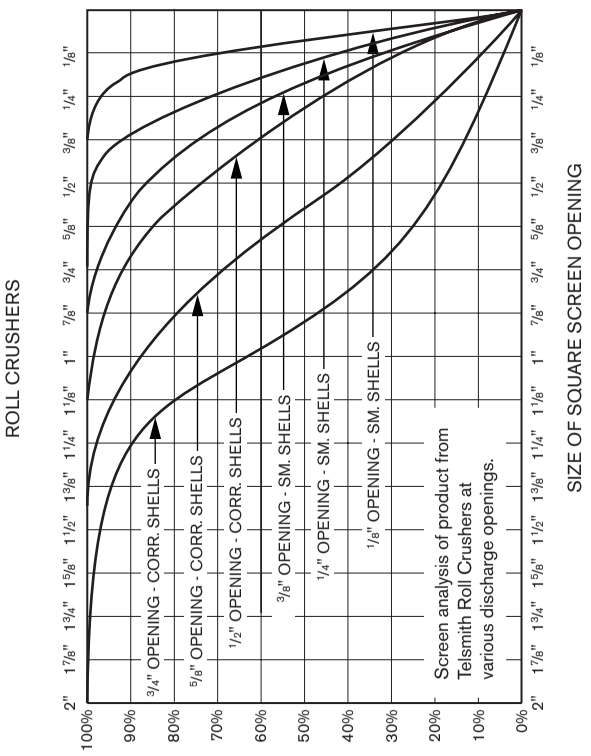


CAPACITIES – SPECIFICATIONS – TELSMITH DOUBLE ROLL CRUSHERS

Size of Rolls, diameter × face	24"×16"		30"×18"		(Note 2) 30"×26"		40"×22"		(Note 3) 40"×30"	
Net weight of Roll Crusher, lbs. approx.	5,500		10,400		17,000		16,700		28,740	
Gross weight lbs. export, packed, approx	5,900		10,900		17,900		17,600		29,740	
Cubical content, cu. ft., export packed, approx	170		265		370		470		470	
Size of drive pulley, diameter × face	36"×10"		36"×10"		48"×12"		48"×12"		64"×14"	
Speed of drive pulley, RPM	260		330		350		250		290	
Horsepower required (Note 2, page 19)	30		40		100		60		200/250	
Surface speed of Roll Shell, FPM †	575		550		550		550		550	
Approximate capacity, in tons per hour, with size of permissable feed at… (Note 3, page 19)	Tons per Hour	Max. Size of feed (Note1)	Tons per Hour	Max. Size of feed (Note1)	Tons per Hour	Max. Size of feed (Note1)	Tons per Hour	Max. Size of feed (Note1)	Tons per Hour	Max. Size of feed (Note1)
…w/ 1/8" spacing between rolls (Notes 4/5, page 19)	12	3/8"	13	3/8"	19	3/8"	15	3/8"	21	3/8"
…w/ 1/4" spacing between rolls	24	3/4"	26	3/4"	37	3/4"	31	3/4"	42	3/4"
…w/ 3/8" spacing between rolls	36	1 1/8"	39	1 1/8"	56	1 1/8"	46	1 1/8"	63	1 1/8"
…w/ 1/2" spacing between rolls	48	*1 1/4"	52	*1 3/8"	75	*1 3/8"	62	1 1/2"	85	*1 1/4"
…w/ 3/4" spacing between rolls	72	*1 1/2"	79	*1 5/8"	112	*1 5/8"	92	*1 7/8"	126	*1 1/2"
…w/ 1" spacing between rolls	96	*1 3/4"	103	*1 7/8"	149	*1 7/8"	125	*2 1/8"	170	*2 1/8"
…w/ 1 1/4" spacing between rolls	120	*2"	130	*2 1/8"	186	*2 1/8"	156	*2 3/8"	212	*2 3/8"
…w/ 1 1/2" spacing between rolls	144	*2 1/4"	156	*2 3/8"	223	*2 3/8"	187	*2 5/8"	255	*2 5/8"

* NOTE 1: Indicates that, where corrugated rolls are used, somewhat larger feed is permissable, but coarser product will result.
NOTE 2: The 30" × 26" Telsmith Roll has a star gear drive. Other sizes have chain drive.
NOTE 3: The 40" × 30" Telsmith Roll is a pneumatic tired drive.
NOTE 4: Capacities are based on 50% of theoritical ribbon of material weighing 100 lbs. per ft.^{3} bulk density. The capacities at a given setting depends on type of crushing shells, reduction ratio, slippage and horsepower employed.
† Speed indicated is for average conditions and should be maintained. Speed can be varied to suit special conditions – Consult factory.
For General Notes, see pages 18 & 19. These crushers are not in current production. Use this data for reference material.

SCREEN ANALYSIS OF CRUSHER PRODUCT



NOTES:

TELSMITH SCREENS

Manufactured in both Horizontal and Inclined types, Telsmith Screens are available in specified sizes from 3' × 10' to 8' × 24' in single, double or triple deck configurations. Depending upon the screen selected, materials can be separated into sizes from minus 6" to minus 16 Mesh.

CAPACITY AND SELECTION OF VIBRATING SCREENS

Information required to select type of Vibrating Screen:

1. Size and weight of largest piece in feed
2. Size of largest opening in screen decks
3. Limitations on space and weight
4. Temperature of feed
5. Gradation of feed
6. Total feed in TPH
7. Duplication of existing machinery
8. Method of mounting screen
9. Special construction features required
10. Duty required, i.e., scalping, sizing, washing and hours per day of operation
11. Allowable Depth of Bed should not exceed 4 times the wire cloth opening when screening material weighing 100 lbs. per ft.^{3}, or 3 times the wire cloth opening when screening material weighing 50 lbs. per ft.^{3}
    6' to 10' lg. $1^1/_2$–2×partical size
    12' to 16' lg. 2–$2^1/_2$×partical size
    18' to 24' lg. $2^1/_2$–3×partical size

Maximum TPH Feed to Standard Vibrating Screens

Width FT.	Vibro-King	Specmaker	Horizontal
3	200	150	150
4	350	300	250
5	500	450	500
6	650	550	650
7	800	700	–
8	*950–1,200	800	–

NOTE: If feed TPH exceeds those shown in table, the screen frames may have to be of extra heavy construction and additional HP may be required.

*For tonnages above 950 TPH, it may be necessary to increase the screen slope to as much as 24°.

Estimating Thickness of Material on a Screen Deck:

$$D = \frac{T \times C}{5 \times F \times W}$$

D = Depth in inches
T = TPH retained on deck
C = Bulk density, ft.^{3}/ton (20 ft.^{3}/ton = 100#/ft.^{3})
F = Ft. per min. travel speed†
W = Width of screen, ft.

† Use 80–120 FPM Average for Slope Screens and 40–60 FPM Average for Horizontal Screens. Actual FPM will vary depending on material, stroke, speed and slope.

VIBRATING SCREEN SELECTION GUIDE

Screen Type	Screen Openings		Maximum Feed Size
	Minimum	Maximum	
Vibrating Grizzly	$1^1/_2$"	8"	36"
Vibro-King	6 mesh	6"	18"
Horizontal	6 mesh	3"	6"
Specmaker	16 mesh	$2^1/_2$"	8"
Valu-King	16 mesh	$2^1/_2$"	5"
Vari-Vibe Scalper	$^3/_4$"	2"	6"
Duo-Vibe	20 mesh	2"	6"
Vari-Vibe II, III, IIIM	20 mesh	$^1/_2$"	2"

CAPACITY AND SELECTION OF VIBRATING SCREENS

The throw, speed, slope and screening surfaces of vibrating screens are established by the factory for each application. Due to the uncertainties inherent in screening operations, it is sometimes necessary to make alterations in the field. The data below is intended as a guide in making adjustments in the field to improve screen performance.

Operating Standards
Vibrating Screens (Dry Screening)

Inclined Screens — Circular Motion

Vibro-King Screen Cloth Opening	Valu-King* Specmaker Screen Cloth Opening	Minimum Throw	Std. Slope Degrees	Shaft Rotation Direction
6"	$2\frac{1}{2}$"	$\frac{1}{2}$"	19	Flow
2"–5"	2"–$2\frac{1}{2}$"	$\frac{3}{8}$"	19	Flow
$\frac{1}{8}$"–$1\frac{7}{8}$"	$\frac{1}{8}$"–$1\frac{7}{8}$"	$\frac{5}{16}$"	19	Flow or Counter Flow
16 mesh–$\frac{3}{32}$"	16 mesh–$\frac{3}{32}$"	$\frac{1}{4}$"	20	Counter Flow

Horizontal Screens

Screen Cloth Opening	Minimum Throw	Std. Slope Degrees	Shaft Rotation Direction
2"–3"	$\frac{5}{8}$"	0	–
$1\frac{1}{2}$"–2"	$\frac{1}{2}$"	0	–
$\frac{7}{8}$"–$1\frac{5}{8}$"	$\frac{7}{16}$"	0	–
$\frac{1}{8}$"–$\frac{3}{4}$"	$\frac{3}{8}$"	0	–

NOTE: For standard speeds, see screen specifications – inclined or horizontal

* Valu-King screens standard slope is 18 degrees

CAPACITY OF VIBRATING SCREENS

INFORMATION REQUIRED TO CALCULATE CAPACITY AND SIZE OF VIBRATING SCREENS

1. Sieve analysis of feed–obtained by testing a sample, from crusher product curves or in from plant production records.
2. Weight per ft.^{3} material to be screened.
3. Determine if screening is to be done dry or with water sprays.
4. Shape of screen openings, i.e., round, square or rectangular.
5. If dry screening, what is moisture content, and is clay present? (see notes 4 & 5 on page 117).
6. Size of openings in screen decks and if nominal or specification sizing is required.
7. Screening efficiency required (see Note 3 below)
8. Total feed to screen, including any circulating load from crushers, in short TPH. Allow for peak tonnage.

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1. TO DETERMINE SIZE OF SCREEN. Use the formula: $\text{Area (Sq. Ft)} = \frac{\text{TF} - \text{Oversize}}{\text{A} \times \text{B} \times \text{C} \times \text{D} \times \text{E} \times \text{F}}$ in which, TF = Total feed to screen in TPH. Oversize = Amount of feed larger than deck openings, in TPH. A, B, C, D, E & F are factors obtained from the tables below.
2. TO DETERMINE TOTAL CAPACITY OF A GIVEN SCREEN. Use the formula: C (capacity through screen) = [Area×(A×B×C×D×E×F)] plus Oversize.
3. Efficiency is the ratio of the undersize obtained in screening to the amount of undersize available in the feed. It is found by the formula: $\text{E}(\%) = \frac{100(\text{e}-\text{v})}{\text{e}(100-\text{v})} \times 100$ $\begin{matrix}\text{e} = \text{percentage undersize in feed} \\ \text{v} = \text{percentage undersize in overproduct}\end{matrix}$

CAPACITY OF VIBRATING SCREENS (Cont.)

4. When dry screening, excessive moisture in the material may cause blinding of the screen cloth. Where moisture content exceeds that given in the following table, the use of special wire cloth, ball deck trays, or electric heating may be required. Consult factory.

Square Screen Opening	Moisture	Square Screen Opening	Moisture
1/16" & smaller	0%	7/16" to 3/8"	4%
3/16" to 1/8"	1%	1" to 1/2"	6%
5/16" to 1/4"	2%	larger than 1"	8%

5. Maximum moisture content of feed when screening with ball decks.

Square Screen Opening	Moisture	Square Screen Opening	Moisture
1/4"	5%	1/16"	2%
3/16"	4 1/2%	1/32"	1%
1/8"	4%		

6. Where rectangular shaped screen cloth openings are used, Factor "A" in the table following may be increased 25% for openings 5 times as long as they are wide, and 50% for openings 10 times as long as they are wide. For round openings use 80% of Factor "A"
7. WHEN RESCREENING OR SIMILAR APPLICATION. Where Factor "D" in the table below cannot be determined, screening area may be calculated by dividing one-half the screen feed in TPH by Factor "A" for the screen opening. Neglect "B" and "C", use "E" and "F" if appropriate.
8. The formulae in items 1 and 2 when applied to inclined, circular motion screens at a slope of 19° requiring operation at less slope, reduce the capacity 10% for each 2 1/2° below 19°.
9. Factors given are for screen cloth having approximately 50% open area. Increase or decrease factors in proportion to percent open area of cloth selected as shown on page 124.

CAPACITY OF VIBRATING SCREENS (Cont.)

FACTOR "A" Capacity in Tons Per Hour Passing Through 1 ft.² of Screen Cloth Based on 95% Efficiency with 25% Oversize																		
Size of Clear Square Opening	.0331"	.0661"	.093"	.125"	.131"	.185"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
U.S.S. Mesh Size	20	12	8	7	6	4	–	–	–	–	–	–	–	–	–	–	–	–	–
Sand	.58	.94	1.01	1.47	1.59	1.69	–	–	–	–	–	–	–	–	–	–	–	–	–
Stone Dust	.48	.78	.84	1.19	1.30	1.41	–	–	–	–	–	–	–	–	–	–	–	–	–
***Coal Dust**	.36	.59	.64	.91	.98	1.07	–	–	–	–	–	–	–	–	–	–	–	–	–
Natural Gravel	–	–	–	–	–	–	2.13	2.40	2.74	2.90	3.03	3.23	3.36	3.56	3.63	4.12	4.59	4.98	6.17
Crushed Stone & Crushed Gravel	–	–	–	–	–	–	1.74	2.04	2.29	2.39	2.52	2.68	2.78	2.95	3.04	3.45	3.83	4.17	5.13
***Coal**	–	–	–	–	–	–	1.35	1.51	1.26	1.80	1.91	2.02	2.10	2.25	2.27	2.57	2.87	3.11	3.87

FACTOR "B"

Determine or estimate percentage of oversize in feed to screen and use proper factor as given below. For example, if screen has 1" openings and 60% of feed to screen will go thru 1" openings, there is 40% of oversize and factor .88 would apply. Other percentages accordingly.

*Note: Factor "A" based on 75 lbs./ft.³ (hard coal only). For soft coal use 1/2 the factor shown for stone dust or crushed stone.

Amount of Oversize	Factor "B"	Amount of Oversize	Factor "B"	Amount of Oversize	Factor "B"
10%	1.13	60%	.70	92%	.43
20%	1.02	70%	.62	94%	.40
30%	.96	80%	.53	96%	.32
40%	.88	85%	.50	98%	.24
50%	.79	90%	.46	100%	.00

CAPACITY OF VIBRATING SCREENS (Cont.)

Desired Efficiency	70%	75%	80%	85%	90%	92%	94%	96%	98%	**Factor "C"** Slight inaccuracies are seldom objectionable in screening aggregate and perfect separation (100% efficiency) is not consistent with economy. For finished products, 98% efficiency is the extreme practicable limit and 90-94% is usually satisfactory. 60% to 75% efficiency is usually acceptable for scalping purposes.
Factor "C"	1.90	1.70	1.50	1.35	1.15	1.08	1.00	.95	.90	

Amount of Feed less than $^1/_2$ the Size of Opening	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	**Factor "D"** Consider this factor carefully where sand or fine rock is present in feed. For example, if screen has $^1/_2$" square openings and a large percentage of the feed is $^1/_4$" or less in size, such as sand or dust, determine percentage and use proper factor given opposite.
Factor "D"	.50	.60	.80	1.00	1.20	1.40	1.70	2.00	2.40	…	

Wet Screening													
Size Opening (Mesh or Inches)	20	14	10	8	$^1/_8$"	6	4	$^1/_4$"	$^5/_{16}$"	$^3/_8$"	$^1/_2$"	$^3/_4$"	1" or more
Factor "E"	1.10	1.50	2.00	2.25	2.00	2.50	2.50	2.00	2.00	1.75	1.40	1.30	1.25

Wet screen below 20 mesh not recommended.

Factor "E" If material is dry, use factor 1.00. If there is water in material or if water is sprayed on screen, use proper factor given opposite. Wet screening means the use of approximately 5 to 10 GPM of water per yard^3 of material per hour or for 50 yards^3 per hour of material use 250-500 GPM of water, etc.

Deck	Top	Second	Third	Fourth	For examples, see next page.	**Factor "F"** For single deck screen, use factor 1.00. For multiple deck screen, be sure to use proper factor for each deck.
Factor"F"	1.00	.90	.80	.70		

Typical examples showing how to determine the size of vibrating screen required for a certain capacity or to determine the capacity of any size of vibrating screen.

EXAMPLE NO. 1

To determine the capacity in TPH that can be passed through a 3' × 8' vibrating screen under the following conditions:–

1. The material to be screened is ordinary gravel.
2. Screen cloth having 1" square opening.
3. 30% of the material to be screened is larger than 1" or there is 30% of oversize.
4. Desired screening efficiency 90%.
5. 50% of the material to be screened is less than one-half the size of the screen opening. In other words, one-half of the material to be screened is less than $^1/_2$" in size.
6. Screening will be done dry, or as the gravel comes from the bank. No water will be used.
7. A single deck vibrating screen will be used.

Referring to the capacity and factor tables on Pages 116–119, we select the following factors:–

Factor "A": – Gravel with 1" square opening–3.36.

Factor "B": – 30% of oversize–.96.

Factor "C": – 90% efficiency–1.15.

Factor "D": – 50% less than one-half size of opening–1.20.

* Factor "E": – Dry screening–1.00.

Factor "F": – Single deck screen (top deck)–1.00.

The solution, in accordance with formula No. 1, is the area of the screen cloth multiplied by all of the above factors or 3'×8'=24 sq. ft. of area ×3.36×.96×1.15×1.20×1.00×1.00=107 tons per hour.

107 tons per hour is the capacity passing through the 1" holes of the screen, and is 70% of the feed to the screen. 30% of the feed was rejected by the 1" holes. The total capacity that can be handled by the screen is the sum of these two or 153 tons per hour.

*Note:–For wet screening, change this factor as shown in table under Factor "E". Same applies in Examples 2 and 3.

EXAMPLE NO. 2

To determine the size of the vibrating screen required under the following conditions:–

1. The material to be screened is crushed stone.
2. Screen cloth having $1^1/_4$" square openings.
3. Total capacity required – 60 tons per hour.
4. 25% of the material to be screened is larger than $1^1/_4$".
5. Desired screening efficiency 92%.
6. 20% of the stone is less than $^1/_2$ the size of the $1^1/_4$" openings.
7. The stone will be screened dry.
8. A single deck vibrating screen will be used.

Continued on next page

Referring to the capacity and factor tables on Pages 116–119, we select the following factors:–

Factor "A": – 2.95.
Factor "B": – .99.
Factor "C": – 1.08.
Factor "D": – .60.
* Factor "E": – 1.00.
Factor "F": – 1.00.

The solution, in accordance with formula No. 3, is as follows: – 60 TPH less 25% of 60 or 15 TPH gives 45 TPH divided by (2.95 × .99 × 1.08 × .60 × 1.00 × 1.00) = 23.8 ft.^{2} of screen surface. A 3'×8' screen is the correct size.

EXAMPLE NO. 3

To determine the size of a double deck screen under the following conditions:–

1. The material to be screened is crushed stone.
2. Capacity to be handled is 80 tons per hour.
3. Square openings in top deck are 1".
4. Square openings in bottom deck are 1/4".
5. 20% of the 80 TPH is over 1" in size.
6. An efficiency of 96% is required.
7. 40% of the material is less than one-half the size of the top deck or 1" openings.
8. There is 15% of minus 1/4" material to be taken out through the bottom deck; and of this 1/4" material, 10% is less than one-half the size of the 1/4" opening.
9. The oversize from the top deck is to be recrushed to minus 1" and returned to the screen.

A problem of this kind must be treated as two separate computations, one for the top deck and one for the bottom deck. The solution is as follows:–

$$\text{Area} = \frac{80\text{TPH}}{A \times B \times C \times D \times E \times F} = \frac{80\text{TPH}}{2.78 \times 1.02 \times .95 \times 1.00 \times 1.00 \times 1.00} = 29.7 = \text{No. of Sq. Ft.}$$

screen surface required for the top deck = 3'×10' vibrating screen

Considering the lower deck, we find that 15% of the total of 80 TPH must pass through the bottom deck or 12 TPH must pass through the 1/4" openings. This makes 85% of oversize on the bottom deck. Using formula No. 3 and factors again, we have the following for the bottom deck:–

$$\text{Area} = \frac{12\text{TPH}}{A \times B \times C \times D \times E \times F} = \frac{12\text{TPH}}{1.74 \times .50 \times .95 \times .5 \times 1.00 \times .90} = 29.7 = \text{No. of Sq. Ft.}$$

of screen surface required for the bottom deck = about 4'×8' screen

In problems like Example 3, especially where the bottom deck has a fairly small opening, it will usually be found that the size of the bottom deck determines the size of the screen. In a case of this kind where one deck requires a larger area than the other, always select a screen or screens which will give the larger area for both decks.

CAPACITY OF SPRAY NOZZLES FOR TELSMITH VIBRATING SCREENS

Pressure PSI	CAPACITY IN GPM											
	DIAMETER OF ORIFICE											
	5/32"	3/16"	7/32"	1/4"	9/32"	5/16"	11/32"	3/8"	13/32"	7/16"	15/32"	1/2"
20	2.1	3.0	4.0	5.2	6.6	8.1	9.8	11.7	13.7	15.8	18.2	20.1
30	2.5	3.6	4.8	6.4	8.1	10.0	12.0	14.4	16.8	19.5	22.4	25.4
40*	2.9	4.1	5.7	7.4	9.3	11.5	13.9	16.5	19.4	22.4	25.8	29.4
50	3.2	4.6	6.3	8.2	10.4	12.8	15.5	18.5	21.6	25.0	28.8	32.9
60	3.5	5.1	6.9	9.0	11.8	14.0	17.0	20.2	23.8	27.5	31.6	36.0
70	3.8	5.6	7.5	9.7	12.3	15.1	18.3	21.8	25.6	29.6	34.0	38.8
80	4.1	5.9	8.0	10.3	13.1	16.2	19.5	23.3	27.3	31.6	36.3	41.4
90	4.3	6.2	8.5	11.0	14.0	17.2	20.8	24.8	29.0	33.6	38.7	44.0
100	4.6	6.6	8.9	11.6	14.7	18.1	21.9	26.1	30.6	35.4	40.7	46.4

* = Pressure usually recommended

⇑ Orifice usually used.

SCREEN CLOTH INFORMATION

Equivalent openings flat testing screens U.S standard sieve series		Recommended Square Screen Opening for Vibrating Screen on 19° Angle	Recommended Round Screen Opening for Revolving Screen on 6° Slope
Round ○	Square □	Opening □	Opening ○
1/8"	3/32"	1/8"	5/32"
3/16"	5/32"	3/16"	1/4"
1/4"	3/16"	1/4"	5/16"
5/16"	1/4"	5/16"	3/8"
3/8"	5/16"	3/8"	1/2"
1/2"	3/8"	1/2"	5/8"
5/8"	1/2"	5/8"	3/4"
3/4"	5/8"	3/4"	1"
7/8"	3/4"	7/8"	1 1/8"
1"	7/8"	1"	1 1/4"
1 1/4"	1"	1 1/8"	1 9/16"
1 3/8"	1 1/8"	1 1/4"	1 3/4"
1 1/2"	1 1/4"	1 3/8"	1 7/8"
1 3/4"	1 1/2"	1 9/16"	2 1/4"
2"	1 3/4"	1 7/8"	2 1/2"
2 1/4"	1 7/8"	2"	2 3/4"
2 3/8"	2"	2 1/8"	2 15/16"
2 1/2"	2 1/8"	2 1/4"	3 1/8"
2 3/4"	2 1/4"	2 1/2"	3 1/2"
3"	2 1/2"	2 3/4"	3 3/4"
3 1/4"	2 3/4"	3"	4"
3 1/2"	3"	3 1/4"	4 3/8"
3 3/4"	3 1/8"	3 1/2"	4 3/4"
4"	3 5/16"	3 3/4"	5"
5"	4 1/4"	4 1/2"	6 1/4"
6"	5 1/4"	5 1/2"	7 1/2"

SELECTION OF WIRE DIAMETERS FOR WOVEN SCREEN CLOTH

A – Medium Light: 50-75 lb. ft.^{3} – Coal, Non-Abrasive. **B** – Medium: 75-100 lb. ft.^{3} – Limestone, Sand and Gravel. **C** – Medium Heavy: 100-120 lb. ft.^{3} – Average Ores – Moderate Abrasives. **D** – Heavy: 120-140 lb. ft.^{3} – Heavy Ores – High Abrasives.

Clear Square Opening	A		B		C		D		Feed Size		
	Dia.	Open Area	Dia.	Open Area	Dia.	Open Area	Dia.	Open Area	I	II	III
1/16"	.035	42.3	.041	37.0	.047	33.2	.063	24.6	1/2"	5/8"	7/8"
3/32"(8M)	.041	47.6	.047	45.2	.063	35.0	.080	29.6	5/8"	3/4"	1"
1/8"	.054	48.7	.072	40.2	.092	33.4	.105	29.5	5/8"	3/4"	1"
5/32"	.063	51.2	.080	43.5	.105	36.0	.120	32.2	3/4"	1"	1 1/4"
3/16"(4M)	.080	49.1	.092	45.1	.120	37.2	.135	33.8	3/4"	1"	1 1/4"
1/4"	.105	49.6	.120	45.6	.135	42.2	.148	39.4	1"	1 1/2"	2"
5/16"	.120	52.2	.135	48.8	.148	46.0	.162	43.4	1 1/2"	2"	2 1/2"
3/8"	.135	54.1	.148	51.4	.162	48.7	.177	46.1	1 1/2"	2"	2 1/2"
7/16"	.148	55.8	.162	53.2	.177	50.7	.192	48.3	2"	2 1/2"	3"
1/2"	.162	57.1	.177	54.5	.192	52.2	.207	49.8	2"	2 1/2"	3"
9/16"	.162	61.0	.177	57.6	.192	55.0	.225	50.7	2 1/2"	3 1/4"	3 3/4"
5/8"	.177	60.7	.192	58.5	.225	54.0	.250	51.0	2 1/2"	3 1/4"	3 3/4"
3/4"	.192	63.4	.207	61.4	.250	56.3	.3125	49.8	3"	3 3/4"	4 1/2"
7/8"	.207	65.3	.225	63.3	.250	60.5	.3125	54.3	3"	3 3/4"	4 1/2"
1"	.225	66.6	.250	64.0	.3125	58.0	.375	52.9	3 1/2"	4 1/2"	5 1/4"
1 1/8"	.225	69.6	.250	67.0	.3125	61.0	.375	55.7	3 1/2"	4 1/2"	5 1/4"
1 1/4"	.250	69.4	.3125	64.0	.375	59.2	.4375	54.8	4"	5"	6"
1 3/8"	.250	71.5	.3125	66.5	.375	61.6	.4375	57.5	4"	5"	6"
1 1/2"	.250	73.4	.3125	68.5	.375	64.0	.500	56.3	4"	5"	6"
1 3/4"	.3125	71.9	.375	67.8	.4375	64.0	.500	60.5	4 1/2"	5 1/2"	7"
2"	.3125	74.8	.375	70.9	.500	64.0	.625	58.0	5"	6 1/2"	8"
2 1/4"	.375	73.4	.4375	70.1	.500	66.9	.625	61.2	5"	6 1/2"	8"
2 1/2"	.375	75.6	.4375	72.4	.500	69.4	.625	64.0	5"	6 1/2"	8"
2 3/4"	.375	77.4	.4375	74.4	.500	71.6	.625	66.4	5"	6 1/2"	8"
3"	.4375	76.2	.500	73.5	.625	68.5	.750	64.0	6"	7 1/2"	9"
3 1/2"	.4375	79.0	.500	76.6	.625	72.0	.750	67.8	6"	7 1/2"	9"
4"	.500	79.0	.625	74.8	.750	70.9	1.000	64.0	7"	8 1/2"	10"

NOTES: Wire diameters listed above are suitable for feed size not exceeding that listed in Column I. When feed size exceeds Column I but not Column II, use next larger wire diameter. When it exceeds Column II but not Column III, increase wire diameter two sizes. Wet Screen: Select next larger wire diameter. Perforated Plate is recommended for openings larger than 4". 1/2" diameter and smaller wire furnished with hooked edges as standard and for side tension bars. Larger than 1/2" diameter wire requires flat support tray and clamping strips. New screens normally furnished with wire diameters as listed in Column C, medium heavy wire, for top deck; and lower deck surfaces with medium wire Column B. Spring steel cloth is standard. Oil tempered, stainless steel, profile wire, or rubber deck surfaces are optional extras – Consult Factory.

A typical example of open area correction to screen is:

50% (Mentioned in "A" Factor) ÷ the open area percentage = the percentage to be multiplied by the square footage of screen area.

Calculation: .50/.58 = 86%×190 ft.^{2} = reduced area to 163 ft.^{2} (58% open area was derived by 1" clear ft.^{2} opening, "C" medium heavy wire .3125)

U.S. SIEVE SERIES and TYLER EQUIVALENTS
A.S.T.M. – E-11-61

Sieve Designation		Sieve Opening		Nominal Wire Diameter		Tyler Screen Scale Equivalent
Standard	Alternate	mm	in.**	mm	in.**	Designation
107.6 mm	4.24 in.	107.6	4.24	6.40	.2520	···
101.6 mm	4 in. (a)	101.6	4.00	6.30	.2480	···
90.5 mm	3 1/2 in.	90.5	3.50	6.08	.2394	···
76.1 mm	3 in.	76.1	3.00	5.80	.2283	···
64.0 mm	2 1/2 in.	64.0	2.50	5.50	.2165	···
53.8 mm	2.12 in.	53.8	2.12	5.15	.2028	···
50.8 mm	2 in. (a)	50.8	2.00	5.05	.1988	···
45.3 mm	1 3/4 in.	45.3	1.75	4.85	.1909	···
38.1 mm	1 1/2 in.	38.1	1.50	4.59	.1807	···
32.0 mm	1 1/4 in.	32.0	1.25	4.23	.1665	···
26.9 mm	1.06 in.	26.9	1.06	3.90	.1535	1.050 in.
25.4 mm	1 in. (a)	25.4	1.00	3.80	.1496	···
*22.6 mm	7/8 in.	22.6	0.875	3.50	.1378	.883 in.
19.0 mm	3/4 in.	19.0	0.750	3.30	.1299	.742 in.
*16.0 mm	5/8 in.	16.0	0.625	3.00	.1181	.624 in.
13.5 mm	.530 in.	13.5	0.530	2.75	.1083	.525 in.
12.7 mm	1/2 in. (a)	12.7	0.500	2.67	.1051	···
*11.2 mm	7/16 in.	11.2	0.438	2.45	.0965	.441 in.
9.51 mm	3/8 in.	9.51	0.375	2.27	.0894	.371 in.
*8.00 mm	5/16 in.	8.00	0.312	2.07	.0815	2 1/2 mesh
6.73 mm	.265 in.	6.73	0.265	1.87	.0736	3 mesh
6.35 mm	1/4 in. (a)	6.35	0.250	1.82	.0717	···
*5.66 mm	No. 3 1/2	5.66	0.223	1.68	.0661	3 1/2 mesh
4.76 mm	No. 4	4.76	0.187	1.54	.0606	4 mesh
*4.00 mm	No. 5	4.00	0.157	1.37	.0539	5 mesh
3.36 mm	No. 6	3.36	0.132	1.23	.0484	6 mesh
*2.83 mm	No. 7	2.83	0.111	1.10	.0430	7 mesh
2.38 mm	No. 8	2.38	0.0937	1.00	.0394	8 mesh
*2.00 mm	No. 10	2.00	0.0787	.900	.0354	9 mesh
1.68 mm	No. 12	1.68	0.0661	.810	.0319	10 mesh
*1.41 mm	No. 14	1.41	0.0555	.725	.0285	12 mesh
1.19 mm	No. 16	1.19	0.0469	.650	.0256	14 mesh
*1.00 mm	No. 18	1.00	0.0394	.580	.0228	16 mesh
841micron	No. 20	0.841	0.0331	.510	.0201	20 mesh
*707 micron	No. 25	0.707	0.0278	.450	.0177	24 mesh
595 micron	No. 30	0.595	0.0234	.390	.0154	28 mesh
*500 micron	No. 35	0.500	0.0197	.340	.0134	32 mesh
420 micron	No. 40	0.420	0.0165	.290	.0114	35 mesh
*354 micron	No. 45	0.354	0.0139	.247	.0097	42 mesh
297 micron	No. 50	0.297	0.0117	.215	.0085	48 mesh
*250 micron	No. 60	0.250	0.0098	.180	.0071	60 mesh
210 micron	No. 70	0.210	0.0083	.152	.0060	65 mesh
*177 micron	No. 80	0.177	0.0070	.131	.0052	80 mesh
149 micron	No. 100	0.149	0.0059	.110	.0043	100 mesh
*125 micron	No. 120	0.125	0.0049	.091	.0036	115 mesh
105 micron	No. 140	0.105	0.0041	.076	.0030	150 mesh
*88 micron	No. 170	0.088	0.0035	.064	.0025	170 mesh
74 micron	No. 200	0.074	0.0029	.053	.0021	200 mesh
*63 micron	No. 230	0.063	0.0025	.044	.0017	250 mesh
53 micron	No. 270	0.053	0.0021	.037	.0015	270 mesh
*44 micron	No. 325	0.044	0.0017	.030	.0012	325 mesh
37 micron	No. 400	0.037	0.0015	.025	.0010	400 mesh

* These sieves correspond to those proposed as an International (ISO) Standard. It is recommended that wherever possible these sieves be included in all sieve analysis data or reports intended for international publication.

** Decimal measurements given in approximate equivalents.

(a) These sieves are not in the fourth root of 2 Series, but they have been included because they are in common usage.

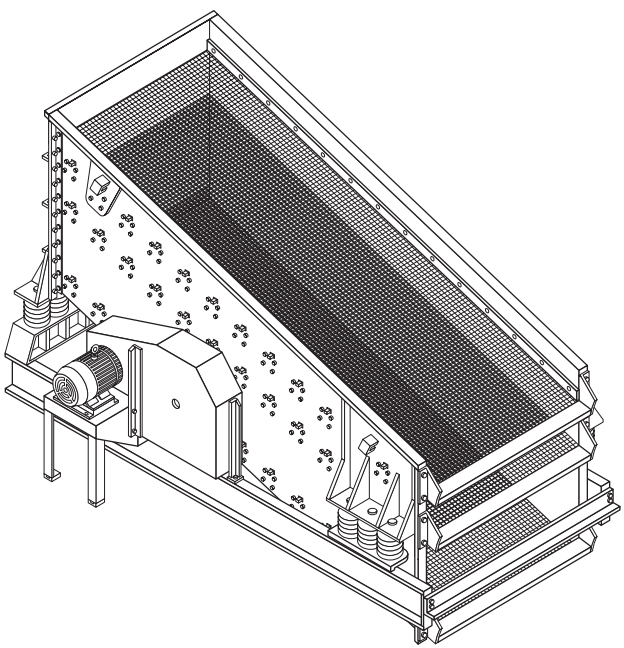
VIBRO-KING SCREENS

The Vibro-King Screen is Telsmith's inclined heavy-duty screen that can handle a variety of applications from heavy-duty scalping behind large primary crushers to final sizing down to 16 mesh range.

Inclined screens are the most popluar design for use in stationary plants or where headroom is not a limiting factor.

Telsmith Vibro-King Screens are built in single shaft, two bearing style with patented retracting counterweights for smoother starting and stopping in sizes of 5'×16' and 6'×16' in single, double or triple deck configurations.

Four bearing, two shaft, two motor, timed Vibro-King Screens with fixed counterweights are built in sizes of 7'×20' and 8'×24' in single, double or triple deck designs. For full description and illustrations, refer to Bulletin T301.



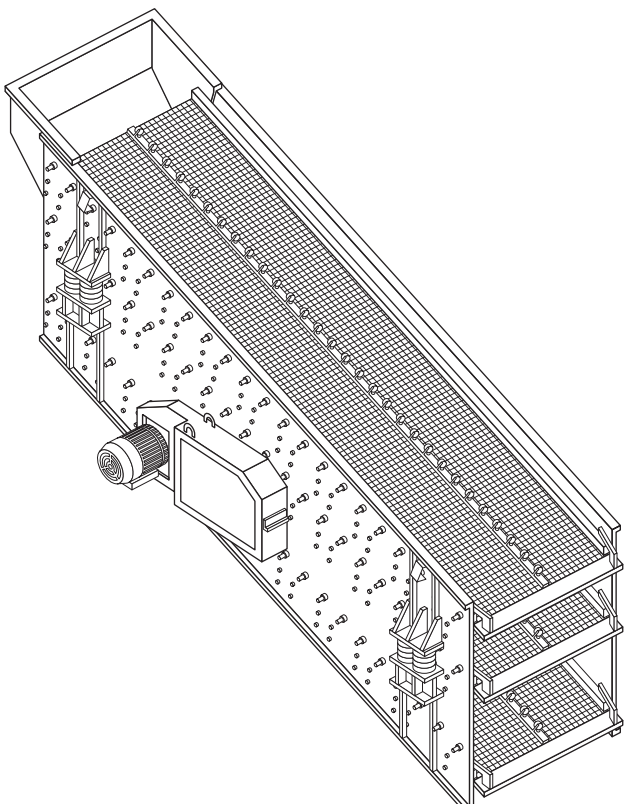
VIBRO-KING SCREEN SPECIFICATIONS

Screen Size Width × Length Ft. (mm)	No. of Decks	Screen Pulley RPM (NOTE 1)	Size of Vib. Unit (NOTE 2)	HP of 1800 RPM Electric Motor (NOTE 3)	Dry Screen Gross Wt. Lbs. Approx.	Dry Screen Exp. Wt. Lbs. Approx.	Cu. Cont. Ft.^{3} Approx.	Number of Spray Nozzles
5'×16' (1524×4877)	S	600-1,050	32 SA	20	9,175	9,750	690	20
	D			20	10,725	11,375	820	35
	T			25	13,300	14,075	960	35
6'×16' (1829×4877)	S	600-1,050	32 SA	20	10,550	11,225	1,200	24
	D			20	12,340	12,990	1,300	48
	T			25	15,450	16,050	1,390	48
7'×20' (2134×6096)	S	600-1,050	2-32M	2-30	16,100	16,600	1,500	35
	D				20,600	21,100	1,600	70
	T				24,200	24,700	1,850	70
8'×20' (2439×6096)	S	600-1,050	2-32M	2-30	22,050	22,650	1,970	40
	D				26,100	26,750	2,070	80
	T				30,200	30,800	2,210	80
8'×24' (2439×7315)	S	600-1,050	2-32M	2-30	24,400	25,150	3,290	48
	D				29,650	30,400	3,390	96
	T				38,300	39,050	3,500	96

NOTE 1: Screen pulley speed (RPM) is dependent on peak-to-peak amplitude and the application. Refer to certified installation drawing for actual speed.
NOTE 2: 7' & 8' wide screens use two 32M vibrating units coupled by a timing belt.
NOTE 3: 7' & 8' wide screens use two drive motors. One motor drives each shaft.

SPECMAKER SCREENS

Designed expressly to accomplish the precision screening required in final sizing and separations down to 16 mesh. Telsmith's Specmaker Screens are built in sizes from 5'×14' to 8'×20' in single, double and triple deck designs and in 6'×16' and 6'×20' four deck versions. For full description and illustrations, refer to Bulletin T301.



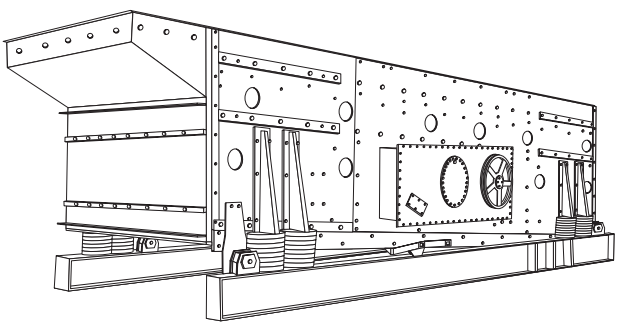
SPECMAKER SCREEN SPECIFICATIONS

Screen Size Width × Length Ft. (mm)	No. of Decks	Screen Pulley RPM Speed Range	Size of Vib. Unit	HP of 1750 RPM Electric Motor	Dry Screen Net Wt. Lbs.	Dry Screen Exp. Wt. Lbs.	Cu. Cont. Ft.^{3} Approx.	Number of Spray Nozzles
4'×10' (1219×3048)	S D T	800-1,100	22B	7.5	5,700 5,785 7,620	6,050 6,135 7,970	330 330 480	16 32 48
5'×14' (1524×4267)	S D T	800-1,100	22B	15	6,840 7,920 9,970	7,290 8,370 10,420	585 595 840	20 40 60
5'×16' (1524×4877)	S D T	800-1,100	22B 22B 26B	15 15 20	7,250 8,350 11,000	7,840 8,940 11,590	690 820 960	22 44 66
6'×16' (1829×4877)	S D T 4	800-1,100	22B 22B 26B 32B	15 15 20 30	7,800 9,275 12,440 15,605	8,480 9,955 13,120 16,285	750 760 1,060 1,350	24 48 72 96
6'×20' (1829×6096)	S D T 4	800-1,100	26B 26B 32B 32B	20 20 30 40	9,110 10,810 15,430 20,050	9,610 11,310 15,930 20,550	910 925 1,275 1,625	30 60 90 120

NOTE : All of the above vibrating units are grease lubricated (standard)

HORIZONTAL SCREENS

Horizontal Screens are used where there is limited headroom, such as portable plants and/or only a minimum amount of water carry over from a rinsing application is allowed. Horizontal Screens are available in double or triple deck configurations in sizes from 5' × 14' to 8' × 20'. For a full description and illustrations, consult factory.



HORIZONTAL SCREEN SPECIFICATIONS

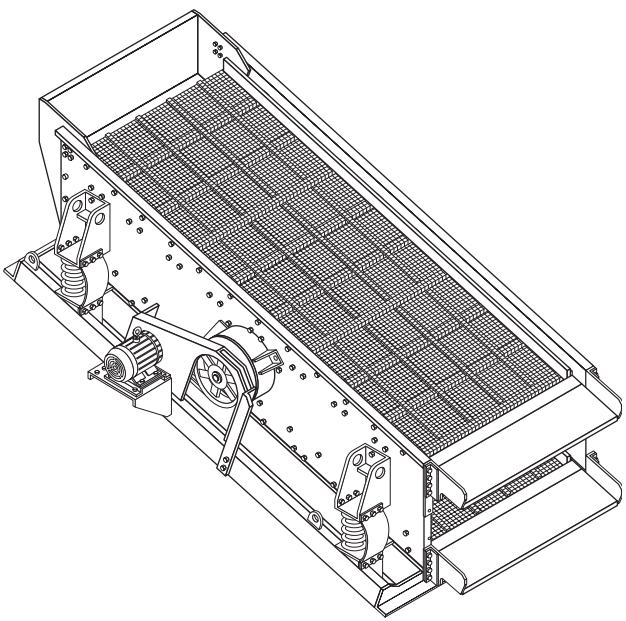
Screen Size Width × Length Ft. (mm)	No. of Decks	Screen Pulley RPM NOTE 1	HP of 1200 RPM Electric Motor	Dry Screen Gross Wt. Lbs.	Dry Screen Export Wt. Lbs.	Cu. Cont. Ft.^{3} Approx. NOTE 2	Dry Screen Gross Wt. Kilos	Dry Screen Export Wt. Kilos
5'×14' (1524×4267)	2 3	675-875	25 25	11,500 14,000	11,750 14,250	552 712	5,216 6,350	5,330 6,464
5'×16' (1524×4877)	2 3	675-875	25 30	12,500 15,300	12,750 15,550	650 825	5,670 6,940	5,795 7,095
6'×16' (1829×4877)	2 3	675-875	30 40	15,100 19,100	15,400 19,485	754 965	6,849 8,664	7,000 8,860
6'×20' (1829×6096)	2 3	675-875	40 40	19,100 22,700	19,485 23,155	1,070 1,330	8,664 10,297	8,860 10,525
7'×20' (2134×6096)	2 3	675-875	50 50	21,500 22,500	21,930 26,010	1,150 1,480	9,752 11,567	9,970 11,825
8'×20' (2439×6096)	2 3	675-875	50 50	25,400 29,100	25,900 29,600	1,260 1,630	11,521 13,200	11,748 13,426

NOTE 1: Screen pulley speed (RPM) is dependent on application.
Refer to certified installation drawing or consult factory for actual speed.

NOTE 2: Cu. cont. based on box of parts shipped between bottom and center deck and includes optional electric motor.

VALU-KING SCREENS

The Telsmith Valu-King line-up of screens is exceptionally well suited for finished screening of aggregates. Built in sizes from 4'×8' to 6'×16' in single and double deck configurations, these screens can be fitted with spray nozzles for rinsing applications. For details, contact factory.

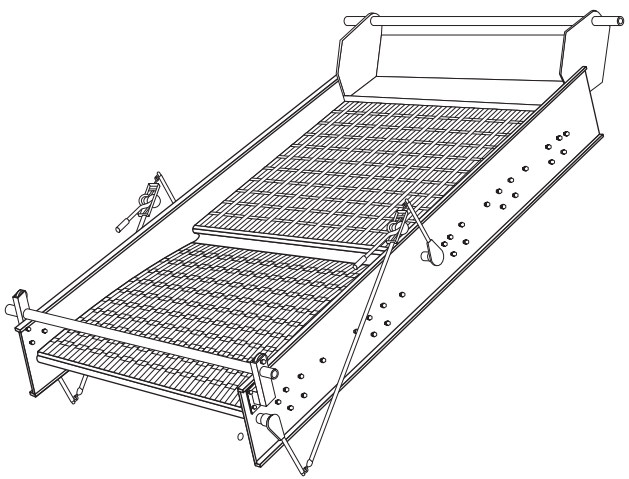


VALU-KING SCREEN SPECIFICATIONS

Screen Size Width × Length Ft. (mm)	No of Decks	Screen Pulley RPM	Size of Vib. Unit	HP of 1750 RPM Electric Motor	Dry Screen Net Wt. Lbs.	Cu. Cont. Ft.^{3} Approx.	Number of Spray Nozzles
4'×8' (1219×2438)	S D	815	18A	5	3,600 4,750	275	16
4'×12' (1219×3658)	S D	815	18A	5 7.5	5,400 6,000	415	16 32
4'×14' (1219×4267)	S D	815	18A	7.5 10	5,700 6,500	480	16 32
5'×12' (1524×3658)	S D	815	18A	10	5,950 7,000	500	20 40
5'×16' (1524×4877)	S D	815	18A 22A	15 20	7,150 8,500	665	30 60
6'×16' (1829×4877)	S D	815	18A 22A	20	8,500 9,500	975	32 64

P.E.P. SCREENS

Manufactured to utilize either amplitude or frequency vibrations, these screens can be used for scalping (Vari-Vibe Scalper – amplitude type), fines separation (Vari-Vibe II, III, IIIM – frequency type) or a combination of both (Duo-Vibe). They are available in several configurations utilizing components of 4'×8' to 6'×18'. The Vari-Vibe models are highly efficient in fines separation. For more information including application data, consult factory.

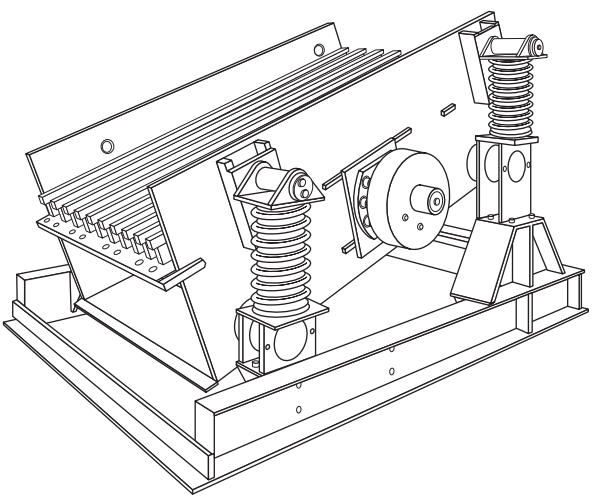


P.E.P. SCREEN SPECIFICATIONS

Model of Screen	Screen Size Width × Length Ft. (mm)	No of Decks	Screen Pulley RPM	HP of 1750 RPM Electric Motor
Vari-Vibe Scalper	5'×10' (1524×3048)	S	1200	5
Vari-Vibe II	6'×12' (1829×3658)	S	0-5000	15
Vari-Vibe III	6'×18' (1829×5486)	S	0-5000	20
Vari-Vibe IIIM	6'×18' (1829×5486) Top 6'×12' (1829×3658) Bot	D	0-5000	30
Duo-Vibe	5'×10' (1524×3048) Top 6'×12' (1829×3658) Bot	D	1200 0-5000	5 15
DD Vari-Vibe III	6'×18' (1829×5486)	D	0-5000	40
DD Vari-Vibe II	6'×12' (1829×3658)	D	0-5000	30
3-Deck Vari-Vibe	5'×10' (1524×3048) Top 6'×12' (1829×3658) Mid 6'×12' (1829×3658) Bot	T	1200 0-5000 0-5000	5 } 30

HEAVY DUTY VIBRATING GRIZZLY

The Heavy Duty Vibrating Grizzly is a two bearing inclined screen made from thick steel plates and beams and is expressly designed to remove excess fines ahead of primary crushers. Made in sizes 3'×5', 3'9"×7', 4'6"×8', 5'×10' and 6'×16' with single or double decks. For more information, consult factory.



VIBRATING GRIZZLY (Floor Mounted) SPECIFICATIONS

Screen Size Width × Length Ft. (mm)	No of Decks	Screen Pulley RPM	HP of 1750 RPM Electric Motor	Screen Net. Wt. Lbs. Approx.	Screen Export Gross Wt. Lbs. Approx.	Screen Net. Wt. Kilograms Approx.	Screen Export Gross Wt. Kilograms Approx.	Cubic Cont. Ft.^{3} Approx.
3'×5' (914×1524)	S D	955	5	3,550 4,600	3,750 4,800	1,610 2,085	1,700 2,175	190 225
3'9"×7' (1143×2134)	S D	955 850	7.5 10	4,400 6,900	4,600 7,150	2,000 3,130	2,085 3,245	235 250
4'6"×8' (1372×2438)	S D	850	10	5,900 8,500	6,150 8,750	2,680 3,860	2,790 3,970	310 320
5'×10' (1524×3048)	S D	820	20	11,600 12,950	11,850 13,200	5,260 5,875	5,375 5,990	560 700
6'×16' (1829×4877)	D	828	40	23,255	24,300	10,550	11,022	5000

The above weights do not include motor, drive, motor support or extras listed in published price schedules.

VIBRATING GRIZZLY (Pedestal Mounted) SPECIFICATIONS

Screen Size Width × Length Ft. (mm)	No of Decks	Screen Pulley RPM	HP of 1750 RPM Electric Motor	Screen Net. Wt. Lbs. Approx.	Screen Export Gross Wt. Lbs. Approx.	Screen Net. Wt. Kilograms Approx.	Screen Export Gross Wt. Kilograms Approx.	Cubic Cont. Ft.^{3} Approx.
3'×5' (914×1524)	S D	955	5	3,050 3,500	3,250 3,700	1,358 1,590	1,475 1,675	70 100
3'9"×7' (1143×2134)	S D	955 850	7.5 10	3,800 6,300	4,000 6,550	1,725 2,850	1,815 2,970	125 150
4'6"×8' (1372×2438)	S D	850	10	5,200 7,800	5,450 8,050	2,360 3,540	2,470 3,650	175 200
5'×10' (1524×3048)	S D	820	20	10,800 12,150	11,050 12,400	4,900 5,510	5,005 5,620	325 400
6'×16' (1829×4877)	D	828	40	20,500	20,700	9,300	9,380	960

The above weights do not include motor, drive, motor support or extras listed in published price schedules.

SPECIFICATIONS — CAPACITIES — TELSMITH ROTARY SCREENS

	Standard Rotary Screen								Hercules Rotary Screen					
Dia. Inches	32		40		48		60		48		60		72	
Type	Dry	Washing	Dry	Washing	Dry	Washing	Dry	Washing	Dry	Washing	Dry	Washing	Dry	Washing
Basic length, or standard length main cylinder, feet	6	12 1/2	6	14	6	16 1/2	6	19	6	16 1/2	6	19	6	22
Maximum length permissible, feet	18	16	20	18	24	20	24	22	22	20 1/2	24	22	26	25
Weight of basic or standard length, lbs., approx.	2,070	3,600	3,300	5,700	6,150	9,800	9,700	15,500	10,900	16,500	15,300	25,000	19,000	38,000
Additional weight per foot, lbs., approx.	115	115	175	175	225	225	350	350	375	375	550	550	750	750
Washing Screen Standard length, scrubbing section feet	–	6 1/2	–	7	–	8 1/2	–	10	–	8 1/2	–	10	–	12
Standard length of first jacket, feet	–	5	–	6	–	6	–	7	–	6	–	7	–	9
Standard length of second jacket, feet	–	4	–	4	–	4	–	5	–	4	–	5	–	5
Number of products, including sand and oversize, standard length washer	–	4	–	4	–	4	–	4	–	4	–	4	–	4
Water required, gallons per minute, approx.	–	350	–	700	–	1,200	–	2,000	–	1,200	–	2,000	–	2,800
Capacity per hour, cubic yards (Note 1)	–	20-25	–	40-50	–	70-85	–	160-190	–	70-85	–	120-140	–	175-200
Inside diameter, sand or dust jacket, inches	45	45	55	55	65	65	78	78	69	69	84	84	99 1/2	99 1/2
Weight of sand or dust jacket, per foot, lbs., approx.	55	55	70	70	80	80	100	100	110	–	135	–	160	–
Thickness of material in main cylinder, inches	3/16	3/16	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8	1/2	1/2
Speed of cylinder, RPM	16	16	14 1/2	14 1/2	12 1/4	12 1/4	10	10	12 1/4	–	10	–	8	–
Speed of countershaft, RPM	57	57	52	52	50	50	40	40	50	50	40	40	33	33
Size of drive sheave diameter × face, inches	30×6	30×6	36×8	36×8	42×10	42×10	48×12	48×12	42×10	42×10	48×12	48×12	60×12	60×12
Horsepower required	4-6	4-6	7-10	7-10	10-14	12-15	15-20	20-25	7-10	7-10	10-15	15-20	15-22	20-25
Pitch recommended, inches per foot of length	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4

Chute or flume angle from wash box to washing screen (with water) – 7°. Chute or flume angle from washing screen to sand classifiers – 10° to 15°.

NOTE 1: Capacity ratings of washing screens based on aggregate containing 50% sand and 50% gravel. Consult factory for capacity of dry screens.

NOTE 2: Effective screening area = 1/3 Dia. Scr. Length.

NOTE 3: Not in current production. Use for reference material.

WASHING EQUIPMENT

Washing Equipment, as outlined on the following pages, consists of information not only of the equipment itself, but also includes the data pertaining to pipes, capacities, water friction, etc., which is needed in putting the washing equipment into use.

TO FIND THE HORSEPOWER REQUIRED FOR PUMPING WATER

$$\text{Required HP} = \frac{\text{Gals. per min.} \times \text{wt. of one gal. water} \times \text{total head in feet}}{33{,}000 \times \text{mechanical efficiency of pump}}$$

A number of factors involved in this formula will be constant for all problems.

Weight of 1 gal. of water is 8.33 pounds.

Total head in feet = suction lift + discharge head + friction head 33,000 foot lbs. per min. = 1 HP

The mechanical efficiency of reciprocating pumps can be safely estimated at 50% to 75%; that of centrifugal pumps at 40% to 60%.

Example: It is desired to pump 80 GPM through 4 miles of $2^1/_2$" pipe against an elevation of 90' with suction lift to 10'

(From Table) Friction for 80 GPM through 100' of $2^1/_2$" pipe is 4.66'.

4 miles × 5280 = 21,120' of $2^1/_2$" pipe.

$\frac{21{,}120}{100} = 211.2 \times 4.66 = 984'$ friction loss

984 + 90 + 10 = 1,084 total head in feet.

Substituting known factors in the formula given, we have:

$$\text{HP} = \frac{80 \times 8.33 \times 1{,}084}{33{,}000 \times .70} = 31.4$$

Lbs./In^2	Feet Head	Lbs./In^2	Feet Head	Lbs./In^2	Feet Head	Lbs./In^2	Feet Head	Lbs./In^2	Feet Head	Lbs./In^2	Feet Head
1	2.31	8	18.47	40	92.36	110	253.98	170	392.52	300	692.69
2	4.62	9	20.78	50	115.45	120	277.07	180	415.61	325	750.41
3	6.93	10	23.09	60	138.54	125	288.62	190	438.90	350	808.13
4	9.24	15	34.63	70	161.63	130	300.16	200	461.78	375	865.89
5	11.54	20	46.18	80	184.72	140	323.25	225	519.51	400	922.58
6	13.85	25	57.72	90	207.81	150	346.34	250	577.24	500	1154.48
7	16.16	30	69.27	100	230.90	160	369.43	275	643.03	1000	2308.00

FRICTION OF WATER IN PIPES

Loss of Head per 100 Feet in Wrought Iron or Steel Pipes of Various Sizes.

1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		5"	
GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet
3	0.772	4	0.342	10	0.829	14	0.453	40	1.28	100	2.39	100	0.624	180	0.606
4	1.295	5	0.508	14	1.53	20	0.868	50	1.94	120	3.37	120	0.877	220	0.879
5	1.93	10	1.77	20	2.94	24	1.20	60	2.72	140	4.51	150	1.32	240	1.035
10	6.86	14	3.28	24	4.14	30	1.82	70	3.63	160	5.81	170	1.67	300	1.58
14	12.8	20	6.34	30	6.26	40	3.10	80	4.66	180	7.28	200	2.27	340	2.00
20	25.1	24	8.92	34	7.92	50	4.67	90	5.82	200	8.90	220	2.72	400	2.72
24	35.6	30	13.6	40	10.79	60	6.59	100	7.11	220	10.7	240	3.21	440	3.26
30	54.6	34	17.2	44	12.9	70	8.86	110	8.51	240	12.6	280	4.30	500	4.16
34	69.4	40	23.5	50	16.4	80	11.4	120	10.00	280	16.9	300	4.89	550	4.98
40	95.0	44	28.2	60	23.2	90	14.2	140	13.5	300	19.2	320	5.51	600	5.88
		50	36.0	70	31.3	100	17.4	160	17.4	320	20.0	340	6.19	650	6.87
		60	51.0	80	40.5	110	20.9	180	21.9	340	24.8	400	8.47	700	7.93
		70	68.8	90	51.0	120	24.7	200	26.7	380	30.7	440	10.2	800	10.22
				100	62.2	140	33.2	220	32.2	400	33.9	500	13.0	900	12.9

FRICTION OF WATER IN PIPES (Cont.)

6"		8"		10"		12"		14"		16"		18"		20"	
GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet	GPM	Feet
200	0.299	600	0.597	1,000	0.500	1,000	0.210	1,000	0.131	1,800	0.203	2,000	0.139	3,500	0.232
300	0.637	700	0.797	1,200	0.703	1,200	0.296	1,200	0.185	2,000	0.248	2,500	0.211	4,000	0.298
400	1.09	800	1.02	1,400	0.940	1,400	0.395	1,500	0.281	2,500	0.377	3,000	0.297	4,500	0.372
500	1.66	900	1.27	1,600	1.21	1,600	0.509	1,700	0.355	3,000	0.535	3,500	0.397	5,000	0.455
600	2.34	1,000	1.56	1,800	1.52	1,800	0.636	2,000	0.483	3,500	0.718	4,000	0.511	5,500	–
700	3.13	1,200	2.20	2,000	1.86	2,000	0.776	2,500	0.738	3,600	–	4,500	0.639	6,000	0.645
800	4.03	1,400	2.95	2,200	2.23	2,200	0.930	3,000	1.04	4,000	0.921	5,000	0.781	6,500	–
900	5.05	1,500	3.37	2,400	2.64	2,400	1.093	3,500	1.40	4,500	1.15	5,500	–	7,000	0.862
1000	6.17	1,600	3.82	2,600	3.08	3,000	1.68	4,000	1.81	5,000	1.41	6,000	1.11	7,500	–
1,100	7.41	1,800	4.79	2,800	3.56	3,200	1.90	4,500	2.27	5,200	–	6,500	–	8,000	1.11
1,200	8.76	2,000	5.86	3,000	4.06	3,400	2.13	5,000	2.78	5,600	–	7,000	1.49	8,500	–
1,300	10.2	2,200	7.02	3,200	4.59	3,600	2.37	5,500	–	6,000	2.01	8,000	1.93	9,000	1.39
1,400	11.8	2,400	8.31	3,400	5.16	4,000	2.92	6,000	3.95	7,000	2.69	9,000	2.42	10,000	1.70
1,500	13.5	2,600	9.70	3,600	5.76	4,500	3.65	7,000	5.32	8,000	3.49	10,000	2.97	11,000	2.05
						5,000	4.47	8,000	6.90	9,000	4.38	12,000	4.21	12,000	2.44
						6,000	6.39	9,000	8.70	10,000	5.38	14,000	5.69	14,000	3.29

FRICTION OF WATER IN 90° ELBOWS

Equivalent Number of Feet Straight Pipe

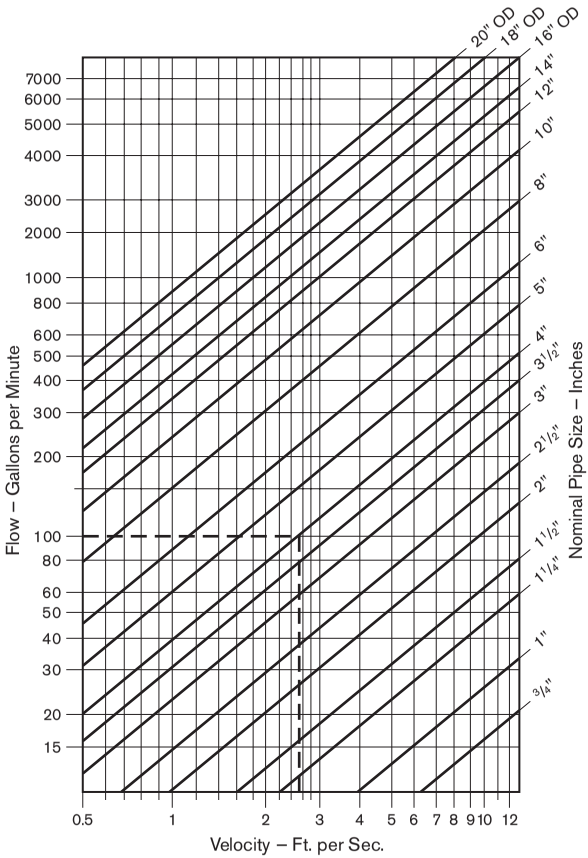
Size of Elbow, inches	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20
Friction Equivalent Feet Straight Pipe	6	8	8	8	11	15	16	18	18	24	30	40	54	55	65	70

EQUALIZATION OF PIPES

Actual Internal Dia.	0.364	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548	4.026	5.047	6.065	7.981	9.635	11.594
Schedule 40 pipe size.	1/4	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12
1/4	1															
1/2	3.8	1														
3/4	8	2	1													
1	14	3.7	1.8	1												
1 1/4	28	7	3.6	2	1											
1 1/2	41	11	5.3	2.9	1.5	1										
2	77	20	10	5.5	2.7	1.9	1									
2 1/2	120	31	16	8	4.3	2.9	1.6	1								
3	206	54	27	15	7	5	2.7	1.7	1							
3 1/2	297	78	38	21	11	7	3.9	2.5	1.4	1						
4	407	107	53	29	15	10	5.3	3.4	2.0	1.4	1					
5	716	188	93	51	26	17	9	6	3.5	2.4	1.8	1				
6	1133	297	147	80	40	28	15	9	5.5	3.8	2.8	1.6	1			
8	2251	590	292	160	80	55	29	19	10.9	7.6	5.5	3.1	2.0	1		
10	3976	1042	516	282	142	97	52	33	19	13	10	5.6	3.5	1.8	1	
12	6240	1635	809	443	223	152	81	52	30	21	15	8.7	5.5	2.8	1.4	1

Numerals shown in body of table represent the number of small pipes having a discharge capacity equivalent to one large pipe of a given diameter.

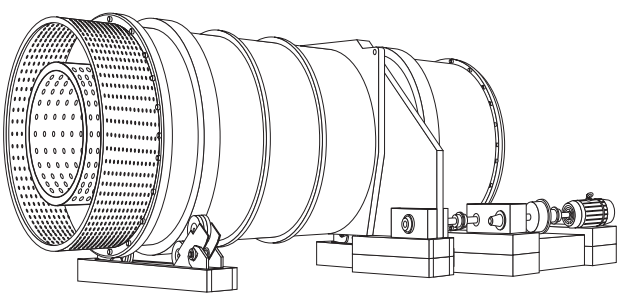
FLOW VELOCITY FOR STANDARD-WEIGHT PIPE



Fluid velocity in ft. per sec. for any flow in gal. per min. is found directly from chart. For example, 100 gal. per min. flowing in standard-weight 4 in. pipe has a velocity of 2.55 ft. per sec.

SUPER-SCRUBBERS

Designed to clean ore, stone, gravel and sand, Telsmith Super-Scrubbers make dirty pits useable and will also upgrade some deposits by removing soft stone by attrition crushing in the milling and cascading action of the material and water. Telsmith Super-Scrubbers are made in four sizes. They are self-aligning, steel trunnion supported on flanged railroad type bearings and driven by a saddle drive chain. They are built in 96" and 120" diameters in 14'-0", 17'-6" and 24'-6" lengths. The 120" is also built in a 32'-6" length for additional milling action. Capacities are 120 to 1,000 TPH. For a full description and illustrations, refer to Bulletin T-800.



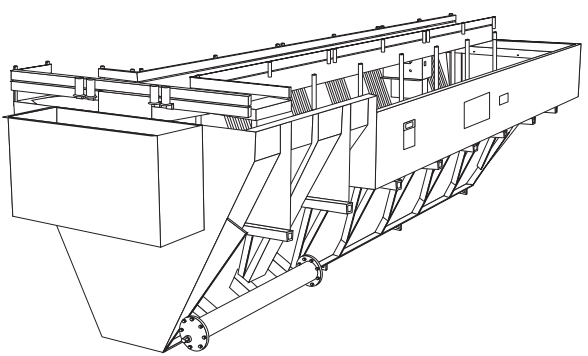
SPECIFICATIONS – CAPACITIES – TELSMITH SUPER-SCRUBBERS

Size		120×32'6"	120×24"6"	120×17'6"	96×14'0"
Capacity, TPH		600 – 1,000	225 – 750	225 – 750	120 – 410
Drum	…outer diameter	120"	120"	120"	96"
	…thickness	1"	3/4"	3/4"	5/8"
Liner	…thickness	3/4"	5/8"	5/8"	5/8"
	…quantity	180	140	100	64
Outer trommel	…outer diameter	120"	120"	120"	96"
	…length	72"	55"	55"	43"
Power required	…electric	500 HP	250 HP	200 HP	100 HP
Approximate total weight, lbs.	…less drive	170,000	135,000	101,550	58,600
	…with drive	195,000	151,700	110,600	64,600
	…material weight	66,500	51,600	36,900	18,500
	…full load weight	261,500	203,300	147,500	83,100
Water required, GPM		2000–4000	2000–4000	2000–4000	1000–2000

NOTE: Approximate washing capacities based on 1 minute to 3.5 minutes retention time.
Maximum lump for feed: 120" = 12"; 96" = 8".

DEWATERING & CLASSIFYING TANKS

Used to recover sand from large volumes of water through settling, these units are indispensible in aggregate washing operations. Telsmith Dewatering and Classifying Tanks are built in 8' widths for average water flows in 20' to 32' lengths, 10' widths for greater capacity and water volumes in 24' to 40' lengths, and 12' × 48' size for maximum capacity; these tanks are designed to separate the sand into various particle sizes through the use of multiple discharge valves and multi-compartment flumes. Accurate specification sands can be produced using these tanks. For full description and illustrations, refer to Bulletin T-800.



SPECIFICATIONS – DEWATERING AND CLASSIFYING TANKS

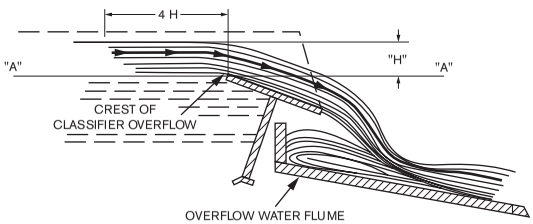
Size of Tank	8' Width (Standard)				10' Width (Wide)					12'
Length, feet (NOTE 1): Single	20	24	28	32	24	28	32	36	40	48
Dead load, lbs., approx. (NOTE 1)	9,600	11,800	14,000	16,300	16,000	18,000	21,000	24,000	27,000	39,000
Live load, lbs., approx. (NOTE 1)	61,000	73,000	86,800	99,600	125,000	145,000	160,000	180,000	200,000	270,000
Water capacity, GPM – Recovering:										
+ 100 Mesh sand (NOTE 2)	2,300	2,800	3,200	3,500	3,500	4,100	4,700	5,300	5,900	8,100
+ 150 Mesh sand (NOTE 2)	1,200	1,400	1,600	1,800	1,800	2,100	2,400	2,700	3,000	4,200
+ 200 Mesh sand (NOTE 2)	700	800	900	950	950	1,100	1,250	1,400	1,550	2,150
Number of discharge stations	6	7	8	9	7	8	9	10	11	11

NOTE 1: Appoximate weights include three product flume, rising current cells and manifold, discharge down pipes and handrails around tank bridge. Approximate weights do not include support structure, access (stairs or ladder) and recirculating pump.

NOTE 2: This means recovering sand with a gradation consisting of fairly uniform amounts of the various intermediate sizes between the top size and 100, 150 or 200 Mesh size. The amount of sand recovered in the finer mesh sizes will vary according to the gradation and uniformity of the sand and the amount of water being handled. Results may vary considerably according to local conditions.

NOTE 3: Double tanks are available and consist of two tanks mounted in tandem. Capacities are double that of single tanks. For weights of double tanks with the support structure consult factory.

TABLE TO DETERMINE OVERFLOW IN GALLONS PER MINUTE from Sand Classifiers and Sand Tanks

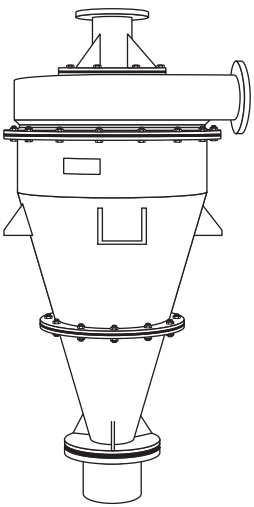


Depth of Overflow "H"	Gallons Per Minute Over Weir 1 Ft. Wide
3/8"	8
1/2"	13
5/8"	18
3/4"	23
7/8"	29
1"	36
1 1/8"	43
1 1/4"	50
1 3/8"	58
1 1/2"	66
1 5/8"	74
1 3/4"	82
1 7/8"	91
2"	100
2 1/8"	110
2 1/4"	120
2 3/8"	130
2 1/2"	140
2 5/8"	150
2 3/4"	160
2 7/8"	170
3"	180

To determine the GPM of water in the overflow of a sand classifier or sand tank, take measurement "H" in inches at a point several inches back from the crest. For example, if the water is about 2" deep at the crest, take a measurement about 6" to 8" back from the crest and from the surface of the water down to the horizontal line "A-A" securing depth of overflow "H". Using table, determining GPM for weir 1 ft. wide and multiply this by width of overflow in feet.

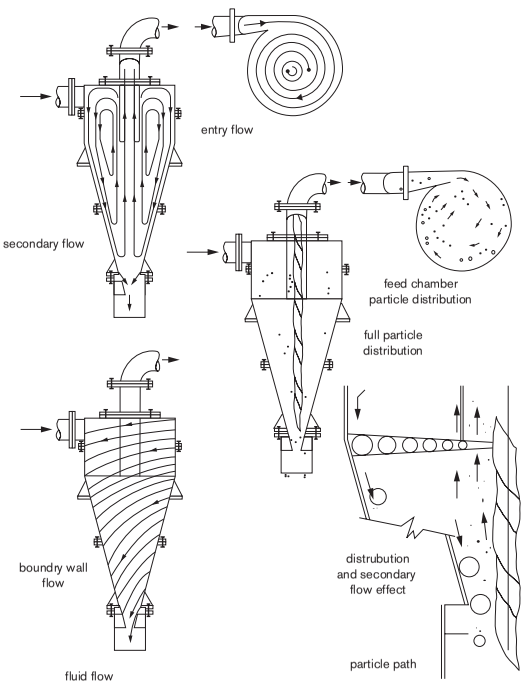
CYCLONE CLASSIFIERS

These fine sand reclaiming units have no moving parts. They operate on the principle of centrifugal force. This force, introduced by the slurry in-flow separates the coarser fractions from the non-desired fines. They normally separate at the 150 mesh size range. In operations where minus 30 mesh sand is in short supply they can significantly increase plant capacity of specification materials. For a full description, refer to Bulletin T-800.



SAND RECOVERY WITH THE TELSMITH CYCLONE

The Telsmith Cyclone recovers fine sand in the 30-200 mesh size range to increase sand recovery capacity and restores those fine sizes needed to meet present day sand specifications. This premium sand, formerly discharged into water settling basins where frequent removal is necessary, becomes a source of income rather than an expense.



FAST PARTICLE AND FLUID DISTRIBUTION

A three-way flow speeds particle separation. Powerful entry flow sets up secondary flows in the feed and cone sections to move waste upward through the vortex and out the top overflow. The boundary wall flow, through centrifugal force releases recovery sand through bottom discharge valve.

WATER CAPACITY — 24" TELSMITH CYCLONE — ST & RL

Operating Head		Expected Max. Flows w/5" Vortex Finder		Expected Max. Flows w/8" Vortex Finder		Expected Max. Flows w/10" Vortex Finder	
(NOTE 2)	(NOTE 3)	(NOTE 4)		(NOTE 4)		(NOTE 4)	
ft.	psi	gpm	pump	gpm	pump	gpm	pump
50	22	850	NOTE 5	1200	NOTE 5	1450	NOTE 5
Apex Valves (NOTE 6)		$1^1/_2$" to 3" Diameter		2" to 3" Diameter		2" to 4" Diameter	

SPECIFICATIONS:

NOTE 1. If the water overflowing from your sand classifier is insufficient to supply a pump of the gpm shown, part of overflow from the Telsmith cyclone may be recirculated thru the pump and cyclone to give proper operation. The proper design of a sump ahead of the pump is important and the data to build a sump will be furnished upon request. Data in table is based on making classification at about 200 mesh, the generally accepted dividing line between silt and sand.

NOTE 2. The operating head is the pressure drop through the cyclone. To this you must add the vertical head (distance in feet from the surface of the water in the sump to the centerline of the cyclone) and the estimated head loss in feet due to friction in the pipe and fittings. Use the total head (operating head plus vertical head plus friction head) for selecting the proper pump. See note 5.

NOTE 3. PSI is pounds per square inch of pressure required at feed inlet of the Telsmith cyclone to give proper operation. Best pressure for the 24" Cyclone is about 20-30 psi. Higher pressures will recover more of the finer sand but may also recover some of the coarser silt.

NOTE 4. The gpm is the maximum gallons per minute which the 24" Cyclone will handle under ordinary conditions, and with the size of Vortex Finder shown. The 24" Telsmith Cyclone works best handling pulps running 15% solids or less with a minimum of about 750-800 gpm using a 5" Vortex Finder and the smaller Apex Valves. For larger water capacities handling large percentages of clay or higher percentages of solids, the larger Vortex Finder and larger Apex Valves may be necessary.

NOTE 5. Details of piping and installation plus flow rate, total head, percent of solids in pulp and specific gravity of solids should be referred to a pump manufacturer for the proper selection of pump size, speed and horsepower. The pump should be capable of handling a mixture of water and abrasive sand and one which will give the gpm and psi shown. A V-belt driven pump is recommended so the pump speed can be changed.

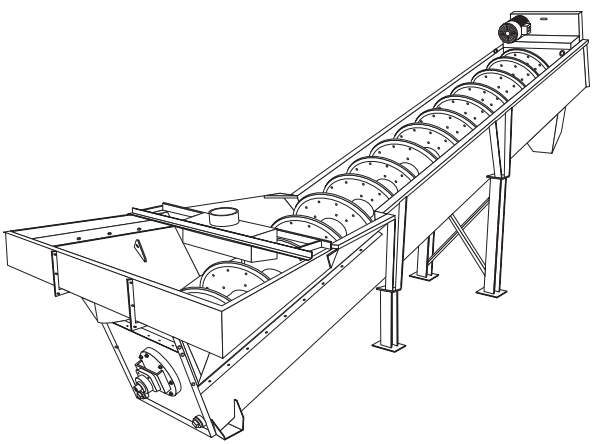
NOTE 6. This the size of Apex Valve recommended for the size of Vortex Finder indicated.

NOTE 7. Approximate weight 925 pounds.

NOTE 8. Discharge consistency approximately 70% solids and 30% water.

FINE MATERIAL WASHERS

Fine Material Washers are used to separate water and silt from sand while dewatering the sand. Sand discharged from a Fine Material Washer is dry enough to carry on a belt conveyor to storage. These units are built in single and twin screw units with a large settling area for best salvage of fine sands. Available in spiral diameters of 24" to 66" and spiral lengths of 25'-0" to 35'-0". For more information, see Bulletin ATP K-Sand-01.



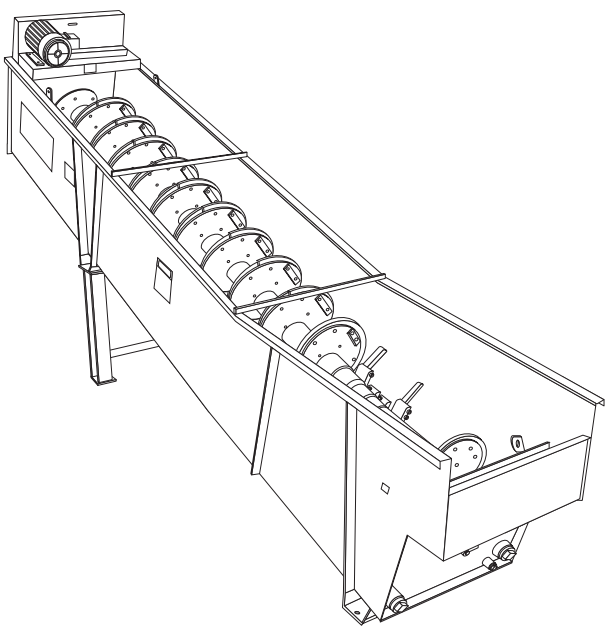
CAPACITY – FINE MATERIAL WASHERS

Size	SINGLE SCREW							TWIN SCREW			
	Capacity TPH*	Peripheral Speed FPM*	Spiral RPM	HP	Overflow Capacities – GPM			Capacity TPH*	Overflow Capacities – GPM		
					100 Mesh	150 Mesh	200 Mesh		100 Mesh	150 Mesh	200 Mesh
No. 24 25'-0" length	50 37 25 12	200 150 100 50	32 24 16 8	7 1/2 5 5 3	500	225	125	Twin Screw Units are not built in No. 24 & 30. Peripheral speeds and spiral RPM same as single units. Motor HP same as single units but 2 motors req'd.			
No. 30 25'-0" length	75 55 38 18	200 150 100 50	25 19 13 7	10 10 7 1/2 5	550	275	150				
No. 36 25'-0" length	100 75 50 25	200 150 100 50	21 15 12 6	15 10 7 1/2 5	700	325	175	200 150 100 50	1,200	600	300
No. 44 32'-0" length	175 130 85 45	200 150 100 50	17 13 9 5	20 15 10 7 1/2	1,500	750	400	350 260 170 90	2,700	1,300	750
No. 48 32'-0" length	200 150 100 50	200 150 100 50	16 12 8 4	20 15 10 7 1/2	1,650	825	450	400 300 200 100	2,900	1,450	825
No. 54 34'-0" length	250 185 125 60	200 150 100 50	14 11 7 4	30 25 15 10	1,800	900	525	500 370 250 120	3,200	1,600	900
No. 60 35'-0" length	325 250 165 85	200 150 100 50	13 9 5 3	30 25 20 15	2,200	1,000	550	650 500 330 170	3,600	1,800	950
No. 66 35'-0" length	400 300 200 100	200 150 100 50	11 8 5 3	40 30 25 15	2,400	1,100	625	800 600 400 200	4,000	2,000	1,000

* Capacities shown are based on peripheral speed listed. Selection of peripheral speed is determined by a screen analysis of the product.

COARSE MATERIAL WASHERS

Coarse Material Washers are used to wash coarse sand or crushed stone and gravel with a maximum size of $2^1/_2$" and to dewater the cleaned material sufficiently so it can be conveyed to storage. They are also used, in some installations to assist with the removal of lignite, mica, bark, leaves and trash. They are manufactured in single and double spiral configurations with spiral diameters of 24" to 48" and tank lengths of 15'-0" to 23'-3". For more information, see Bulletin ATP K-Sand-01.

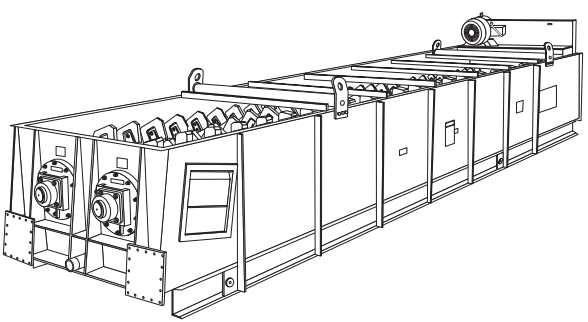


SPECIFICATIONS – CAPACITIES – COARSE MATERIAL WASHERS

Spiral Diameter	Tank Length	Spiral RPM	Single Spiral			Twin Spiral		
			HP	Wt. – lbs.	Capacity – TPH	HP	Wt. – lbs.	Capacity – TPH
24"	15'-0"	40	15	6,200	60–75	Twin Spiral Model Not Available in 24"		
36"	19'-3"	30	25	10,400	150–175	2–25	18,000	300–350
48"	23'-3"	22	40	15,600	200–250	2–40	27,920	400–500

LOG WASHERS

Log washers consist of a variably inclined tub with two counter-rotating “logs”. Each log has four (4) rows of paddles which overlap (log-to-log) to create the scrubbing action required. The primary purpose of the log washer is to remove tough, plastic soluble clays from natural and crushed gravel, crushed stone and ore feeds. It will also remove coatings from individual particles, break up agglomerations, and reduce some soft fractions by a mild form of differential grinding. Log washers are available in sizes of 24", 36" and 48" diameter sizes. For more information, see Bulletin ATP K-Sand-01.



LOG WASHER CAPACITIES & SPECIFICATIONS

Size	24'×18'	36'×30'	48'×30'	48'×35'
Dead Load Lbs. approx.	12,500	34,000	47,500	53,000
Live Load Lbs. approx.	20,500	75,000	90,000	95,500
Motor HP	40	100	150	200
Shaft Speed RPM	45	33	28	28
Capacity Range TPH	25–60	85–125	125–225	125–225
Feed Size Max. Typ + $^{3}/_{8}$"	3"	4"	5"	5"
Water Requirements GPM	25–250	50–500	100–800	100–800

BELT CONVEYORS

Belt Conveyors are available in a complete range of types and sizes to suit every material handling requirement. Standard and specially engineered units and various combinations of both, permit engineers to select the system best suited to a particular job from the industries broad selection of conveyor components and accessories.

Every component is backed by more than a half century of experience in the design and manufacture of materials handling equipment.

By purchasing both materials handling and processing equipment from the same manufacturer, the buyer is assured of greatest efficiency and economy from single-source responsibility for design, manufacture, erection and proper operation of the entire plant. The resulting balanced design eliminates bottlenecks and assures peak capacity and efficiency from every unit in the system.

BELT CONVEYOR TONNAGE CHART

To determine the tonnage being handled on an existing belt conveyor it is necessary to know the belt speed, which can be determined from the table on page 145. After the belt speed is known, a certain amount of material must be removed from the belt and weighed. Each ton of capacity is represented by one pound of material on the belt. See table for length of material on belt to be weighed.

Belt Speed – Ft. Per. Min.	200	225	250	275	300	325	350	375	400	425	450	475	500
Length of Material To Be Weighed	6'-0"	6'-9"	7'-6"	8'-3"	9'-0"	9'-9"	10'-6"	11'-3"	12'-0"	12'-9"	13'-6"	14'-3"	15'-0"

EXAMPLE: Belt speed is known to be 300 FPM. Referring to table, we find the length of material on the belt to be weighed is 9'-0". Mark off 9'-0" on the belt, remove all material between marks and weigh. Assuming this weight to be 300 lbs. the conveyor is delivering 300 TPH.

NOTE: To check length of material to be weighed for belt speeds not given in the table, multiply the belt speed in FPM by .03. The result will be in feet. 230 FPM × .03 = 6.90' = 6'-10$^{3}/_{4}$"

LENGTH OF BELT REQUIRED FOR A BELT CONVEYOR

Length of Belt Required = 2 × Centers + Extra Lengths Given Below											
HEAD END DRIVE							PLAIN HEAD END – FIXED TAIL END				
		Screw Take-up	Horizontal Gravity Take-up	Vertical Gravity Take-up			Intermediate Wrap Drive				
Diameter Head Pulley	Diameter Tail Pulley	Extra Belt Length	Extra Belt Length	Diameter Take-up Pulley	Diameter Bend Pulleys	Extra Belt Length	Diameter Head Pulley	Diameter Drive Pulley	Diameter Snub Pulley	Diameter Tail Pulley	Extra Belt Length
20"	14"	6'	7'	20"	14"	14'	20"	20"	14"	14"	15'
20"	20"	7'	8'	20"	14"	15'	24"	24"	14"	14"	16'
24"	14"	6'	7'	20"	14"	15'	24"	24"	14"	20"	17'
24"	20"	7'	8'	20"	14"	16'	30"	30"	18"	24"	20'
24"	24"	8'	8'	24"	20"	17'	Diameter of Belt Roll				
30"	20"	9'	9'	20"	16"	17'					
30"	24"	9'	10'	24"	16"	18'					
Belt Thickness = No. Plys × Duck Thickness + Thickness of Top and Bottom Covers											
Duck	Thickness	Duck	Thickness	Example: 4 ply, 42 oz. with $^1/_8$" + $^1/_{32}$" covers 4×.063+.125+.0312=.4082" or $^{13}/_{32}$" thick							
28 oz.	.052	36 oz.	.060								
32 oz.	.058	42 oz.	.063								

$$D = \sqrt{15LT + 2} \quad L = \frac{(D-2)^2}{15T} \text{ or } \frac{D^2 - d^2}{15.3T}$$

D = roll outside dia. in inches.
L = Length of belt in feet.
T = Belt thickness in inches.
d = Spool dia. in inches.

CONVEYOR BELT SPEEDS – PULLEY REVOLUTIONS PER MINUTE

Dia. of Pulley	Pulley Circum-ference	BELT SPEEDS IN FEET PER MINUTE								
		100	150	200	250	300	350	400	450	500
		PULLEY REVOLUTIONS PER MINUTE								
12"	3.14'	31.8	47.7	63.7	79.6	95.6				
14"	3.67'	27.2	40.8	54.5	68.2	81.7				
16"	4.18'	23.9	35.8	47.8	59.8	71.8				
18"	4.72'	21.2	31.8	42.4	53.0	63.6	74.2			
20"	5.24'	19.1	28.6	38.2	47.7	57.2	66.8	76.4		
24"	6.28'	16.0	23.9	31.9	39.8	47.8	55.7	63.7	71.7	79.7
26"	6.80'	14.7	22.0	29.4	36.7	44.2	51.5	58.8	66.2	73.5
28"	7.32'	13.7	20.5	27.3	34.2	41.0	47.8	54.7	61.5	68.3
30"	7.85'	12.7	19.1	25.5	31.8	38.2	44.6	51.0	57.3	63.7
32"	8.37'	11.9	17.9	23.9	29.8	35.8	41.8	47.7	53.7	59.7
36"	9.42'	10.6	15.9	21.2	26.5	31.8	37.2	42.5	47.8	53.0
40"	10.47'		14.3	19.1	23.9	28.6	33.4	38.2	43.0	47.7
42"	11.00'		13.6	18.2	22.7	27.3	31.8	36.4	40.8	45.4
44"	11.50'		13.0	17.4	21.7	26.1	30.4	34.8	39.1	43.5
48"	12.56'		12.0	15.9	19.9	23.9	27.8	31.9	35.8	39.8
52"	13.60'			14.7	18.4	22.0	25.7	29.4	33.1	36.8
54"	14.15'			14.1	17.6	21.2	24.7	28.3	31.8	35.3
60"	15.70'			12.7	15.9	19.1	22.3	25.4	28.6	31.8

To determine belt speed in feet per minute when pulley diameter and RPM are known, multiply pulley diameter in inches × RPM × .262.

Example: Determine conveyor belt speed when a 24" diameter pulley turns at 50 RPM. 24"×50×.262=314 FPM

NOTE: .262 is a constant derived from $\frac{\pi}{12} = \frac{3.1416}{12} = .262$

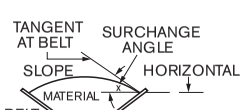
MAXIMUM BELT CAPACITIES

Belt Width	Trough Angle in Degrees	MAXIMUM BELT CAPACITY IN TPH[1]					Maximum Material Size	
		Surcharge Angle[2]					Uniform Size	Mixed With 50% Fines[3]
		5°	10°	20°	25°	30°		
18"	20°	–	–	50	56	63	4"	4"
	35°	Not recommended						
	45°	Not recommended						
24"	20°	–	–	96	108	120	5"	7"
	35°	–	102	122	132	142	2 1/2"	3 1/2"
	45°	106	115	132	140	170	2 1/2"	3 1/2"
30"	20°	–	–	157	175	195	6"	10"
	35°	–	167	200	215	232	3"	5"
	45°	175	187	215	230	244	3"	5"
36"	20°	–	–	230	260	290	7"	12"
	35°	–	248	295	318	343	3 1/2"	6"
	45°	258	278	318	340	360	3 1/2"	6"
42"	20°	–	–	320	360	400	8"	14"
	35°	–	344	408	442	475	4"	7"
	45°	358	386	440	470	500	4"	7"
48"	20°	–	–	430	480	530	10"	16"
	35°	–	457	540	645	630	5"	8"
	45°	475	510	584	623	660	5"	8"
54"	20°	–	–	547	612	678	11"	18"
	35°	–	585	693	750	806	5 1/2"	9"
	45°	608	655	748	797	845	5 1/2"	9"
60"	20°	–	–	680	762	844	12"	20"
	35°	–	730	863	933	1000	6"	10"
	45°	758	815	930	992	1050	6"	10"

[1] All capacities shown are for material weighing 100 lbs. per ft.^{3} and moving on belt at 100 fpm. For other weights, capacity equals table capacity $\times \frac{\text{wt./ft.}^3}{100}$

For other belt speeds, capacity equals table capacity (or calculated capacity) $\times \frac{\text{fpm}}{100}$

[2] The surcharge angle is the angle formed between a horizontal line and a line tangent to the material's slope, both of which lines pass through the point where the slope meets the belt. Usually the surcharge angle is 10°-15° less than the angle of repose. See sketch at right.



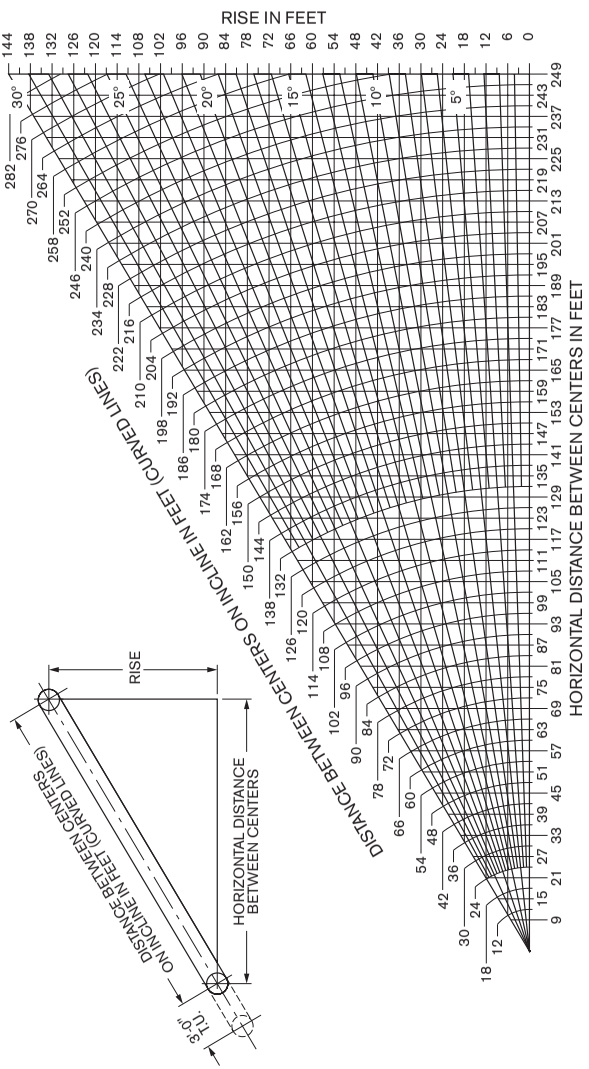
[3] "Mixed with 50% fines" means at least half of the material must be less than one-half the maximum material size.

MAXIMUM RECOMMENDED BELT SPEEDS

MATERIAL			BELT SPEED IN FPM							
			Belt Width							
Characteristics		Example	18"	24"	30"	36"	42"	48"	54"	60"
Lumps Are Max. Size Recommended[1]	Non-Abrasive	Coal, Earth	350	400	450	500	550	600	600	600
	Semi-Abrasive	Gravel	300	350	400	450	500	550	550	550
	Highly Abrasive	Stone, Ore	250	300	350	400	450	500	500	500
Lumps Are 1/2 Max. Size Recommended[1]	Non-Abrasive	Coal, Earth	400	450	500	550	600	650	700	750
	Semi-Abrasive	Gravel	350	400	450	500	550	600	650	700
	Highly Abrasive	Stone, Ore	300	350	400	450	500	550	600	650
Granular 1/8"–1/2"		Sand, Grain, Wood Chips	400	500	600	700	800	900	900	900
Aerating Powders		Cement, Flue Dust	200-300							
Conveyors With Plow Discharge			200							

[1] See Table, page 146, “Maximum Material Size”

CHART OF INCLINED CONVEYORS



MEASURE OF ANGLES

Degrees	Rise in Inches per Foot (decimal)	Percent of Rise in Feet per 100 Feet Horizontal	Rise in Inches per Foot	Degrees and Minutes
1	.210	1.7455	1/4"	1°– 11'
2	.419	3.4924	1/2"	2°– 23'
3	.629	5.2407	3/4"	3°– 35'
4	.839	6.9926	1"	4°– 46'
5	1.050	8.7489	1 1/4"	5°– 56'
6	1.261	10.5100	1 1/2"	7°– 7'
7	1.473	12.278	1 3/4"	8°– 18'
8	1.686	14.054	2"	9°– 28'
9	1.901	15.838	2 1/4"	10°– 37'
10	2.116	17.633	2 1/2"	11°– 46'
11	2.333	19.438	2 3/4"	12°– 54'
12	2.551	21.256	3"	14°– 2'
13	2.770	23.087	3 1/4"	15°– 9'
14	2.992	24.933	3 1/2"	16°– 15'
15	3.215	26.795	3 3/4"	17°– 21'
16	3.441	28.675	4"	18°– 26'
17	3.669	30.573	4 1/4"	19°– 30'
18	3.900	32.492	4 1/2"	20°– 33'
19	4.132	34.433	4 3/4"	21°– 36'
20	4.368	36.397	5"	22°– 37'
21	4.606	38.386	5 1/4"	23°– 38'
22	4.848	40.403	5 1/2"	24°– 37'
23	5.094	42.448	5 3/4"	25°– 36'
24	5.343	44.523	6"	26°– 34'
25	5.596	46.631	6 1/4"	27°– 31'
26	5.853	48.773	6 1/2"	28°– 27'
27	6.114	50.953	6 3/4"	29°– 22'
28	6.381	53.171	7"	30°– 16'
29	6.652	55.431	7 1/4"	31°– 8'
30	6.928	57.735	7 1/2"	32°–
31	7.210	60.086	7 3/4"	32°– 51'
32	7.498	62.487	8"	33°– 41'
33	7.793	64.941	8 1/4"	34°– 30'
34	8.094	67.451	8 1/2"	35°– 19'
35	8.403	70.021	8 3/4"	36°– 5'

HORSEPOWER REQUIRED FOR BELT CONVEYORS

(With Anti-Friction Bearing Idlers)

TABLE NO. 1 — FACTOR (x)							TABLE NO. 2 — FACTOR (y)									
Horsepower Required at Headshaft for Empty Conveyor at 100 FPM Belt Speed							Horsepower Required at Headshaft to Move Load Horizontally Any Belt Speed – Any Material									
Belt Width						Conveyor Centers	Capacity – Tons Per Hour									
18"	24"	30"	36"	42"	48"		50	100	150	200	250	300	350	400	500	600
.44	.53	.62	.72	.82	.98	25'	.25	.50	.76	1.01	1.26	1.51	1.77	2.02	2.52	3.03
.47	.57	.67	.77	.89	1.06	50'	.28	.57	.85	1.14	1.42	1.70	1.99	2.27	2.84	3.41
.52	.63	.76	.87	1.02	1.21	100'	.35	.69	1.04	1.39	1.74	2.08	2.43	2.78	3.47	4.17
.57	.69	.85	.97	1.15	1.36	150'	.41	.82	1.23	1.64	2.05	2.46	2.87	3.28	4.10	4.92
.62	.76	.93	1.08	1.28	1.50	200'	.47	.95	1.42	1.89	2.37	2.84	3.31	3.79	4.73	5.68
.67	.82	1.02	1.18	1.41	1.65	250'	.54	1.07	1.61	2.15	2.68	3.22	3.75	4.29	5.36	6.44
.72	.89	1.11	1.29	1.54	1.80	300'	.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80	6.00	7.20
.77	.95	1.20	1.39	1.67	1.95	350'	.66	1.32	1.98	2.65	3.31	3.97	4.64	5.30	6.63	7.95
.82	1.02	1.28	1.50	1.80	2.10	400'	.72	1.45	2.17	2.90	3.63	4.35	5.08	5.81	7.26	8.71
.87	1.08	1.37	1.60	1.93	2.25	450'	.79	1.58	2.36	3.16	3.94	4.73	5.52	6.31	7.89	9.47
.92	1.15	1.46	1.71	2.06	2.40	500'	.85	1.70	2.55	3.41	4.26	5.11	5.96	6.82	8.52	10.23

HORSEPOWER REQUIRED FOR BELT CONVEYORS

(Horsepower at Headshaft to Lift Load Vertically — Any Belt Speed — Any Material)

TABLE NO. 3 — FACTOR (z)										
Rise or Vertical Lift	Capacity — Tons Per Hour									
	50	100	150	200	250	300	350	400	500	600
5'	.25	.51	.76	1.01	1.26	1.51	1.76	2.02	2.52	3.03
10'	.51	1.01	1.52	2.02	2.52	3.03	3.53	4.04	5.05	6.06
20'	1.01	2.02	3.03	4.04	5.05	6.06	7.07	8.08	10.10	12.12
30'	1.52	3.03	4.55	6.06	7.57	9.09	10.60	12.12	15.15	18.18
40'	2.02	4.04	6.06	8.08	10.10	12.12	14.14	16.16	20.20	24.24
50'	2.53	5.05	7.58	10.10	12.62	15.15	17.67	20.20	25.25	30.30
60'	3.03	6.06	9.09	12.12	15.15	18.18	21.21	24.24	30.30	36.36
70'	3.54	7.07	10.60	14.14	17.67	21.21	24.74	28.28	35.35	42.42
80'	4.04	8.08	12.12	16.16	20.20	24.24	28.28	32.32	40.40	48.48

THE TOTAL HP AT THE HEADSHAFT IS THE TOTAL OF FACTORS (x) + (y) + (z). Add 10% to total for friction loss.

NOTE: If factor (z) exceeds $^1/_2$ the sum of (x + y), backstop is necessary.

SELECTING IDLERS
NUMBER OF IDLERS REQUIRED

To determine the number of troughing idlers required for a conveyor, follow this formula: Divide the length of the conveyor (in feet) by the idler spacing (in feet – see Table below), and subtract one. Then add two idlers for each loading point. For tail-loading points, mount one flat idler at the back of the loading hopper to prevent spillage.

For return idlers, divide the length of the conveyor (in feet) by the return idler spacing (in feet – see Table below), and subtract one.

Example: Determine the number of troughing and return idlers required for the following conveyor:

30" width × 402'-0" centers
Recommended idler spacing – 4'-0"
One loading point, at conveyor tail end

Number of Troughing Idlers:

$$\frac{402}{4} + 2 = 102.5$$

103 Troughing Idlers:

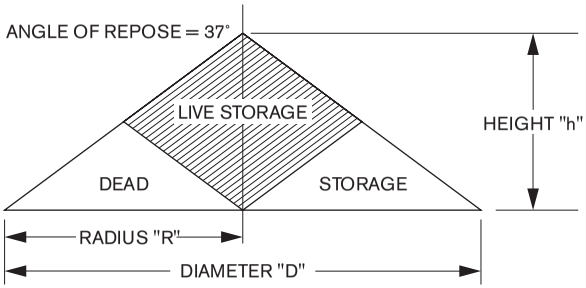
Number of Return Idlers:

$$\frac{402}{10} - 1 = 39$$

IDLER SPACING

Belt Width	SUGGESTED NORMAL SPACING						
	Troughing Idlers						Return Idlers
	Weight of Material in Lbs./Ft.^{3}						
	30	50	75	100	150	200	
18"	5'-6"	5'-0"	5'-0"	5'-0"	4'-6"	4'-6"	10'-0"
24"	5'-0"	4'-6"	4'-6"	4'-0"	4'-0"	4'-0"	10'-0"
30"	5'-0"	4'-6"	4'-6"	4'-0"	4'-0"	4'-0"	10'-0"
36"	5'-0"	4'-6"	4'-0"	4'-0"	3'-6"	3'-6"	10'-0"
42"	4'-6"	4'-6"	4'-0"	3'-6"	3'-0"	3'-0"	10'-0"
48"	4'-6"	4'-0"	4'-0"	3'-6"	3'-0"	3'-0"	10'-0"
54"	4'-6"	4'-0"	3'-6"	3'-6"	3'-0"	3'-0"	10'-0"
60"	4'-0"	4'-0"	3'-6"	3'-0"	3'-0"	3'-0"	10'-0"

CONICAL STOCKPILE VOLUMES



THEORETICAL TOTAL VOLUME (Yds.^{3}) = .0097 × hD^2 = .0388 × hR^2
LIVE STORAGE = .0097 hR^2

HEIGHT	RADIUS	PERIMETER	TOTAL (YDS.^{3})	TOTAL TONS	LIVE YDS.	LIVE TONS
10'	13'-3"	28 yds.	68	92	17	23
15'	19'-11"	42 yds.	230	310	58	78
20'	26'-6"	56 yds.	546	737	137	185
25'	33'-2"	69 yds.	1,067	1,441	267	360
30'	39'-9"	83 yds.	1,844	2,489	462	623
35'	46'-5"	97 yds.	2,928	3,953	733	990
40'	53'-1"	111 yds.	4,371	5,901	1,094	1,477
45'	59'-9"	125 yds.	6,224	8,402	1,558	2,104
50'	66'-4"	139 yds.	8,538	11,526	2,138	2,886
55'	73'-0"	153 yds.	11,363	15,341	2,845	3,841
60'	79'-6"	167 yds.	14,753	19,916	3,694	4,986
65'	86'-3"	181 yds.	18,757	25,321	4,696	6,340
70'	92'-10"	195 yds.	23,427	31,626	5,865	7,918
75'	99'-6"	208 yds.	28,814	38,898	7,214	9,739
80'	106'-2"	222 yds.	34,970	47,208	8,755	11,820
85'	112'-9"	236 yds.	41,944	56,625	10,502	14,177
90'	119'-5"	250 yds.	49,790	66,217	12,466	16,829
95'	126'-1"	264 yds.	58,559	79,054	14,661	19,793
100'	132'-8"	278 yds.	68,300	92,205	17,100	23,085

Above capacities approximate only.

VOLUME OF ELONGATED OR TENT-SHAPED STOCKPILES

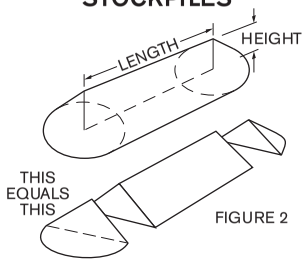


FIGURE 2

Determining the volume of an elongated stockpile becomes readily apparent by separating the pile into its two basic forms, a conical pile and a prism-shaped pile. (See Figure 2.) From the chart on Page 171, find the volume and dimensions of the conical pile which is equivalent to the two ends, and to this add the volume of the prism-shaped center section.

EXAMPLE

An area 120' wide and 415' long is available for an elongated stockpile. What volume can be stockpiled if the material has a 37° angle of repose?

1. From the chart, we find the conical pile in the preceding example is equivalent to the ends of this tent-shaped pile and, therefore, the volume is 6224 yds^3.
2. Subtract width of the conical pile from overall pile length to determine the length of prism-shaped section.

$$\begin{array}{r} 420 \\ -120 \\ \hline = 300 \end{array}$$

3. Find the volume of prism by:

$$W = \frac{\text{LENGTH} \times \text{WIDTH} \times \text{HEIGHT}}{2} = \frac{300\text{ ft.} \times 120\text{ ft.} \times 45\text{ft.}}{2} = 720{,}000\text{ ft}^3$$

4. Since there are 27 ft^3 per yd^3, divide:

$$\frac{720{,}000\text{ ft}^3}{27\text{ ft}^3/\text{yd}^3} = 26{,}677\text{ yd}^3 \text{ (Prism volume)}$$

5. Add the volume of ends and prism:

$$\begin{array}{r} 26{,}667\text{ yd}^3 \\ 6{,}224 \\ \hline = 32{,}891\text{ yds}^3 \text{ (Total Volume)} \end{array}$$

VOLUMES OF KIDNEY SHAPED WINDROWS

YARDS³ & TONS PER DEGREE OF ARC (LESS ENDS)

Radius,	Stockpile Height																	
	10'		15'		20'		25'		30'		35'		40'		45'		50'	
Feet	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS	YDS	TONS
25	2.14	2.89																
30	2.57	3.47																
35	3.00	4.05	6.75	9.12														
40	3.43	4.63	7.72	10.42	13.72	18.52												
45	3.86	5.21	8.68	11.72	15.44	20.84												
50	4.29	5.79	9.65	13.02	17.15	23.16	26.80	36.18										
55	4.72	6.37	10.61	14.33	18.87	25.47	29.48	39.80										
60	5.15	6.95	11.58	15.63	20.58	27.79	32.16	43.42	46.31	62.52								
65	5.57	7.53	12.54	16.93	22.30	30.10	34.84	47.03	50.17	67.73								
70	6.00	8.10	13.51	18.23	24.01	32.42	37.52	50.65	54.02	72.94								
75			14.47	19.54	25.73	34.73	40.20	54.27	57.89	78.15								
80			15.44	20.84	27.44	37.05	42.88	57.89	61.75	83.36								
85			16.40	22.14	29.16	39.36	45.56	61.51	65.61	88.57	89.30	120.55						
90			17.37	23.44	30.87	41.67	48.24	65.12	69.46	93.77	94.55	127.64	123.49	166.71				
95			18.33	24.74	32.58	43.99	50.92	68.74	73.72	98.98	99.80	134.73	130.35	175.98				
100			19.29	26.04	34.30	46.31	53.60	72.36	77.18	104.19	105.05	141.82	137.21	185.24				
105					36.01	48.62	56.28	75.97	81.04	109.41	110.31	148.92	144.08	194.51	182.35	246.17		
110					37.73	50.94	58.96	79.59	84.90	114.62	115.56	156.01	150.94	203.77	191.03	257.89		
115					39.45	53.25	61.64	83.28	88.76	119.83	120.82	163.10	157.80	213.03	199.72	269.62	246.56	332.86
120							64.32	86.83	92.62	125.04	126.07	170.19	164.66	222.29	208.40	281.34	257.28	337.33
125							67.00	90.45	96.48	130.25	131.32	177.28	171.52	231.55	217.08	293.06	286.00	361.80
130							69.68	94.07	100.34	135.46	136.57	184.37	178.38	240.82	225.77	304.78	278.72	376.28
135							72.36	97.69	104.20	140.67	141.83	191.47	185.24	250.28	234.45	316.51	289.44	390.75
140									108.06	145.88	147.08	198.56	192.01	259.34	243.13	328.23	300.16	405.22
145									111.92	151.09	152.33	205.65	198.97	268.60	251.82	339.95	310.88	419.69
150									115.78	156.30	157.59	212.74	205.83	277.86	260.50	351.67	321.60	434.16

To determine the total volume of a kidney shaped stockpile, utilize the following formula:

V = Volume in Yds. or Tons = $(V_1 \times D) + V_2$

V_1 = Volume in 1° of Arc

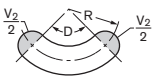
D = Degrees of Arc

V_2 = Volume of Ends (See Conical Stockpile Chart)

Example: 30' High Pile, 120' Radius, 90° Arc

$V = (92.62 \times 90) + 1844 = 10{,}179.8\ yd^3$

Also $V = (125.04 \times 90) + 2489 = 13{,}742.6$ Tons



NOTES:

MATERIALS

This section of the Telsmith Mineral Processing Handbook contains data pertaining to rock and mineral identification, hardness, testing and other lists and charts as they relate to the mining and aggregate industries.

BULK MATERIAL CHARACTERISTICS

Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.	Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.
Ashes, Coal, Dry, Minus 3"	D46T 40°	35–40	20°–25°	Coke, Breeze, Minus 1/4"	C37Y 30°-45°	25–35	20°–22°
Ashes, Coal, Wet, Minus 3"	C46T 50°	45–50	23°–27°	Concrete, Wet:			
Barite	D36	180	18°	6" Slump	D26	110–150	12°
Barite, Crushed, Minus 3"	D36	75–85	20°	4" Slump	D26	110–150	20°–22°
Bentonite, Minus 100 Mesh	A26XY	50–60	20°	2" Slump	D26	110–150	24°–26°
Borax, Fine	B26T	45–55	20°–22°	Copper Ore	D27	120–150	20°
Cast Iron Chips	C46	130–200	20°	Coral, Crushed	D26	40–45	20°
Cement, Portland	A26M 39°	94	20°–23°	Corn, Shelled	C25NW 21°	45	10°
Cement, Clinker	D37 30°–40°	75–95	18°–20°	Cullet, Crushed	D37Z	80–120	20°
Charcoal	D36Q 35°	18–25	20°–25°	Culm, Minus 3/64", Damp	B25TVY	45–60	20°
Cinders, Coal	D37T 35°	40	20°	Dolomite, Lumpy	D26	90–100	22°
Coal, Anthracite, Sized, 3/8" to 6"	C26 27°	55–60	16°	Earth, Common, Loam, Dry	B36 35°	70–80	20°
Coal, Bituminous, Slack	C45T 40°	43–50	22°	Earth, Clay, Dry	B36 35°	65	20°
Coal, Bituminous, Run of Mine	D35T 38°	43–55	18°	Earth, Moist	B46 45°	100–110	23°
Coffee, Bean	C25Q 25°	32	10°–15°	Feldspar, Ground, Minus 1/8"	B36 38°	70–85	18°
Coke, Loose	D47QVT	23–35	18°	Fluorspar	D46	110–120	20°
Coke, Petroleum	D36V	35–45	20°	Fuller's Earth, Burnt	B26 35°	40	20°

BULK MATERIAL CHARACTERISTICS (Cont.)

Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.	Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.
Fuller's Earth, Raw	B26 35°	35–40	20°	Manganese Ore	D37 39°	125–140	20°
Glass, Batch	D27Z	80–100	20°–22°	Marble, Crushed, Over 1/2"	D27	80–95	20°
Granite, Broken	D27	95–100	20°	Mica, Ground, Minus 1/8"	B36 34°	13–15	23°
Gravel, Average, Blended	D27 38°–40°	90–100	20°	Phosphate rock	D26 25°–30°	75–85	12°–15°
Gravel, Sharp	D27 40°	90–100	15°–17°	Salt, Coarse, Dry	C25TU	40–45	18°–22°
Gravel, Pebble	D36 30°	90–100	12°	Salt, Fine, Dry	D26TUW 25°	70–80	11°
Gypsum, Calcined	C36 40°	70–80	21°	Sand, Bank, Damp	B47 45°	110–130	20°–22°
Gypsum, Crushed	D26 30°	70–80	15°	Sand, Bank, Dry	B37 35°	90–110	16°–18°
Gypsum, Powdered	A36Y 42°	60–70	23°	Sand, Foundry, Prepared	B47	80–90	24°
Iron Ore	D36 35°	100–200	18°–20°	Sand, Foundry, Shakeout	D37 39°	90–100	22°
Kaolin Clay, Minus 3"	D36 35°	63	19°	Sand, Silica, Dry	B27	90–100	10°–15°
Lignite, Air Dried	D25	45–55	20°	Sand, Saturated	B27	110–130	15°
Lime, Ground, Minus 1/8"	B45X 43°	60–65	23°	Shale, Crushed	C36 39°	85–90	22°
Lime, Pebble	D35 30°	53–56	17°	Slag, Furnace, Crushed	A27 25°	80–90	10°
Lime, Over 1/2"	D35	55	18°	Slag, Furnace, Granulated	C27 25°	60–65	13°–16°
Limestone, Agricultural	B26	68	20°	Slate, Crushed, Minus 1/2"	C26 28°	80–90	15°
Limestone, Crushed	C26X 38°	85–90	18°	Slate, Ground, Minus 1/8"	A36Y 35°	70–80	20°

BULK MATERIAL CHARACTERISTICS (Cont.)

Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.	Material	Class	Avg. Wt. Lbs./Ft³	Conveying Angle–Max.
Soda Ash, Light	A36Y 37°	20–35	22°	Sulphate, Lumpy, Minus 3"	D25NS	80–85	18°
Soda Ash, Heavy	B36 32°	55–65	19°	Sulphate, Powdered	B25NW	50–60	21°
Stone, Crushed	D36V	85–90	20°	Traprock, Crushed	D37	100–110	20°
Stone, Screenings	C36	85–90	18°	Vermiculite Ore	D36Y	70–80	20°
Stone, Dust	B36Y	75–85	20°	Wheat	C25N 28°	45–48	12°
Sulphate, Crushed, Minus 1/2"	C25NS	50–60	20°	Wood Chips	E45WY	10–30	27°

Key to Classification of Material

Size Characteristics
- A – Very fine, under 100 mesh
- B – Fine, under 1/8"
- C – Granular, 1/8" to 1/2"
- D – Lumpy, over 1/2"
- E – Irregular, stringy, interlocking, mats together

Flow Characteristics
- 2 – Free flowing, angle of repose 20° to 30°
- 3 – Average flowing, angle of repose 30° to 45°
- 4 – Sluggish, angle of repose over 45°

Abrasive Characteristics
- 5 – Non-abrasive
- 6 – Abrasive
- 7 – Very abrasive

Miscellaneous Characteristics
- N – Contains explosive dust
- Q – Degradeable, affecting use or saleability
- S – Highly corrosive
- T – Mildly corrosive
- U – Hygroscopic
- V – Interlocks or mats
- W – Oils or chemical present, may affect rubber products
- X – Packs under pressure
- Y – Very light and fluffy, may be wind swept
- Z – Elevated temperature

Example: Limestone, Crushed – C26X 38°
- C – Granular, 1/8" to 1/2"
- 2 – Free flowing, angle of repose 20° to 30°
- 6 – Abrasive
- X – Packs under pressure
- 38° – Angle of repose

SPECIFICATIONS

1. Lightweight Aggregates – structural concrete – ASTM Designation C330-53T
2. Concrete Aggregates – ASTM Designation C33-55T
3. Coarse Aggregate – Highway Construction – ASTM Designation D448-54
4. Crushed Slag and Gravel – Bituminous Concrete Base and Surface Courses – ASTM Designation D692-54
5. Crushed Slag and Gravel – Waterbound Macadam Base and Surface Courses – ASTM Designation D694-55

Total %	Screen Size (Square Opening)														
Passing	4"	3 1/2"	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 50	No.100
SPR No. 1	100	90–100	–	25–60	–	0–15	–	0–5							
SPR No. 2			100	90–100	35–70	0–15	–	0–5							
SPR No. 24			100	90–100	–	25–60	–	0–10	0–5						
SPR No. 3				100	95–100	35–70	0–15	–	0–5						
SPR No. 357				100	95–100	–	35–70	–	10–30	–	0–5				
SPR No. 4					100	90–100	20–55	0–15	–	0–5					
SPR No. 467					100	95–100	–	35–70	–	10–30	0–5				
SPR No. 5						100	90–100	20–55	0–10	0–5					

(Continued on next page)

SPR – Simplified practice recommendation

SPECIFICATIONS (Cont.)

Total %	Screen Size (Square Opening)														
Passing	4"	3 1/2"	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 50	No.100
SPR No. 56						100	90–100	40–75	15–35	0–15	0–5				
SPR No. 57						100	95–100	–	25–60	–	0–10	0–5			
SPR No. 6							100	90–100	20–55	0–15	0–5				
SPR No. 67							100	90–100	–	20–55	0–10	0–5			
SPR No. 68							100	90–100	–	30–65	5–25	0–10	0–5		
SPR No. 7								100	90–100	40–70	0–15	0–5			
SPR No. 78								100	90–100	40–75	5–25	0–10	0–5		
SPR No. 8									100	85–100	10–30	0–10	0–5		
SPR No. 89									100	90–100	20–55	5–30	0–10	0–5	
SPR No. 9										100	85–100	10–40	0–10	0–5	
SPR No. 10										100	85–100	–	–	–	10–30

SPR – Simplified practice recommendation

AGGREGATE, GENERAL INFORMATION

AGGREGATE is made up of inert material such as sand and gravel, crushed stone or slag, which when bound together into a conglomerated mass by a matrix forms concretes, mortars, plaster and mastics such as black top or macadam roads and asphalt road surfaces.

SAND is a finer granular material (usually lass than $1/4$" in dia.) resulting from the natural disintegration of rock or from the crushing of friable sandstone rock or other suitable rocks.

GRAVEL is a coarse granular material (usually larger than $1/4$" in dia.) resulting from the natural erosion and disintegration of rock.

CRUSHED GRAVEL is the product resulting from the artificial crushing of gravel with most all fragments having at least one face resulting from fracture.

CRUSHED STONE is the product resulting from the artificial crushing of rocks, boulders or large cobblestones with the fragments having all faces resulting from the crushing operation.

ROCK, from which crushed stone, sand and gravel are made and the rock most suitable for making good aggregates is formed all over the world. See page 188 for the various kinds of rocks and their physical properties.

SLAG is the air-cooled, non-metallic by-product of a blast furnace operation consisting essentially of silicates and alumina-silicates of lime and other bases which is developed simultaneously with iron in a blast furnace. Naturally, it is only available in those localities where pig iron is produced. Crushed slag weighs about 80 lbs. per ft^3.

The value of rock for road building depends largely upon the extent to which it will resist the destructive influences of traffic and the weather. The most important physical properties are hardness, toughness and soundness. Hardness is the resistance which the rock offers to the displacement of its surface particles by abrasion, toughness is the resistance which it offers to fracture under impact, and soundness is the resistance offered to the effects of weathering. The hardness of a rock is determined by the Los Angeles Abrasion test, the Dorry hardness test and the Deval Abrasion test. The abrasion tests are also a measure of the toughness of rock and supplement in this respect the impact test for toughness.

If the rock, sand and gravel or other material which the aggregate producer proposes to process, passes all of the required State Highway Department tests satisfactorily, and is available in sufficient quantity to warrant the installation of a quarry or gravel plant, this aggregate producers data book gives up-to-date information on the size and type of equipment most generally used for crushing, screening and processing. Be sure to consult your State Highway Department for aggregate specifications.

STANDARD DESCRIPTIVE NOMENCLATURE OF CONSTITUENTS OF NATURAL MINERAL AGGREGATES

The purpose of this nomenclature is to provide brief, useful and accurate descriptions of some of the more common or more important natural materials found as constituents of mineral aggregates. These descriptions are for minerals and rocks as they occur in nature only, and do not include blast-furnace slag or lightweight aggregates which are prepared by the alteration of the structure of a natural material. The descriptions have been prepared to provide a basis for understanding these terms when they are used to designate aggregate constituents. It should be emphasized that many of the materials described frequently occur in particles that do not display all of the characteristics given in the descriptions and that most of these materials grade from varieties meeting one description to varieties meeting another, with all intermediate stages being found.

These descriptions are not adequate to permit the identification of materials, since the accurate identification of the natural constituents of mineral aggregates can, in many cases, only be made by a qualified geologist, mineralogist or petrographer using the apparatus and procedures of these sciences. Reference to these descriptions may, however, serve to indicate or prevent gross errors in identification. Identification of the constituent materials in a mineral aggregate may assist in recognizing its properties, but identification alone, however accurately it may be accomplished, cannot provide a basis for predicting the behavior of aggregates in service. Mineral aggregates composed of constituents of any type or combination of types may perform well or poorly in service depending upon the exposure to which they are subjected, the physical and chemical properties of the matrix in which they are embedded, their physical condition at the time they are used, and upon other factors.

The natural materials found as constituents of mineral aggregates are, for the most part, particles of rocks and minerals. Rocks are classified according to origin into three major groups: igneous, sedimentary and metamorphic; and are subdivided into types according to mineral and chemical composition, texture and structure. Most rock particles are composed of mineral grains of more than one type. However, in some cases, a rock may be composed of grains of only one mineral. Certain examples of the rock quartzite are composed exclusively of the mineral quartz. The particles composing the finer sizes of many sands frequently consist of individual mineral grains. Descriptions are, therefore, given not only of rock types but also of minerals.

Silica Minerals

1. (a) QUARTZ – Quartz is a hard mineral (will scratch glass and not be scratched by a knife) composed wholly of silica (silicon dioxide). When pure it is colorless with a glassy (vitreous) luster and a shell-like (conchoidal) fracture. It lacks a visible cleavage, and, when present in massive rocks such as granite, it usually has no characteristic shape.

(b) OPAL – Opal is a hydrous form of silica which occurs as an amorphous mineral and, therefore, is without characteristic external shape or internal crystalline arrangement. It has variable water content ranging from 2% to 10%. The specific gravity and hardness are always less than those of quartz. The color is variable and the luster is resinous to glassy. It is usually found in sedimentary rocks and is the principal constituent of diatomite, but it is also found as a secondary material filling cavities and fissures in igneous rocks. It is of particular importance as a constituent of mineral aggregates because of its reactivity with the alkalies in portland cement.

(c) CHALCEDONY – Chalcedony has been considered both as a distinct mineral and as a variety of quartz. It is now generally believed to be composed of a submicroscopic mixture of fibrous quartz with a smaller but variable amount of opal. The properties of chalcedony are intermediate between those of opal and quartz, from which it can be distinguished only by laboratory tests. It frequently occurs as a constituent of the rock chert and is reactive with the alkalies in portland cement.

(d) TRIDYMITE AND CRISTOBALITE – These minerals are crystalline forms of silica which are sometimes found in volcanic igneous rocks. They are metastable at ordinary temperatures and pressures. Unless they occur in well-shaped crystals, they can only be distinguished from quartz by laboratory tests. They are rare minerals and are included here only because of their reactivity with cement alkalies.

Feldspars

2. The minerals of the feldspar group are the most abundant rock-forming minerals. Since all feldspars have good cleavage in two directions, particles of feldspar usually show several smooth surfaces. Frequently, the smooth cleavage surfaces show fine parallel lines. All feldspars are softer than, and can be scratched by, quartz. The various members of the group are differentiated by chemical composition and crystallographic properties. The potash feldspars orthoclase, sanidine and microcline are silicates of aluminum and potassium, and are frequently referred to as the "potash" or potassium feldspars. The plagioclase feldspars include those that are silicates of aluminum and sodium, aluminum and calcium, or aluminum and both sodium and calcium. This group is frequently referred to as the "soda-lime" group and includes a continuous series, of varying chemical composition, from albite, the aluminum-sodium feldspar, to anorthite, the aluminum-calcium feldspar, with intermediate members of the series designated oligoclase, andesine, labradorite and bytownite. Feldspars containing potassium or sodium occur typically in granite and rhyolitic rocks, whereas those of higher calcium content are found in rocks of lower silica content such as diorite, gabbro, andesite and basalt.

Micaceous Minerals

3. The micaceous minerals characteristically have a perfect cleavage. Particles of such minerals can, therefore, usually be split into extremely thin flakes. The true micas are usually colorless or light green (muscovite); or dark green, dark brown, to black (biotite), and have elastic flakes. The green micaceous material often found in schists usually represents minerals of the chlorite group which may be distinguished from the micas because they form comparatively nonelastic flakes.

Carbonate Minerals

4. The most common carbonate mineral is calcite (calcium carbonate). The mineral dolomite consists of calcium carbonate and magnesium carbonate in equivalent chemical amounts, which are 54.27% and 45.73% by weight, respectively. Both calcite and dolomite are relatively soft, the hardness of calcite being 3 and that of dolomite $3^1/_2$ to 4 on the Mohs scale, and are readily scratched by a knife blade. They have rhombohedral cleavage which results in their breaking into fragments with smooth parallelogram-shaped sides. Calcite is soluble with effervescence in cold dilute hydrochloric acid; dolomite is soluble with effervescence only if the acid or the sample is heated or if the sample is pulverized.

Ferromagnesian Minerals

5. The various types of igneous rocks contain characteristic dark green to black minerals. These are generally silicates of iron or magnesium, or both, and include the minerals of the amphibole and pyroxene groups. The most common amphibole is hornblende; the most common pyroxene is augite. Black mica, biotite, may also be considered as a ferromagnesian mineral. Amphiboles, pyroxenes, and biotite may also be found in marble.

STANDARD DESCRIPTIVE NOMENCLATURE OF CONSTITUENTS OF NATURAL MINERAL AGGREGATES (Cont.)

Olivine, usually olive-green in color, is a characteristic mineral of igneous rocks of very low silica content.

Clay Minerals

6. The term "clay" refers to a rock or other natural material composed of particles of a specific size range, and containing appreciable quantities of clay minerals (hydrosilicates of aluminum, or magnesium, or both). Clay minerals generally are formed by the alteration of feldspars, other silicate minerals, and volcanic glass. Most particles consisting of clay minerals are soft and porous, and some clay minerals of the montmorillonite and illite (hydromica) groups (swelling clays) undergo large volume change with wetting and drying. Clay minerals are found in seams and pockets of limestones, disseminated through limestones and other sedimentary rocks in weathered igneous rocks and are important constituents of shales.

Sulfides

7. Many sulfide minerals are important ores of metals, but only pyrite and marcasite, both sulfides of iron, are frequently found in mineral aggregates. Pyrite is found in igneous, sedimentary, and metamorphic rocks; marcasite is much less common and is found mainly in sedimentary rocks. Pyrite is brass yellow in color and has a metallic luster; marcasite is also metallic but lighter in color. Pyrite is often found in cubic crystals. Marcasite often oxidizes with the liberation of sulfuric acid and formation of iron oxides and hydroxides and, to a much lesser extent, sulfates; pyrite does so less readily. Both minerals are known as "fool's gold."

Iron Oxides

8. The common iron oxide minerals may be grouped in three classes:

(1) Black, magnetic: magnetite; (2) Red or reddish when powdered: hematite; (3) Brown or yellowish: limonite. Magnetite is an important accessory mineral in many dark igneous rocks. Limonite is a term applied loosely to a variety of brown or yellowish minerals, some of which are hydrous and include the iron minerals in many ferruginous sandstones, shales, and clay ironstones.

Zeolites:

9. The zeolite minerals comprise a large group of soft, hydrous silicates usually white or light colored, formed as a secondary filling in cavities or fissures in rocks. Some zeolites, particularly laumontite, natrolite, and heulandite, are reported to have produced deleterious effects in concrete, the latter two having been reported to be reactive with cement alkalies.

DESCRIPTIONS OF IGNEOUS ROCKS

10. Igneous rocks are those that have been formed by cooling from a molten mass. They may be divided into two classes: (1) Coarse-Grained (intrusive, deep-seated), and (2) Fine-grained (shallow-intrusive, extrusive surface, volcanic) rocks. The coarse-grained rocks cooled slowly within the earth. The fine-grained rocks formed as rather quickly cooled lavas and frequently contain natural glass. The porphyries are characterized by the presence of large mineral grains in a fine-grained groundmass. This texture is the result of a sharp change in the rate of cooling or other physicochemical conditions during the solidification of the rock.

Within the two classes, rocks are usually classified and named on the basis of their mineral content, which in turn depends to a large extent on the chemical composition. Rocks in the intrusive class generally have chemical equivalents in the extrusive class.

Coarse-Grained Intrusive Igneous Rocks

11. (a) GRANITE. – Granite is a medium-to coarse-grained, light-colored rock characterized by the presence of quartz and feldspar. The characteristic feldspars are orthoclase, microcline, or albite. Feldspar is usually more abundant than quartz. Dark-colored mica (biotite) is usually present and light-colored mica (muscovite) frequently. Other dark-colored minerals, especially hornblende, may be present in amounts less than those of the light-colored constituents. Quartz-monzonite and granodiorite may be mentioned as rocks similar to granite, but containing more plagioclase feldspar.

(b) SYENITE. – Syenite is a medium-to coarse-grained, light-colored rock composed essentially of feldspar, generally orthoclase. Quartz is generally absent. Dark ferromagnesian minerals such as hornblende, biotite, or pyroxene may be present.

(c) DIORITE. – Diorite is a medium-to coarse-grained rock composed essentially of plagioclase feldspar and one or more ferromagnesian minerals such as hornblende, biotite, or pyroxene. The plagioclase is intermediate in composition, usually of the variety known as andesine. Diorite is darker in color than granite or syenite and lighter than gabbro. If quartz is present, the rock is called quartz diorite.

(d) GABBRO. – Gabbro is a medium-to coarse-grained, dark-colored rock consisting essentially of ferromagnesian minerals and plagioclase feldspar. The ferromagnesian minerals may be pyroxenes, amphiboles, or both. The plagioclase is one of the calcium-rich varieties such as labradorite. Ferromagnesian minerals are usually more abundant than feldspar. Diabase is rock of similar composition to gabbro and basalt but is intermediate in mode of origin, usually occurring in smaller intrusions than gabbro, and having a medium-grained texture. The term "trap" or "trap rock" is a collective term for dark-colored, fine- to medium-grained igneous rocks such as diabase and basalt.

(e)PYROXENITE AND PERIDOTITE. – Rocks composed almost entirely of olivine or of both olivine and pyroxene are known as peridotites. Pyroxenites are composed almost entirely of pyroxene.

Rocks of these types are relatively rare but their metamorphosed equivalent, serpentine, is more common.

(f) PEGMATITE. – Extremely coarse-grained varieties of igneous rocks are known as pegmatites. These are usually light colored and are generally equivalent to granite or syenite.

Fine-Grained Extrusive Igneous Rocks

12. The fine-grained equivalents of the coarse-grained igneous rocks described above have similar chemical compositions. The extrusive rocks are so fine-grained that the individual mineral grains are usually not visible to the naked eye. They may contain the same constituent minerals, or the rocks may be partially or wholly glassy.

(a) OBSIDIAN, PUMICE, AND PERLITE. – Igneous rocks composed wholly of glass have been named on the basis of their texture. A dense natural glass is called obsidian, while a glassy froth filled with bubbles is called pumice. A siliceous or glassy lava with an onion-like structure and a pearly luster, containing 2% to 5% water, is called perlite. When heated quickly to the softening temperature, perlite puffs to become an artificial pumice. These rocks may be reactive with the alkalies in portland cement

(b) FELSITE. – Light-colored, fine-grained igneous rocks are collectively known as felsite. The felsite group includes rhyolite, dacite, fine-grained andesite, and trachyte which are the equivalents of granite, quartz diorite, diorite, and syenite, respectively. These rocks are usually light colored but may be dark red or even black. When they are dark they are more properly classed as "trap" (see Gabbro). When they contain natural glass, the glass

frequently has such a high silica content that it is reactive with cement alkalies.

(c) BASALT. – Basalt is the fine-grained extrusive equivalent of gabbro. When basalt contains natural glass, the glass is generally lower in silica content than that of the lighter-colored extrusive rocks and is hence less likely to be reactive with cement alkalies.

DESCRIPTIONS OF SEDIMENTARY ROCKS AND THEIR METAMORPHIC EQUIVALENTS

13. Sedimentary rocks are stratified rocks laid down for the most part under water, although wind action occasionally is important. They may be composed of particles of pre-existing rocks derived by mechanical agencies or they may be of chemical or organic origin.

Carbonate Rocks

14. Carbonate rocks are generally referred to as limestones unless more than 50% of the carbonate constituent is known to consist of the mineral dolomite, in which case they are called dolomites. If 50% to 90% of the carbonate content is the mineral calcite, the rock may be called dolomite limestone; if 50% to 90% is the mineral dolomite, the rock may be called calcitic dolomite. Most carbonate rocks contain some noncarbonate impurities such as silica minerals, clay, organic matter, or hydrous calcium sulfate (gypsum). Carbonate rocks containing 10% to 50% sand are arenaceous (or sandy) limestones (or dolomites); those containing 10% to 50% clay are argillaceous (or clayey or shaly) limestones (or dolomites). Marl is a clayey limestone which is fine-grained and commonly soft. Very soft carbonate rocks are known as chalk or "lime rock." Limestone recrystallized by metamorphism is known as marble. NOTE. - "Magnesium limestone" is sometimes applied to dolomitic limestones and calcitic dolomites but it is ambiguous and its use should be avoided. The term "lime rock" also is not recommended.

Conglomerates, Sandstones, and Quartzites

15. (a) These rocks consist of particles of sand or gravel, or both, cemented together. If the particles include a considerable proportion of gravel, the rock is a conglomerate. If the particles are in the sand sizes, the rock is a sandstone or a quartzite. If the rock, when fractured, breaks around the sand grains, it is a sandstone; if the grains and the cement are largely quartz and the fracture passes through the grains, it is a quartzite. Conglomerates and sandstones are sedimentary rocks. Quartzites may be sedimentary or may be metamorphosed sandstones. The cementing material of sandstone may be quartz, opal, calcite, dolomite, clay, iron oxides, or other materials. If the nature of the cementing material is known, the designation of the rock may include a reference thereto, as "opal-bonded sandstone," or "ferruginous conglomerate."

(b) Graywacke is sandstone containing abundant dark particles of rocks, such as chert, slate, phyllite, and schists, in addition to mineral grains and a matrix resembling shale or slate.

(c) Arkose is coarse-grained sandstone containing conspicuous amounts of feldspar and is derived from granite.

Argillaceous Rocks

16. These rocks are largely composed of, or derived from, sedimentary silts and clays. When relatively soft and massive they are known as claystones, or siltstones, depending on the particles of which they are composed. When harder and platy they are known as shales, and when metamorphosed they become, with progressively greater alteration, slates, phyllites, and schists. All of these metamorphic rocks are usually characterized by a laminated structure and a tendency to break into thin particles.

Chert

17. Chert is a very fine-grained siliceous rock which is characterized by hardness (scratches glass, is not scratched by a knife blade), conchoidal (shell-like) fracture in dense varieties, the fracture becoming splintery in porous varieties, and a variety of colors. The dense varieties are very tough and are usually gray to black, or white to brown, less frequently green, red, or blue, and have a waxy to greasy luster. The porous varieties are usually lighter in color, most frequently being white or stained yellowish, brownish, or reddish, and have a chalky surface. Dense red and, in some cases, dense yellow, brown, or green chert is sometimes called "jasper." Dense black and, in some cases, dense gray, chert is sometimes called "flint." Chert is composed of silica in the form of chalcedony, cryptocrystalline quartz, or opal, or combinations of any of these three. The determination of which form or forms of silica are present requires careful determination of optical properties, absolute specific gravity, or both. Chert occurs most frequently as nodules or bands in limestones and as particles in sands and gravels derived from such rocks.

DESCRIPTIONS OF METAMORPHIC ROCKS

18. Since the typical metamorphic equivalents of sedimentary rocks have been mentioned under Sedimentary Rocks, the descriptions below cover metamorphosed igneous rocks:

Serpentine

19. Serpentine is a relatively soft, light to dark green to almost black rock formed usually from silica-poor igneous rocks such as pyroxenites and peridotites. It may contain some of the original pyroxene or olivine but is largely composed of softer hydrous minerals. Very soft talc-like material is often present in serpentine.

Gneiss

20. Gneiss is usually formed by the metamorphism of schists or igneous rocks. It is characterized by a layered structure resulting from approximately parallel lenses and bands of platy minerals, usually micas, and of granular minerals, usually quartz and feldspars. Gneisses are usually coarser grained than schists and usually contain an abundance of feldspar. All intermediate varieties between gneiss and schist and between gneiss and granite are found, often in the same areas in which well-defined gneisses occur.

PHYSICAL PROPERTIES OF THE MORE COMMON ROCKS

(Rock and Gravel when Crushed Weigh about 100 lbs. per ft.^{3})

IGNEOUS ROCKS	(Ignis = fire)	Specific Gravity	Compressive Strength lbs./in^2	Absorption %	Abrasion Tests: Toughness	Abrasion Tests: Los Angeles	Abrasion Tests: Deval
Intrusive (Plutonic – named after Pluto God of the lower regions)	Granite	2.63	25,000	.30	9	41.5	4.7
	Syenite	2.71	26,900	.44	14	38.8	4.0
	Diorite*	2.87	10,000	.23	17	…	3.1
	Gabbro*	2.93	41,800	.21	14	14.0	3.4
Extrusive (Volcanic – Ejected with great heat in the form of lava)	Rhyolite	2.61	39,000	.58	18	16.4	3.6
	Trachyte	2.66	25,000	.99	18	20.7	4.2
	Andesite*	2.63	17,000	.93	18	32.5	3.7
	Basalt*	2.84	47,000	.42	30	16.7	3.0
SEDIMENTARY ROCKS	(Sedimentam = settling)						
Formed by action of water (siliceous)	Conglomerate	2.64	20,000	…	10	…	…
	Sandstone	2.48	22,900	1.66	12	58.7	5.4
	Shale	2.66	10,000	1.05	8	…	8.1
Formed by chemical action	Chert (Flint)	2.47	–	1.42	12	26.4	9.5
(Calcareous – containing lime)	Limestone	2.63	17,500	.61	8	33.8	5.6
	Dolomite	2.71	21,200	1.09	8	27.1	5.9
	Limerock	2.71	5,340	1.60	5	36.3	17.4
	Caliche	–	(usually greyish in color – varies from soft to hard)				
METAMORPHIC ROCKS	(Meta = over, morphe = form, to change over)						
Formed by contact Metamorphism	Gneiss	2.68	23,900	.25	8	41.1	4.3
	Schist	2.74	–	.26	9	36.5	5.0
	Marble	2.71	13,600	.21	5	54.2	6.8
	Serpentine	2.63	43,000	.74	13	18.5	7.1
	Slate	2.74	21,800	.36	18	…	4.4
Formed by Regional Metamorphism	Quartzite	2.71–2.68	31,000 – 23,000	.38 – .24	19 – 13	26.1 – 30.3	3.6 – 3.9

*Often designated as trap rock.

WEIGHTS OF MATERIALS

Material	*Average Wt. lbs. Per Ft.^{3}	Material	*Average Wt. lbs. Per Ft.^{3}
Asbestos	153	Hematite, Crushed	210
Asphaltum	81	Iron Ore	135–150
Ashes, Dry	35–40	Ice	57
Ashes, Wet	45–50	Kaolin Clay	160
Bauxite, Crushed	75–85	Lime, Ground	35–60
Borax	50–55	Limestone, Crushed	90–100
Brick	120	Magnetite, Crushed	200
Cement, Portland	90–100	Manganese Ore	120
Cement, Clinker	75–80	Marble, Crushed	90–100
Cinders	40–45	Mud, Fluid	110
Clay	100–120	Phosphate Rock	110
Coal	50	Quartz	110
Coke	75	Sand	90–105
Concrete	150	Shale	85–90
Coral Rock	40–45	Slag, Crushed	80–90
Cullet, Crushed	80–120	Slate, Crushed	80–90
Dolomite	90–100	Snow	8–33
Earth	80–100	Stone, Crushed	100
Feldspar	65–70	Sulphur, Crushed	50–65
Flourspar	90–110	Talc	50–60
Fullers Earth	40	Traprock	100–110
Glass, Crushed	95–100	Vermiculite	80
Granite, Crushed	95–100	Water	62.4
Gravel	100	Wood	20–45
Gypsum, Crushed	65–75	Wood Chips	15–25

* For weight per yard^3, multiply weight per foot^3 by 27.

MOHS SCALE OF HARDNESS

Talc	– 1	Feldspar	– 6
Gypsum	– 2	Quartz	– 7
Calcite	– 3	Topaz	– 8
Fluorite	– 4	Corundum	– 9
Apatite	– 5	Diamond	–10

HARDNESS OF ROCKS

SOFT	MEDIUM	HARD	VERY HARD
Asbestos rock	Limestone	Granite	Iron ore (Taconite)
Gypsum rock	Dolomite	Quartzite	Granite
Slate	Sandstone	Iron ore	Granitic gravel
Talc		Trap rock	Trap rock
Soft Limestone		Gravel	

TESTS USED TO DETERMINE PHYSICAL PROPERTIES OF ROCK

Compressive Strength (ASTM C170)

1. Sample – cylinder of rock 2" high and 2" diameter
2. Cylinder of rock is placed between a special bearing block and the head of a suitable universal testing machine.
3. Unit crushing strength is calculated in lbs. per inch^2.

Specific Gravity Test(ASTM C127, C128)

1. Size of sample – 5 kg. of plus $^3/_8$" agregate.
2. Wash to remove dust – then dry at 110° C.
3. Immerse in 15° to 25° C water for 24 hrs. and then weigh (B).
4. Determine weight of sample in water (C).
5. Dry again @ 110° C and weigh (A).
6. Bulk specific gravity $= \frac{A}{B - C}$
7. Apparent specific gravity $= \frac{A}{A - C}$

Absorption Test

1, 2, 3, 4, 5 and 6. Same as above.

7. Absorption, per cent (%) $= \frac{B - A \times 100}{A}$

IMPACT CRUSHABILITY TEST PROCEDURE

1. Ten to fifteen samples of approximaty 3" x 2" dimensions with two natural parallel sides of 2" to 3" widths are selected.
2. Each sample piece is placed on a pedestal and struck simultaneously by two opposing hammers of standard size and shape.
3. The height of the hammers are increased until the sample is broken and the total foot-pounds (A) of force are recorded. The width (W) of the sample at the fracture is recorded.
4. The work index (W.I.) is calculated from the equation: $\frac{2.59\left(\frac{A}{W}\right)}{\text{Sp. Gr.}}$
5. Two Work Indexes are recorded; The maximum W.I. and the average W.I. of the samples tested.

Los Angeles Abrasion Test
by Los Angeles Machine (ASTM C131)

1. Size of sample – 5000 grams of clean, dry aggregate, properly graded (A).
2. Sample placed in machine which is then rotated for 500 revolutions @ 30 to 33 RPM.
3. Aggregate then removed and screened on a No. 12 sieve. Material retained on screen then washed, dried and weighed (B).
4. Percentage of wear $= \frac{A - B}{A}$

The lower the Los Angeles rating, the harder the rock.

Deval Abrasion Test

1. Sample – about 50 pieces broken by hand from a large piece of rock – wt. 5000 grams.
2. Sample placed in large cylinder mounted at an angle of 30° with the axis of rotation so that the rock charge is thrown from end to end twice during each of 10,000 revolutions.
3. Charge then screened over No. 12 sieve and the amount passing is expressed as a percentage of the initial weight and is called the percent of wear.
4. French coefficient of wear $= \frac{40}{\%\text{ of wear}}$

Dorry Hardness Test

1. Sample – a cylindrical rock core 25 mm in dia. from the rock speciman.
2. Sample is subjected to the abrasive action of quartz sand fed upon a revolving steel disk.
3. The end of the sample is worn away in inverse ratio to its hardness. The amount of loss is expressed in the form of a coefficient as follows:

Coefficient of hardness $= 20 - \frac{W}{3}$

W = loss of wt. after 1000 RPM of disk.

AGGREGATES REQUIRED PER YD.^{2} FOR CONCRETE PAVEMENTS

Average Thickness †	1:1$^1/_2$:2$^1/_2$ Mix			1:1$^1/_2$:3 Mix			1:2:3 Mix			1:2:3$^1/_2$ Mix			1:2:4 Mix			1:2$^1/_2$:5 Mix		
	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}	Cement Sacks	Sand Yd.^{3}	Stone Yd.^{3}
6.00"	1.404	0.078	0.130	1.273	0.070	0.142	1.160	0.086	0.128	1.073	0.080	0.141	1.007	0.075	0.149	0.827	0.077	0.153
7.00"	1.638	0.091	0.152	1.486	0.082	0.165	1.353	0.101	0.150	1.252	0.093	0.161	1.175	0.087	0.174	0.965	0.090	0.179
7.33"†	1.716	0.095	0.159	1.556	0.086	0.173	1.417	0.106	0.157	1.311	0.098	0.169	1.231	0.091	0.182	1.011	0.094	0.187
7.67"†	1.794	0.100	0.166	1.627	0.089	0.181	1.482	0.111	0.164	1.371	0.102	0.177	1.287	0.095	0.191	1.057	0.098	0.196
8.00"	1.872	0.104	0.173	1.698	0.093	0.189	1.546	0.116	0.171	1.431	0.107	0.184	1.342	0.099	0.199	1.102	0.102	0.204
8.33"†	1.950	0.108	0.181	1.771	0.097	0.197	1.612	0.121	0.179	1.490	0.111	0.192	1.398	0.104	0.207	1.148	0.107	0.213
8.67"†	2.028	0.113	0.188	1.839	0.101	0.205	1.676	0.125	0.185	1.550	0.116	0.202	1.454	0.108	0.215	1.194	0.111	0.222
9.00"	2.106	0.117	0.195	1.910	0.105	0.213	1.740	0.130	0.192	1.610	0.120	0.212	1.510	0.112	0.224	1.240	0.115	0.230

†Twice center thickness plus side thickness divided by 3 equals average thickness. Example: pavement 8" thick in center and 6" at sides; 8+8+6=22; 22÷3=7.33 average thickness

YARDS³ OF AGGREGATE REQUIRED — SPREAD LOOSE — Per 100 Foot and Per Mile

Road Width	Yards² of Surface		Yards³ Required For					
			100 Foot Road Length			One Mile Road Length		
	100' Road	1 Mile Road	1" Thick	2" Thick	3" Thick	1" Thick	2" Thick	3" Thick
10'	111.1	5,867	3.08	6.17	9.26	163.0	325.9	488.9
12'	133.3	7,040	3.70	7.41	11.11	195.6	391.1	586.7
14'	155.5	8,213	4.32	8.64	12.96	228.1	456.3	684.4
15'	166.6	8,800	4.63	9.26	13.89	244.5	488.9	733.3
16'	177.7	9,387	4.94	9.88	14.81	260.8	521.5	782.2
18'	200.0	10,560	5.55	11.11	16.67	293.3	586.7	880.0
20'	222.2	11,733	6.18	12.35	18.52	326.0	651.9	977.8
22'	244.4	12,907	6.78	13.58	20.37	358.0	717.0	1,075.6
24'	266.6	14,080	7.40	14.81	22.22	391.1	782.2	1,173.3
25'	277.7	14,667	7.71	15.43	23.15	407.5	814.8	1,222.2
26'	288.8	15,253	8.02	16.05	24.07	423.8	847.4	1,271.1
28'	311.1	16,427	8.63	17.28	25.92	456.3	912.6	1,368.8
30'	333.3	17,600	9.26	18.52	27.78	488.9	977.8	1,466.6
50'	555.5	29,334	15.42	30.86	46.30	815.0	1,629.6	2,444.4
100'	1,111.1	58,667	30.84	61.72	92.60	1,630.0	3,259.2	4,888.8

MISCELLANEOUS DATA

The final section of the Telsmith Mineral Processing Handbook contains useful charts, information lists, formulas and weights & measures used in the normal operation of aggregate plants.

V-BELT DRIVES – LIMITING DIMENSIONS

Continuous-rated general purpose induction motors may be V-belted to loads provided the motor sheaves are no smaller in pitch diameter nor greater in width than the limiting dimensions in the following table. These limiting dimensions are based on frames with "T" shaft extensions.

POLYPHASE INTEGRAL-HP INDUCTION MOTORS

Frame	Horsepower at Sync Speed, RPM			V-belt Sheave			
				Conventional A, B, C, D and E Sections		Narrow 3V, 5V and 8V Sections	
	1800	1200	900	Min Pitch Dia.	Max. Width	Min Outside Dia.	Max. Width
143T	1	3/4	1/2	2.2"	4 1/4"	2.2"	2 1/4"
145T	1 1/2-2	1	3/4	2.4"	4 1/4"	2.4"	2 1/4"
182T	3	1 1/2	1	2.4"	5 1/4"	2.4"	2 3/4"
184T	–	2	1 1/2	2.4"	5 1/4"	2.4"	2 3/4"
184T	5	–	–	3.0"	5 1/4"	3.0"	2 3/4"
213T	7 1/2	3	2	3.0"	6 1/2"	3.0"	3 3/8"
215T	–	5	3	3.0"	6 1/2"	3.0"	3 3/8"
215T	10	–	–	3.8"	6 1/2"	3.8"	3 3/8"
254T	–	7 1/2	5	3.8"	7 3/4"	3.8"	4"
254T	15	–	–	4.4"	7 3/4"	4.4"	4"
256T	–	10	7 1/2	4.4"	7 3/4"	4.4"	4"
256T	20	–	–	4.6"	7 3/4"	4.4"	4"
284T	–	15	10	4.6"	9"	4.4"	4 5/8"
284T	25	–	–	5.0"	9"	4.4"	4 5/8"
286T	30	20	15	5.4"	9"	5.2"	4 5/8"
324T	40	25	20	6.0"	10 1/4"	6.0"	5 1/4"
326T	50	30	25	6.8"	10 1/4"	6.8"	5 1/4"
364T	–	40	30	6.8"	11 1/2"	6.8"	5 7/8"
364T	60	–	–	7.4"	11 1/2"	7.4"	5 7/8"
365T	–	50	40	8.2"	11 1/2"	8.2"	5 7/8"
365T	75	–	–	9.0"	11 1/2"	8.6"	5 7/8"
404T	–	60	–	9.0"	14 1/4"	8.0"	7 1/4"
404T	–	–	50	9.0"	14 1/4"	8.4"	7 1/4"
404T	100	–	–	10.0"	14 1/4"	8.6"	7 1/4"
405T	–	75	60	10.0"	14 1/4"	10.0"	7 1/4"
405T	100	–	–	10.0"	14 1/4"	8.6"	7 1/4"
405T	125	–	–	11.5"	14 1/4"	10.5"	7 1/4"
444T	–	100	–	11.0"	16 3/4"	10.0"	8 1/2"
444T	–	–	75	10.5"	16 3/4"	9.5"	8 1/2"
444T	125	–	–	11.0"	16 3/4"	9.5"	8 1/2"
444T	150	–	–	–	–	10.5"	8 1/2"
445T	–	125	–	12.5"	16 3/4"	12.0"	8 1/2"
445T	–	–	100	12.5"	16 3/4"	12.0"	8 1/2"
445T	150	–	–	–	–	10.5"	8 1/2"
445T	200	–	–	–	–	13.2"	8 1/2"
447T	200	–	–	–	–	13.2"	8 1/2"

V-BELT DRIVES – CLASSICAL

SELECTION OF A V-BELT CROSS- SECTION

Design HP	Motor RPM		
	1800	1200	900 & Below
1 to 2	A	A	A
2 to 7	A	A	A or B
7 to 20	A	A	B
20 to 100	B or C	B or C	B or C
100 and over	C	C or D	C or D

SERVICE FACTORS

Fans to 10 HP	1.2 – 1.3
Fans over 10 HP	1.3 – 1.4
Belt Conveyors	1.3 – 1.4
Revolving & Vibrating Screws	1.3 – 1.4
Piston Compressors	1.5 – 1.6
Conveyors (Drag, Pan, Screw)	1.5 – 1.6
Crushers (Gyratory–Jaw–Roll)	1.6 – 1.8

RECOMMENDED SHEAVE SIZE

Section	Minimum Pitch Diameter	Maximum Pitch Diameter
A	3.0"	Sheaves with rim speed in excess of 5000 ft/ min. should be dynamically balanced. Do not exceed 6000 ft/min.
B	5.4"	
C	9.0"	
D	13.0"	

Courtesy T.B.WOODS, INC., Chambersburg, Pennsylvania

STEP 1.

Design Horsepower = (motor or engine rating) × service factor.

STEP 2.

Corrected HP/Belt = Rated HP × Arc Corr. Factor × Length Corr. Factor.

STEP 3.

Number Belts Required = Design HP divided by corrected HP/Belt.

ARC OF CONTACT CORRECTION FACTOR

$$\text{Arc of Contact} = 180 - \frac{(D - d)\ 60}{C}$$

Arc	180	170	160	150	140	130	120	110
Factor	1.00	.97	.95	.93	.89	.86	.82	.79

LENGTH CORRECTION FACTOR

Length	Cross-Section			
	A	B	C	D
42"	.90	.85		
68"	1.00	.95	.85	
90"	1.06	1.00	.91	
120"	1.13	1.07	.97	.86
180"		1.16	1.05	.94
300"		1.27	1.16	1.05
480"				1.16
660"				1.23

HORSEPOWER RATING — CLASSICAL

Belt Section	RPM of Faster Shaft	Small Sheave Pitch Diameter					Additional Horsepower for Speed Ratio			
		3.0	**3.4**	**3.8**	**4.4**	**5.0**	1.00–1.01	1.10–1.14	1.30–1.49	2.0 & Over
	1,100	1.45	1.90	2.34	3.0	3.64	0.01	0.11	0.22	0.28
A	1,160	1.62	2.13	2.63	3.37	4.10	0.01	0.13	0.25	0.33
	1,750	2.13	2.86	3.57	4.61	5.61	0.01	0.19	0.38	0.49
		5.4	**6.0**	**6.6**	**7.0**	**8.0**				
	1,000	5.07	6.06	7.03	7.67	9.24	0.01	0.21	0.40	0.53
B	1,160	5.66	6.78	7.87	8.59	10.3	0.01	0.24	0.47	0.61
	1,750	7.50	9.00	10.5	11.4	13.6	0.02	0.36	0.70	0.92
		9.0	**10.0**	**11.0**	**12.0**	**13.0**				
	1,000	14.0	16.4	18.8	21.1	23.4	0.03	0.48	0.94	1.23
C	1,160	15.0	18.2	20.8	23.3	25.6	0.03	0.56	1.09	1.42
	1,750	19.3	22.5	25.3	27.9	30.0	0.05	0.85	1.64	2.15
		13.0	**15.0**	**18.0**	**22.0**	**24.0**				
	1,000	30.7	38.5	48.7	59.6	63.6	0.10	1.78	3.45	4.51
D	1,160	32.8	40.8	50.8	59.8*	62.2*	0.11	2.06	4.00	5.23
	1,750	32.6	37.9*	39.5*	–	–	0.17	3.11	6.03	7.89

* Made-to-order ductile iron sheaves required.

Courtesy of T.B. WOODS, INC., Chambersburg, Pennsylvania

V-BELT DRIVES — NARROW (ULTRA-V)

SELECTION OF A V-BELT CROSS- SECTION

Design HP	Motor RPM		
	1800	1200	900 & Below
1 to 2	3V	3V	3V
2 to 7	3V	3V	3V
7 to 20	3V	3V	3V or 5V
20 to 100	3V or 5V	3V or 5V	3V, 5V or 8V
100 and over	5V	5V or 8V	5V or 8V

SERVICE FACTORS

Fans to 10 HP	1.1 – 1.3
Fans over 10 HP	1.2 – 1.4
Belt Conveyors	1.2 – 1.4
Revolving & Vibrating Screws	1.2 – 1.4
Piston Compressors	1.3 – 1.6
Conveyors (Drag, Pan, Screw)	1.3 – 1.6
Crushers (Gyratory–Jaw–Roll)	1.4 – 1.8

RECOMMENDED SHEAVE SIZE

Section	Minimum Pitch Diameter	Maximum Pitch Diameter
3V 5V 8V	2.8" 4.4" 12.5"	Sheaves with rim speed in excess of 5000 ft/ min. should be dynamically balanced. Do not exceed 6000 ft/min.

Courtesy of T.B. WOODS, INC., Chambersburg, Pennsylvania

STEP 1.
Design Horsepower = (motor or engine rating) × service factor.

STEP 2.
Corrected HP/Belt = Rated HP × Arc Corr. Factor × Length Corr. Factor.

STEP 3.
Number Belts Required = Design HP diveded by corrected HP/Belt.

ARC OF CONTACT CORRECTION FACTOR

$$\text{Arc of Contact} = 180 - \frac{(D - d)\ 60}{C}$$

Arc	180	170	160	150	140	130	120	110
Factor	1.00	.97	.95	.93	.89	.86	.82	.79

LENGTH CORRECTION FACTOR

Length	Cross-Section		
	3V	5V	8V
25"	.83	–	–
40"	.92	–	–
50"	.96	.85	–
60"	.99	.88	–
75"	1.03	.92	–
90"	1.07	.95	–
125"	1.13	1.00	.90
160"	–	1.04	.94
200"	–	1.08	.97
250"	–	1.11	1.00
300"	–	1.14	1.02
400"	–	–	1.07
500"	–	–	1.10

HORSEPOWER RATING — NARROW (ULTRA-V)

Belt Section	RPM of Faster Shaft	Small Sheave Pitch Diameter					Additional Horsepower for Speed Ratio			
		3.0	**3.35**	**4.5**	**5.0**	**6.0**	1.00–1.01	1.10–1.14	1.30–1.49	2.0 & Over
3V	1,000	1.75	2.10	3.25	3.74	4.71	0.00	0.07	0.13	0.18
	1,160	1.99	2.39	3.71	4.27	5.38	0.00	0.08	0.16	0.20
	1,750	2.84	3.43	5.33	6.14	7.71	0.01	0.12	0.23	0.31
		9.0	**10.0**	**11.0**	**12.0**	**13.0**				
5V	1,000	15.3	17.8	20.2	22.6	24.9	0.02	0.46	0.89	1.16
	1,160	17.2	20.0	22.8	25.4	27.9	0.03	0.53	1.03	1.35
	1,750	23.4	27.0	30.4	33.5	36.4	0.04	0.80	1.55	2.03
		14.0	**16.0**	**18.0**	**20.0**	**24.8**				
8V	1,000	48.9	60.3	71.0	80.9	101.1	0.12	2.23	4.32	5.65
	1,160	53.8	66.0	77.1	87.1	105.4*	0.14	2.58	5.01	6.56
	1,750	63.0	74.3*	82.1*	86.1*	–	0.21	3.89	7.56	9.90

* Made-to-order ductile iron sheaves required.
Courtesy of T.B. WOODS, INC., Chambersburg, Pennsylvania

IDENTIFYING CODE LETTERS ON ALTERNATING-CURRENT MOTORS

NE Code, NEMA Code Letter	Starting Kva per Horsepower	Branch-circuit Protection in Percent of Motor Full-load Current (From Table 430-152, NE Code 1962)			
		Full- voltage Start		Autotransformer Start	
		Max. Fuse Rating	Max. Breaker Setting †	Max. Fuse Rating	Max. Breaker Setting †
A	0.00 – 3.14	150	150	150	150
B	3.15 – 3.54	250	200	200	200
C	3.55 – 3.99	250	200	200	200
D	4.00 – 4.49	250	200	200	200
E	4.50 – 4.99	250	200	200	200
F	5.00 – 5.59	300	250	250	200
G	5.60 – 6.29	300	250	250	200
H	6.30 – 7.09	300	250	250	200
J	7.10 – 7.99	300	250	250	200
K	8.00 – 8.99	300	250	250	200
L	9.00 – 9.99	300	250	250	200
M	10.00 – 11.19	300	250	250	200
N	11.20 – 12.49	300	250	250	200
P	12.50 – 13.99	300	250	250	200
R	14.00 – 15.99	300	250	250	200
S	16.00 – 17.99	300	250	250	200
T	18.00 – 19.99	300	250	250	200
U	20.00 – 22.39	300	250	250	200
V	22.40	300	250	250	200
Wound-rotor motor*		150	150		

* Has no code letter. † Time-limit type.

$$\text{Starting Kva per HP} = \frac{\text{Volts} \times \text{Locked-rotor Amp}}{1000 \times \text{Horsepower}} \times \begin{cases} 1 \text{ for 1-phase} \\ 2 \text{ for 2-phase} \\ 1.732 \text{ for 3-phase} \end{cases}$$

Code letter Usually Applied to Ratings of Motors Normally Started on Full Voltage

Code Letters		F	G	H	J	K	L
Horse-power	3-phase	15 up	10–7 1/2	5	3	2–1 1/2	1
	1-phase	–	5	3	2–1 1/2	1–3/4	1/2

AMPERE RATING OF AC AND DC MOTORS

The full load ampere rating of motors of a given horsepower rating will vary somewhat depending largely upon the type of motor. The full load values listed in the following table can be considered "average values" for the different types and makes of motors. High torque squirrel cage motors will have a full load current at least 10% higher than the full load values listed in the tables. For 25 cycle motors, the full load current value will be approximately that of a 60 cycle motor having the same number of poles. In other words for a 750 RPM, 25 cycle motor, use the data for the corresponding 1800 RPM, 60 cycle motor. This rule is reasonably correct for 25 cycle motors above 500 RPM.

Ampere Ratings of Three Phase, 60 Hertz, AC Induction Motor

HP	Syn. Speed RPM	Current in Amperes					
		200 Volts	230 Volts	380* Volts	460 Volts	575 Volts	2200 Volts
1/4	1800	1.09	.95	.55	.48	.38	–
	1200	1.61	1.40	.81	.70	.56	–
	900	1.84	1.60	.93	.80	.64	–
1/3	1800	1.37	1.19	.69	.60	.48	–
	1200	1.83	1.59	.92	.80	.64	–
	900	2.07	1.80	1.04	.90	.72	–
1/2	1800	1.98	1.72	.99	.86	.69	–
	1200	2.47	2.15	1.24	1.08	.86	–
	900	2.74	2.38	1.38	1.19	.95	–
3/4	1800	2.83	2.46	1.42	1.23	.98	–
	1200	3.36	2.92	1.69	1.46	1.17	–
	900	3.75	3.26	1.88	1.63	1.30	–
1	3600	3.22	2.80	1.70	1.40	1.12	–
	1800	4.09	3.56	2.06	1.78	1.42	–
	1200	4.32	3.76	2.28	1.88	1.50	–
	900	4.95	4.30	2.60	2.15	1.72	–
1 1/2	3600	5.01	4.36	2.64	2.18	1.74	–
	1800	5.59	4.86	2.94	2.43	1.94	–
	1200	6.07	5.28	3.20	2.64	2.11	–
	900	6.44	5.60	3.39	2.80	2.24	–
2	3600	6.44	5.60	3.39	2.80	2.24	–
	1800	7.36	6.40	3.87	3.20	2.56	–
	1200	7.87	6.84	4.14	3.42	2.74	–
	900	9.09	7.90	4.77	3.95	3.16	–
3	3600	9.59	8.34	5.02	4.17	3.34	–
	1800	10.8	9.40	5.70	4.70	3.76	–
	1200	11.7	10.2	6.20	5.12	4.10	–
	900	13.1	11.4	6.90	5.70	4.55	–
5	3600	15.5	13.5	8.20	6.76	5.41	–
	1800	16.6	14.4	8.74	7.21	5.78	–
	1200	18.2	15.8	9.59	7.91	6.32	–
	900	18.3	15.9	9.60	7.92	6.33	–
7 1/2	3600	22.4	19.5	11.8	9.79	7.81	–
	1800	24.7	21.5	13.0	10.7	8.55	–
	1200	25.1	21.8	13.2	10.9	8.70	–
	900	26.5	23.0	13.9	11.5	9.19	–
10	3600	29.2	25.4	15.4	12.7	10.1	–
	1800	30.8	26.8	16.3	13.4	10.7	–
	1200	32.2	28.0	16.9	14.0	11.2	–
	900	35.1	30.5	18.5	15.2	12.2	–
15	3600	41.9	36.4	22.0	18.2	14.5	–
	1800	45.1	39.2	23.7	19.6	15.7	–
	1200	47.6	41.4	25.0	20.7	16.5	–
	900	51.2	44.5	26.9	22.2	17.8	–

*380V. 50 hz.

Ampere Ratings of Three Phase, 60 Herts, AC Induction Motor

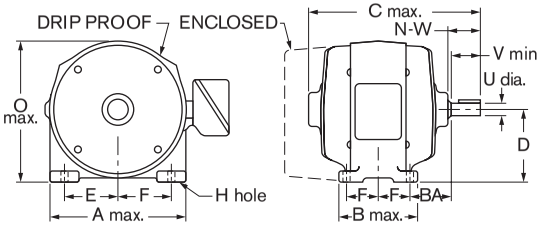
HP	Syn. Speed RPM	Current in Amperes					
		200 Volts	230 Volts	380* Volts	460 Volts	575 Volts	2200 Volts
20	3600	58.0	50.4	30.5	25.2	20.1	–
	1800	58.9	51.2	31.0	25.6	20.5	–
	1200	60.7	52.8	31.9	26.4	21.1	–
	900	63.1	54.9	33.2	27.4	21.9	–
25	3600	69.9	60.8	36.8	30.4	24.3	–
	1800	74.5	64.8	39.2	32.4	25.9	–
	1200	75.4	65.6	39.6	32.8	26.2	–
	900	77.4	67.3	40.7	33.7	27.0	–
30	3600	84.8	73.7	44.4	36.8	29.4	–
	1800	86.9	75.6	45.7	37.8	30.2	–
	1200	90.6	78.8	47.6	39.4	31.5	–
	900	94.1	81.8	49.5	40.9	32.7	–
40	3600	111	96.4	58.2	48.2	38.5	–
	1800	116	101	61.0	50.4	40.3	–
	1200	117	102	61.2	50.6	40.4	–
	900	121	105	63.2	52.2	41.7	–
50	3600	138	120	72.9	60.1	48.2	–
	1800	143	124	75.2	62.2	49.7	–
	1200	145	126	76.2	63.0	50.4	–
	900	150	130	78.5	65.0	52.0	–
60	3600	164	143	86.8	71.7	57.3	–
	1800	171	149	90.0	74.5	59.4	–
	1200	173	150	91.0	75.0	60.0	–
	900	177	154	93.1	77.0	61.5	–
75	3600	206	179	108	89.6	71.7	–
	1800	210	183	111	91.6	73.2	–
	1200	212	184	112	92.0	73.5	–
	900	222	193	117	96.5	77.5	–
100	3600	266	231	140	115	92.2	–
	1800	271	236	144	118	94.8	23.6
	1200	275	239	145	120	95.6	24.2
	900	290	252	153	126	101	24.8
125	3600	–	292	176	146	116	–
	1800	–	293	177	147	117	29.2
	1200	–	298	180	149	119	29.9
	900	–	305	186	153	122	30.9
150	3600	–	343	208	171	137	–
	1800	–	348	210	174	139	34.8
	1200	–	350	210	174	139	35.5
	900	–	365	211	183	146	37.0
200	3600	–	458	277	229	184	–
	1800	–	452	274	226	181	46.7
	1200	–	460	266	230	184	47.0
	900	–	482	279	241	193	49.4
250	3600	–	559	338	279	223	–
	1800	–	568	343	284	227	57.5
	1200	–	573	345	287	229	58.5
	900	–	600	347	300	240	60.5
300	1800	–	678	392	339	271	69.0
	1200	–	684	395	342	274	70.0
400	1800	–	896	518	448	358	91.8
500	1800	–	1110	642	555	444	116

*380V. 50hz.

ELECTRIC MOTOR CROSS-REFERENCE
"U-FRAME" TO "T-FRAME"

	3600 RPM		1800 RPM		1200 RPM		900 RPM	
HP	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW
DRIPPROOF								
1/2	–	–	–	–	–	–	182	143T
3/4	–	–	–	–	182	143T	184	145T
1	–	–	182	143T	184	145T	213	182T
1 1/2	182	143T	184	145T	184	182T	213	184T
2	184	145T	184	145T	213	184T	215	213T
3	184	145T	213	182T	215	213T	254U	215T
5	213	182T	215	184T	254U	215T	256U	254T
7 1/2	215	184T	254U	213T	256U	254T	284U	256T
10	254U	213T	256U	215T	284U	256T	286U	284T
15	256U	215T	284U	254T	324U	284T	326U	286T
20	284U	254T	286U	256T	326U	286T	364U	324T
25	286U	256T	324U	284T	364U	324T	365U	326T
30	324	284T	326U	286T	365U	326T	404U	364T
40	326	286T	364U	324T	404U	364T	405U	365T
50	364U	324T	365U	326T	405U	365T	444U	404T
60	365U	326T	404U	364T	444U	404T	445U	405T
75	404U	364T	405U	365T	445U	405T	8143	444T
100	405U	365T	444U	404T	8143	444T	8143	445T
125	444U	404T	445U	405T	8143	445T	–	–
150	445U	405T	8143S	444T	–	–	–	–
200	8143	444T	8143S	444T	–	–	–	–
250	8155	445T	–	–	–	–	–	–
ENCLOSED								
1/2	–	–	–	–	–	–	182	143T
3/4	–	–	–	–	182	143T	184	145T
1	–	–	182	143T	184	145T	213	182T
1 1/2	182	143T	184	145T	184	182T	213	184T
2	184	145T	184	148T	213	184T	215	213T
3	184	182T	213	182T	215	213T	254U	215T
5	213	184T	215	184T	254U	215T	256U	254T
7 1/2	215	213T	254U	213T	256U	254T	284U	256T
10	254U	215T	256U	215T	284U	256T	286U	284T
15	256U	254T	284U	254T	324U	284T	326U	286T
20	286U	256T	286U	256T	326U	286T	364U	324T
25	324U	284T	324U	284T	364U	324T	365U	326T
30	326	286T	326U	286T	365U	326T	404U	364T
40	364U	324T	364U	324T	404U	364T	405U	365T
50	365U	326T	365U	326T	405U	365T	444U	404T
60	405U	364T	405U	364T	444U	404T	445U	405T
75	444U	365T	444U	365T	445U	405T	8144	444T
100	445U	405T	445U	405T	8144	444T	8144	445T
125	8144	444T	8144	444T	8144	445T	–	–
150	8144	445T	8144	445T	–	–	–	–

DIAGRAM FOR PAGE 205



Frame	3600 RPM		1800 RPM		1200 RPM		900 RPM	
	U	T	U	T	U	T	U	T
HP	**DRIP PROOF (Pounds)**							
1/2	–	–	–	–	–	–	52	32
3/4	–	–	–	–	52	32	62	38
1	–	–	52	30	57	34	97	56
1 1/2	52	28	57	32	62	52	104	65
2	57	32	62	36	97	56	111	120
3	62	36	97	56	111	113	163	134
5	97	65	111	70	163	127	189	169
7 1/2	111	75	163	127	189	169	248	214
10	163	127	189	141	248	196	293	263
15	189	148	248	187	349	263	380	335
20	248	193	293	211	380	314	534	419
25	293	214	349	263	534	389	585	480
30	349	256	380	300	585	420	730	571
40	380	314	523	409	700	571	815	648
50	523	369	573	460	785	648	1,100	794
60	573	400	700	560	1,080	732	1,265	879
75	730	574	785	648	1,207	833	1,370	1,100
100	815	636	1,120	812	1,460	1,330	1,430	1,361
125	1,080	808	1,283	926	1,400	1,381	–	–
150	1,207	895	1,450	1,255	–	–	–	–
200	1,660	1,195	1,510	1,457	–	–	–	–
250	1,880	1,371	–	–	–	–	–	–
HP	**ENCLOSED (Pounds)**							
1/2	–	–	–	–	–	–	63	32
3/4	–	–	–	–	63	32	73	38
1	–	–	63	30	68	34	122	56
1 1/2	63	28	68	32	73	52	129	65
2	68	32	73	36	122	56	136	141
3	73	56	122	56	136	134	182	155
5	122	65	136	70	182	148	209	228
7 1/2	146	141	182	148	221	228	318	279
10	188	148	209	176	318	260	388	352
15	227	240	318	252	465	355	540	426
20	328	266	358	303	540	412	690	515
25	445	335	465	355	690	515	788	620
30	460	366	540	410	788	560	912	766
40	683	465	743	555	912	790	1,044	890
50	743	550	813	620	967	888	1,347	1,054
60	967	734	1,012	780	1,330	1,026	1,463	1,172
75	1,365	845	1,365	901	1,528	1,142	2,500	1,501
100	1,528	1,079	1,528	1,122	2,540	1,580	2,620	1,749
125	2,500	1,480	2,600	1,500	2,600	1,702	–	–
150	2,550	1,586	2,700	1,728	–	–	–	–
200	2,900	2,130	3,020	2,090	–	–	–	–
250	3,590	2,170	–	–	–	–	–	–

DIMENSIONS AND TOLERANCES
ELECTRIC MOTOR FRAMES

Frame No.	A-max.	B-max.	BA	C drip.	C encl.	D	E	F	H	N-W	O drip.	O encl.	U	V. min
182	8 3/4	6	2 3/4	12 5/16	14 3/16	4 1/2	3 3/4	2 1/4	13/32	2 1/4	9	9 1/4	7/8	2
143T	6 7/8	5 7/8	2 1/4	11 9/16	12 1/16	3 1/2	2 3/4	2	11/32	2 1/4	7 1/8	7 1/8	7/8	2
145T	6 7/8	5 7/8	2 1/4	12 9/16	13 1/16	3 1/2	2 3/4	2 1/2	11/32	2 1/4	7 1/8	7 1/8	7/8	2
184	8 3/4	6 3/4	2 3/4	13 5/16	15 3/16	4 1/2	3 3/4	2 3/4	13/32	2 1/4	9	9 1/2	7/8	2
182T	8 3/4	6 5/8	2 3/4	13 3/4	14 5/8	4 1/2	3 3/4	2 1/4	13/32	2 3/4	9 1/4	9 1/4	1 1/8	2 1/2
213	10 3/8	7	3 1/2	15 5/8	17 1/2	5 1/4	4 1/4	2 3/4	13/32	3	10 1/2	10 3/4	1 1/8	2 3/4
184T	8 3/4	6 5/8	2 3/4	14 3/4	15 5/8	4 1/2	3 3/4	2 3/4	13/32	2 3/4	9 1/4	9 1/4	1 1/8	2 1/2
215	10 3/8	8 1/2	3 1/2	17 1/8	18 15/16	5 1/4	4 1/4	3 1/2	13/32	3	10 1/2	10 3/4	1 1/8	2 3/4
213T	10 1/4	6 7/8	3 1/2	15 15/16	17 3/4	5 1/4	4 1/4	2 3/4	13/32	3 3/8	10 3/8	11 1/4	1 3/8	3 1/8
254U	12 1/2	10	4 1/4	20 5/16	21 9/16	6 1/4	5	4 1/8	17/32	3 3/4	12 5/8	13 1/8	1 3/8	3 1/2
215T	10 1/4	8 3/8	3 1/2	17 7/16	19 1/4	5 1/4	4 1/4	3 1/2	13/32	3 3/8	10 3/8	11 1/4	1 3/8	3 1/8
256U	12 1/2	12	4 1/4	22 1/16	23 5/16	6 1/4	5	5	17/32	3 3/4	12 5/8	13 1/8	1 3/8	3 1/2
254T	12 1/2	10	4 1/4	20 9/16	21 13/16	6 1/4	5	4 1/8	17/32	4	12 5/8	13 1/2	1 5/8	3 3/4
284U	14	11 3/8	4 3/4	23 11/16	24 13/16	7	5 1/2	4 3/4	17/32	4 7/8	14	14 5/8	1 5/8	4 5/8
256T	12 1/2	11 3/4	4 1/4	22 5/16	23 9/16	6 1/4	5	5	17/32	4	12 5/8	13 1/2	1 5/8	3 3/4
286U	14	13	4 3/4	25 3/16	26 5/16	7	5 1/2	5 1/2	17/32	4 7/8	14	14 5/8	1 5/8	4 5/8
284T	14	11 3/8	4 3/4	23 7/16	24 9/16	7	5 1/2	4 3/4	17/32	4 5/8	14	14 5/8	1 7/8	4 3/8
324U	16	13	5 1/4	26 7/16	27 9/16	8	6 1/4	5 1/4	21/32	5 5/8	16	16 3/4	1 7/8	5 3/8
284TS	14	11 3/8	4 3/4	22 1/16	23 3/16	7	5 1/2	4 3/4	17/32	3 1/4	14	14 5/8	1 5/8	3
324S	16	13	5 1/4	24 1/16	25 3/16	8	6 1/4	5 1/4	21/32	3 1/4	16	16 3/4	1 5/8	3
284TS	14	11 3/8	4 3/4	22 1/16	23 3/16	7	5 1/2	4 3/4	17/32	3 1/4	14	14 5/8	1 5/8	3
326U	16	14 1/4	5 1/4	27 15/16	29 1/16	8	6 1/4	6	21/32	5 5/8	16	16 3/4	1 7/8	5 3/8
286T	14	12 7/8	4 3/4	24 15/16	26 1/16	7	5 1/2	5 1/2	17/32	4 5/8	14	14 5/8	1 7/8	4 3/8
326S	16	14 1/4	5 1/4	25 9/16	26 11/16	8	6 1/4	6	21/32	3 1/4	16	16 3/4	1 5/8	3
286TS	14	12 7/8	4 3/4	23 9/16	24 11/16	7	5 1/2	5 1/2	17/32	3 1/4	14	14 5/8	1 5/8	3
364U	18	14	5 7/8	29 3/16	33 9/16	9	7	5 5/8	21/32	6 3/8	18 1/4	18 3/4	2 1/8	6 1/8
324T	16	12 3/4	5 1/4	26 1/16	27 3/16	8	6 1/4	5 1/4	21/32	5 1/4	16	16 3/4	2 1/8	5
364US	18	14	5 7/8	26 9/16	30 15/16	9	7	5 5/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
324TS	16	12 3/4	5 1/4	24 9/16	25 11/16	8	6 1/4	5 1/4	21/32	3 3/4	16	16 3/4	1 7/8	3 1/2
365U	18	15	5 7/8	30 3/16	34 9/16	9	7	6 1/8	21/32	6 3/8	18 1/4	18 3/4	2 1/8	6 1/8
326T	16	14 1/4	5 1/4	27 9/16	28 11/16	8	6 1/4	6	21/32	5 1/4	16	16 3/4	2 1/8	5
365US	18	15	5 7/8	27 9/16	31 15/16	9	7	6 1/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
326TS	16	14 1/4	5 1/4	26 1/16	27 3/16	8	6 1/4	6	21/32	3 3/4	16	16 3/4	1 7/8	3 1/2
404U	20	15 1/4	6 5/8	32 7/16	37 1/16	10	8	6 1/8	13/16	7 1/8	20 1/4	20 7/8	2 3/8	6 7/8
364T	18	13 3/4	5 7/8	28 11/16	33 1/16	9	7	5 5/8	21/32	5 7/8	18 1/4	18 3/4	2 3/8	5 5/8
404US20		15 1/4	6 5/8	29 9/16	34 3/16	10	8	6 1/8	13/16	4 1/4	20 1/4	20 7/8	2 1/8	4
364TS	18	13 3/4	5 7/8	26 9/16	30 15/16	9	7	5 5/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
365T	18	14 3/4	5 7/8	29 11/16	34 1/16	9	7	6 1/8	21/32	5 7/8	18 1/4	18 3/4	2 3/8	5 5/8
405U	20	17	6 5/8	33 15/16	38 9/16	10	8	6 7/8	13/16	7 1/8	20 1/4	20 7/8	2 3/8	6 7/8
364T	18	13 3/4	5 7/8	28 11/16	33 1/16	9	7	5 5/8	21/32	5 7/8	18 1/4	18 3/4	2 3/8	5 5/8
364TS	18	13 3/4	5 7/8	26 9/16	30 15/16	9	7	5 5/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
405US20		17	6 5/8	31 1/16	35 11/16	10	8	6 7/8	13/16	4 1/4	20 1/4	20 7/8	2 1/8	4
365TS	18	14 3/4	5 7/8	27 9/16	31 15/16	9	7	6 1/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
365T	18	14 3/4	5 7/8	29 11/16	34 1/16	9	7	6 1/8	21/32	5 7/8	18 1/4	18 3/4	2 3/8	5 5/8
444U	22	18	7 1/2	37 15/16	42 3/4	11	9	7 1/4	13/16	8 5/8	22 1/4	23 1/8	2 7/8	8 3/8
404T	20	15 1/4	6 5/8	32 9/16	37 3/16	10	8	6 1/8	13/16	7 1/4	20 1/4	20 7/8	2 7/8	7
365TS	18	14 3/4	5 7/8	27 9/16	31 15/16	9	7	6 1/8	21/32	3 3/4	18 1/4	18 3/4	1 7/8	3 1/2
444US	22	18	7 1/2	33 9/16	38 3/8	11	9	7 1/4	13/16	4 1/4	22 1/4	23 1/8	2 1/8	4
404TS	20	15 1/4	6 5/8	29 9/16	34 3/16	10	8	6 1/8	13/16	4 1/4	20 1/4	20 7/8	2 1/8	4
445U	22	20	7 1/2	39 15/16	44 3/4	11	9	8 1/4	13/16	8 5/8	22 1/4	23 1/8	2 7/8	8 3/8
405T	20	16 3/4	6 5/8	34 1/16	38 7/8	10	8	6 7/8	13/16	7 1/4	20 1/4	20 7/8	2 7/8	7
445US	22	20	7 1/2	35 9/16	40 3/8	11	9	8 1/4	13/16	4 1/4	22 1/4	23 1/8	2 1/8	4
405TS	20	16 3/4	6 5/8	31 1/16	35 11/16	10	8	6 7/8	13/16	4 1/4	20 1/4	20 7/8	2 1/8	4
444T	22	17 3/4	7 1/2	37 13/16	–	11	9	7 1/4	13/16	8 1/2	22 1/4	–	3 3/8	8 1/4
8143	25	22	8 1/2	41 13/16	–	12 1/2	10	8	15/16	10 1/8	25	–	3 3/8	9 7/8
445T	22	19 3/4	7 1/2	39 13/16	–	11	9	8 1/4	13/16	8 1/2	22 1/4	–	3 3/8	8 1/4
444TS	22	17 3/4	7 1/2	34 1/16	–	11	9	7 1/4	13/16	4 3/4	22 1/4	–	2 3/8	4 1/2
8143S	25	22	8 1/2	36 15/16	–	12 1/2	10	8	15/16	5 1/4	25	–	2 5/8	5
445TS	22	19 3/4	7 1/2	36 1/16	–	11	9	8 1/4	13/16	4 3/4	22 1/4	–	2 3/8	4 1/2
444T	22	17 3/4	7 1/2	–	42 5/8	11	9	7 1/4	13/16	8 1/2	–	23 1/8	3 3/8	8 1/4
8144	25	21	8 1/2	–	49 5/8	12 1/2	10	8	15/16	10 1/8	–	27 1/4	3 3/8	9 7/8
445T	22	19 3/4	7 1/2	–	44 5/8	11	9	8 1/4	13/16	8 1/2	–	23 1/8	3 3/8	8 1/4
444TS	22	17 3/4	7 1/2	–	38 7/8	11	9	7 1/4	13/16	4 3/4	–	23 1/8	2 3/8	4 1/2
8144S	25	21	8 1/2	–	44 3/4	12 1/2	10	8	15/16	5 1/4	–	27 1/4	2 5/8	5
445TS	22	19 3/4	7 1/2	36 1/16	40 7/8	11	9	8 1/4	13/16	4 3/4	22 1/4	23 1/8	2 3/8	4 1/2
8155S	25	23	8 1/2	40 7/16	–	12 1/2	10	9	15/16	5 3/4	25	–	2 7/8	5 1/2

NOTE: The first two numbers of the Nema frame size divided by 4 equals height of centerline of motor shaft, e.g. frame 145T = 14÷4 = 3.5 inches or dimension D.

ELECTRICAL CONDUIT DATA

MAXIMUM NUMBER OF CONDUCTORS IN TRADE SIZES OF CONDUIT OR TUBING (From National Electrical Code)

Types RF-2, RFH-2, R, RH, RW, RH-RW, RHW, RHH, RU, RUH, RUW, SF, SFF, TF, T, TW AND THW.

Size A W G or MCM	Maximum No. of Conductors in Conduit or Tubing Based Upon Conductor Fill for New York and Re-Wiring											
	1/2 In.	3/4 In.	1 In.	1 1/4 In.	1 1/2 In.	2 In.	2 1/2 In.	3 In.	3 1/2 In.	4 In.	5 In.	6 In.
18	7	12	20	35	49	80	115	176	–	–	–	–
16	6	10	17	30	41	68	98	150	–	–	–	–
14	4	6	10	18	25	41	58	90	121	155	–	–
12	3	5	8	15	21	34	50	76	103	132	208	
10	1	4	7	13	17	29	41	64	86	110	173	
8	1	3	4	7	10	17	25	38	52	67	105	152
6	1	1	3	4	6	10	15	23	32	41	64	93
4	1	1	1	3*	5	8	12	18	24	31	49	72
3	–	1	1	3	4	7	10	16	21	28	44	63
2	–	1	1	3	3	6	9	14	19	24	38	55
1	–	1	1	1	3	4	7	10	14	18	29	42
0	–	–	1	1	2	4	6	9	12	16	25	37
00	–	–	1	1	1	3	5	8	11	14	22	32
000	–	–	1	1	1	3	4	7	9	12	19	27
0000	–	–	–	1	1	2	3	6	8	10	16	23
250	–	–	–	1	1	1	3	5	6	8	13	19
300	–	–	–	1	1	1	3	4	5	7	11	16
350	–	–	–	1	1	1	1	3	5	6	10	15
400	–	–	–	–	1	1	1	3	4	6	9	13
500	–	–	–	–	1	1	1	3	4	5	8	11
600	–	–	–	–	–	1	1	1	3	4	6	9
700	–	–	–	–	–	1	1	1	3	3	6	8
750	–	–	–	–	–	1	1	1	3	3	5	8
800	–	–	–	–	–	1	1	1	2	3	5	7
900	–	–	–	–	–	1	1	1	1	3	4	7
1000	–	–	–	–	–	1	1	1	1	3	4	6

* Where and existing service run of conduit or electrical metallic tubing does not exceed 50 ft. in length and does not contain more than the equivalent of two quarter bends from end to end, two No. 4 insulated and one No. 4 bare conductors may be installed in 1-inch conduit or tubing.

See National Electric Code for derating factors for more than 3 conductors.

CONVERSION TABLE, LINEAR FEET TO MILES

1 to 9		10 to 90		100 to 900	
Feet	Miles	Feet	Miles	Feet	Miles
1	0.00019	10	0.00189	100	0.01894
2	0.00038	20	0.00379	200	0.03788
3	0.00057	30	0.00568	300	0.05682
4	0.00076	40	0.00758	400	0.07576
5	0.00095	50	0.00947	500	0.09470
6	0.00114	60	0.01136	600	0.11364
7	0.00133	70	0.01326	700	0.13258
8	0.00152	80	0.01515	800	0.15152
9	0.00170	90	0.01705	900	0.17046

1,000 to 9,000		10,000 to 90,000	
Feet	Miles	Feet	Miles
1,000	0.18939	10,000	1.8939
2,000	0.37879	20,000	3.7879
3,000	0.56818	30,000	5.6818
4,000	0.75758	40,000	7.5758
5,000	0.94697	50,000	9.4697
6,000	1.13636	60,000	11.3636
7,000	1.32576	70,000	13.2576
8,000	1.51515	80,000	15.1515
9,000	1.70455	90,000	17.0455

RECOMMENDED MAXIMUM TORQUE VALUE ±5%

Identification Mark														
Grade			2			5			7			8		
ASTM/SAE Spec.			SAE J429			ASTM A449			SAE J429			ASTM A354		
ISO Designation			R898 Class 4.6			R898 Class 8.8			–			R898 Class 10.9		
			Torque**		Clamp* Load	Torque**		Clamp* Load	Torque**		Clamp* Load	Torque**		Clamp* Load
Dia.	Thr'd.	Series	Dry	Lube		Dry	Lube		Dry	Lube		Dry	Lube	
1/4	20	UNC	5	4	1.31	8	6	2.02	10	8	2.49	12	9	2.86
1/4	28	UNF	6	5	1.50	10	7	2.31	12	9	2.85	14	11	3.26
5/16	18	UNF	11	8	2.16	17	13	3.33	21	16	4.11	24	18	4.70
5/16	24	UNF	13	10	2.39	19	15	3.69	24	18	4.56	27	21	5.21
3/8	16	UNC	20	15	3.19	31	24	4.93	38	29	6.08	44	34	6.95
3/8	24	UNF	23	17	3.61	35	27	5.58	43	33	6.90	49	38	7.88
7/16	14	UNC	32	25	4.37	49	38	6.76	61	47	8.35	70	54	9.55
7/16	20	UNF	36	27	4.89	55	42	7.55	68	52	9.33	78	60	10.68
1/2	13	UNC	49	38	5.83	75	58	9.03	93	72	11.15	105	82	12.75
1/2	20	UNF	55	42	6.59	85	65	10.20	105	80	12.58	120	90	14.38
9/16	12	UNC	70	54	7.07	110	84	11.58	135	105	14.30	155	120	16.35
9/16	18	UNF	78	60	7.90	120	93	12.93	150	115	15.95	170	132	18.25
5/8	11	UNC	92	71	8.79	150	115	14.40	185	145	17.75	210	165	20.30
5/8	18	UNF	105	81	9.95	170	130	16.30	210	160	20.10	240	185	23.00
3/4	10	UNC	165	125	13.20	270	205	21.31	330	250	26.30	375	290	30.00
3/4	16	UNF	180	140	14.52	295	230	23.75	365	280	29.30	430	320	33.50
7/8	9	UNC	200	155	13.82	395	305	27.00	530	405	36.30	605	455	41.50
7/8	14	UNF	225	170	15.25	435	335	29.80	585	450	40.00	670	515	45.80
1	8	UNC	300	230	18.15	590	455	35.40	795	610	47.70	905	695	54.50
1	12	UNF	340	260	20.35	660	510	39.70	890	685	53.50	1030	785	61.20
1 1/8	7	UNC	430	330	22.85	795	610	42.30	1125	865	60.00	1285	990	68.70
1 1/8	12	UNF	480	370	25.60	890	685	47.50	1260	970	67.30	1440	1110	77.00
1 1/4	7	UNC	605	465	29.00	1120	860	53.80	1590	1225	76.30	1820	1400	87.20
1 1/4	12	UNF	670	515	32.10	1240	955	59.59	1765	1355	84.40	2010	1550	96.50
1 3/8	6	UNC	795	610	34.60	1470	1130	64.20	2085	1600	91.00	2380	1830	104.00
1 3/8	12	UNF	905	670	39.40	1670	1290	73.00	2370	1830	103.50	2710	2085	118.30
1 1/2	6	UNC	1050	810	42.20	1950	1500	78.00	2765	2130	110.80	3160	2430	126.50
1 1/2	12	UNF	1186	915	47.30	2190	1690	87.70	3110	2400	124.50	3555	2730	142.20
1 3/4	5	UNC	1660	1280	56.80	3075	2370	105.50	4370	3360	149.50	4980	3810	171.00
2	4 1/2	UNC	2500	1920	75.00	4620	3550	138.50	6550	5050	196.70	7480	5760	225.00

* Clamp loads are shown in 1000 pounds ** All torque values are given in foot-pounds

MISCELLANEOUS INFORMATION

Freezing point of water = 32° F = 0° C

Boiling point of water at atmospheric pressure = 212° F = 100° C

Absolute zero = −459.7° F = −273.2° C

$C^\circ = \frac{5}{9}(F^\circ - 32^\circ)$

$F^\circ = \frac{9}{5}(C^\circ + 32^\circ)$

1 hp = 550 ft. lbs/sec. = 33,000 ft. lbs/min.

1 hp = 2544 BTU's/hr.

1 hp = 745.5 watts = .7455 Kilowatts

1 BTU = 778.26 ft. lbs.

1 $ft.^3$ of water at 39.2° F and atmospheric pressure = 62.428 lbs.

1 $ft.^3$ of water at 60° F and atmospheric pressure = 62.30 lbs.

1 $ft.^3$ of water at 212° F and atmospheric pressure = 59.38 lbs.

Approximate heat capacity of superheated steam at atmospheric pressure = 0.47 BTU/lb./° F

Total heat of saturated steam at atmospheric pressure = 1150.4 BTU's

$\pi = 3.1416$ = ratio of circumference of circle to diameter ($C \div d$) = ratio of area of circle to square of radius ($A \div r^2$)

Circumference of circle = diameter × π ($C = \pi d$)

Diameter of circle = circumference × 0.31831

$$\left(d = 0.31831C = \frac{C}{\pi}\right)$$

Area of circle = square of diameter × 0.7854

$$\left(A = 0.7854d^2 = \frac{\pi}{4}d^2 = \pi r^2\right)$$

Doubling diameter of circle increases its area four times ($4A = 0.7854(2d)^2$)

Area of rectangle = length × width ($A = lw$)

Area of triangle = base × $^1/_2$ perpendicular height ($A = {}^1/_2bh$)

Volume of cone = area of base × $^1/_3$ perpendicular height ($V = {}^1/_3BH$)

1 Kilowatt = 1.341 HP

WEIGHTS AND MEASURES

WEIGHTS

Troy Weight (for gold, silver and jewels)

24 grains = 1 pennyweight (pwt.) — 20 pwt. = 1 ounce
12 ounces = 1 pound — 3,086 grains = 1 carat

Apothecaries Weight

20 grains = 1 scruple — 3 scruples = 1 dram
8 drams = 1 ounce — 12 ounces = 1 pound
The ounce and pound are the same as in Troy Weight.

Avoirdupois Weight

1 grain (Troy) = 1 grain (Apoth.) = 1 grain (Avdp.)
$27^{11}/_{32}$ grains = 1 dram — 16 drams = 1 ounce
16 ounces = 1 pound (lb.) — 25 pounds = 1 quarter
4 quarters = 1 hundredweight (cwt.)
2000 pounds = 1 short ton — 2240 pounds = 1 long ton
The long ton is also called the British ton.

Emergency Weights

Coin, U.S.	Wt. Grains	Wt. Grams
Cent	50	$3^1/_2$
Nickel	80	5
Dime	40	$2^1/_2$
Quarter	100	$6^1/_2$
Half-dollar	200	13
Silver Dollar	400	16

Metric Equivalents

1 ounce = 28.35 grams — 1 gram = .03527 ounce
1 pound = .4536 kilogram — 1 kilogram = 2.2046 lbs.

Miscellaneous Equivalents

pounds × .453 = kilograms
pounds × .0004464 = long tons
pounds × .0004536 = metric tons
long tons × 1.01605 = metric tons
metric tons × 1.10231 = short tons
short tons × 907.185 = kilograms
kg. per $cm.^2$ × 14.223 = lbs. per $in.^2$

kilograms × 2.2046 = pounds
long tons × 1016.05 = kilograms
metric tons × .98421 = long tons
long tons × 1.120 = short tons
short tons × .8928 = long tons
short tons × .907185 = metric tons
lbs. per $in.^2$ × .0703 = kg. per $cm.^2$

WEIGHTS AND MEASURES
MEASURES

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
36 bushels = 1 chaldron
1 bushel = 1.2445 $ft.^3$
1 quart = 67.2 $in.^3$

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
$31\frac{1}{2}$ gallons = barrel
2 barrels = 1 hogshead
1 gallon = 231 $in.^3$
1 British Imperial gallon = 1.2 U.S. gallons
1 $ft.^3$ water = 7.48 gallons = 62.321 pounds

Linear Measure

12 inches = 1 foot
3 feet = 1 yard
$5\frac{1}{2}$ yards = 1 rod
40 rods = 1 furlong
8 furlongs = 1 statute mile
3 miles = 1 league
1 mile = 5,280 feet = 1,760 yards = 320 rods

Square Measure

144 $inches^2$ = 1 $foot^2$
9 $feet^2$ = 1 $yard^2$
43,560 $feet^2$ = 4,830 $yard^2$ = 1 acre
640 acres = 1 $mile^2$
36 $mile^2$ = 1 township

Cubic Measure

1, 728 $inch^3$ = 1 $foot^3$
27 $feet^3$ = 1 $yard^3$
128 $feet^3$ = 1 cord (wood)
231 $inch^3$ = 1 std. gallon
2150.42 $inch^3$ = 1 bushel

Surveyors Measure

7.92 inches = 1 link
25 links = 1 rod
4 rods = 1 chain
10 $chain^2$ = 1 acre
640 acres = 1 $mile^2$
36 $mile^2$ = 1 township

Mariners Measure

6.08 feet = 1 fathom
120 fathoms = 1 cable length
8.31 cable lengths = 6,080 feet = 1 nautical mile
1 nautical mile = 1.15 statute mile
1 knot = a speed of 1 nautical mile per hour

WEIGHTS AND MEASURES
CONVERSIONS TABLES

Weight (See Page 170)

Volume

$in.^3 \times 16.383 = cm.^3$
$ft.^3 \times .0283 = meter^3$
$yd.^3 \times .7645 = meter^3$
$centimeter^3 \times .06102 = in.^3$
$meter^3 \times 35.3145 = ft.^3$
$meter^3 \times 1.3079 = yard^3$

Liquid

U.S gal. × .832702 = British Imp. gal.
U.S. gal. × .11368 = $feet^3$
U.S. gal. ×231 = $inch^3$
U.S. gal. × 3.78543 = Litres
U.S. quart × .946 = Litres
Litres × .26417 = U.S. gallons

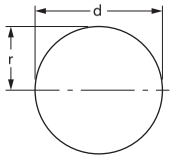
Area

$in.^2 \times 645.2 = millimeter^2$
$in.^2 \times 6.452 = centimeter^2$
$feet^2 \times .0929 = meter^2$
$yard^2 \times .8361 = meter^2$
Acres × .4047 = Hectares
Acres × .00405 = $kilometer^2$
$mile^2 \times 2.59 = kilometer^2$
$millimeter^2 \times .00155 = inch^2$
$centimeter^2 \times .155 = inch^2$
$meter^2 \times 10.764 = feet^2$
$meter^2 \times 1.196 = yard^2$
hectares × 2.471 = acres
$kilometer^2 \times 247.11$ = acres
$kilometer^2 \times .3861 = mile^2$

Length

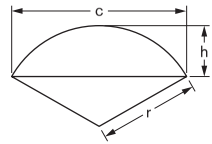
inches × 25.4 = millimeters
inches × 2.54 = centimeters
feet × 30.48 = centimeters
feet × .3048 = meters
yards × .9144 = meters
miles × 1.6093 = kilometers
millimeters × .03937 = inches
centimeters × .3937 = inches
meters × 39.37 = inches
meters × 3.281 = feet
meters × 1.094 = yards
kilometers × 3280.9 = feet
kilometers × 1093.6 = yards
kilometers × .621 = miles
1 millimicron = .001 micron
1 micron = .001 millimeter

VOLUMES AND SURFACE AREAS OF GEOMETRICAL SOLIDS



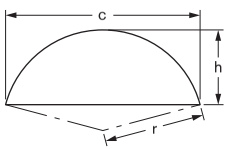
SPHERE

Surface $= 4\pi r^2 = 12.5664r^2 = \pi d^2$
Example: r = 3.
Surface $= 4 \times 3.1416 \times 3^2 = 113.1$ Ans.
Volume $= \frac{4\pi r^3}{3} = 4.1888r^3$
Example: r = 4.
Volume $= 4.1888 \times 4^3 = 268.08$ Ans.
Volume $= \frac{\pi d^3}{6} = 0.5236d3$



SEGMENT OF SPHERE

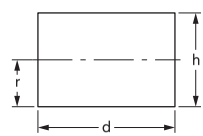
Spherical Surface $= 2\pi rh = \frac{\pi}{4}(c^2 + 4h^2)$.
Example: r = 3; h = 2.
Spherical Surface $= 2 \times 3.1416 \times 3 \times 2$
$= 37.6992$ Ans.
Volume $= \pi h^2(r - \frac{h}{3}) = \pi h\left(\frac{c^2}{8} + \frac{h^2}{6}\right)$
Example: h = 2; r = 3.
Volume $= 3.1416 \times 2^2 (3 - \frac{2}{3})$
$= 29.3216$ Ans.



SECTOR OF SPHERE

Total Surface $= \frac{\pi r}{2}(4h + c)$.
$c = 2\sqrt{h(2r-h)}$
Example: r = 3; h = 2.
Chord $c = \sqrt{4(2 \times 3 \times 2 - 2^2)} = 5.657$
Total Surface $= \frac{3.1416 \times 3}{2}(4 \times + 5.657)$
$= 64.407$ Ans.
Volume $= \frac{2\pi r^2 h}{3} = 2.0944r2h$

Example: r = 3; h = 2
Volume $= 2.0944 \times 3^2 \times 2 = 37.6992$ Ans.

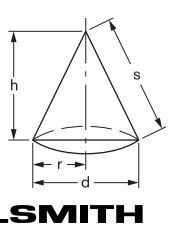


CYLINDER

c = circumference
Volume $= \pi r^2 h = 0.7854d^2h$
Example: d = 3; h = 6.

Volume $= 3.1416 \times \left(\frac{3}{2}\right)2 \times 6$
$= 42.4116$ Ans.

Cylindrical Surface $= \pi dh = 3.1416dh$
Total Surface $= 2\pi r(r + h)$

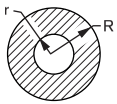


CONE

Volume $= \pi\frac{1}{3}r^2h$ or $\frac{1}{12}d^2h$
$= \frac{3.1416r^2h}{3} = 1.0472r^2h$
$= 0.2618d^2h$
Area of Conical Surface $= \pi r\sqrt{r^2 + h^2}$
$= 3.1416rs = 15708ds$
Surface $= r^2 + h^2 = \frac{d^2}{4} + h^2$

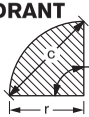
VOLUMES AND SURFACE AREAS OF GEOMETRICAL SOLIDS (Cont.)

CIRCULAR RING



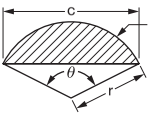
Area $= \pi (R^2 - r^2)$ $= 3.1416 (R^2 - r^2)$
Area $= 0.7854 (D^2 - d^2) = 0.7854 (D - d)(D + d)$
Area = difference in area between the inner and outer circles.
Example: R = 4; r = 2
Area $= 3.1416(4^2 - 2^2) = 37.6992$ Ans

QUADRANT



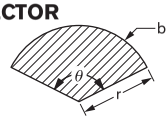
Area $= \frac{\pi r^2}{4} = 0.785r^2 = 0.3927c^2$
Example: r = 3; c = chord
Area $= 0.7854 \times 3^2 = 7.08686$ Ans.

SEGMENT



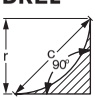
b = length of arc, Ø = angle in degrees
c = chord $= \sqrt{4(2hr\text{-}h^2)}$
Area $= \frac{1}{2}$ [br −c(r − h)] $= \pi r^2 \frac{Ø}{360} - \frac{c(r-h)}{2}$
When Ø is greater than 180°, then $\frac{c}{2} \times$ diffference between r and h is added to the fraction $\frac{\pi r^2 Ø}{360}$
Example: r = 3; Ø = 120°
Area $= 3.1416 \times 3^2 \times \frac{120}{360} - \frac{5.196(3-1.5)}{2} =$
$= 5.5278$ Ans.

SECTOR



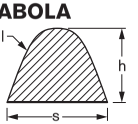
Area $= \frac{br}{2} = \pi r^2 \frac{Ø}{360°}$
b = length of arc; Ø angle in degrees
Example: r = 3; Ø = 120°
Area $= 3.1416 \times 3^2 \times \frac{120}{360} = 9.4248$ Ans.

SPANDREL



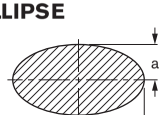
Area $= 0.2146r^2$
Example: r = 3
Area $= 0.2146 \times 3^2 = 1.9314$ Ans.

PARABOLA



l = length of curved line = periphery − s
$l = \frac{s^2}{8h}\left[\sqrt{c(1+c)} + 2.0326 \times \log\left(\sqrt{c} + \sqrt{1+c}\right)\right]$
in which $c = \left(\frac{4h}{8}\right)^2$
Area $= \frac{2}{3}$ sh
Example: s = 3; h = 4
Area $= \frac{2}{3} \times 3 \times 4 = 8$ Ans.

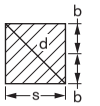
ELLIPSE



Area $= \pi ab = 3.1416ab$
Circumference $= \pi\sqrt{2(a^2 + b^2)}$
[close approximation]
Example: a = 3; b = 4
Area $= 3.1416 \times 3 \times 4 = 37.752$ Ans.
Circumference $= 3.1416\sqrt{2(9 + 16)}$
$= 3.1416 \times \sqrt{50} = 3.1416 \times 7.07 = 22.21$ Ans.

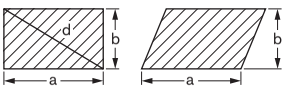
VOLUMES AND SURFACE AREAS OF GEOMETRICAL SOLIDS (Cont.)

SQUARE



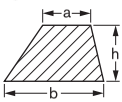
Diagonal $= d = s\sqrt{2}$
Area $= s^2 = 4b^2 = 0.5d^2$
Example: s = 6; b = 3
Area $= 6^2 = 36$ Ans
Diagonal $= 6 \times 1.414 = 8.484$ Ans.

RECTANGLE AND PARALLELOGRAM



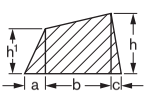
Area $= ab$
Example: s = 6; b = 3
Area $= 6 \times 3 = 18$ Ans

TRAPEZOID



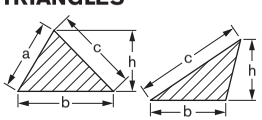
Area $= \frac{1}{2}h(a + b)$
Example: a = 2; b = 4; h = 3
Area $= \frac{1}{2} \times 3(2 + 4) = 9$ Ans.

TRAPEZIUM



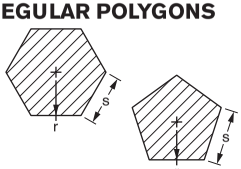
Area $= \frac{1}{2}[a(h+h^1)+bh^1 + ch]$
Example: a = 4; b = 2; h = 3; $h^1 = 2$
Area $= \frac{1}{2}[4(3+2)+(2\times2) + (2\times3)] = 15$ Ans.

TRIANGLES



Formula applies to both figures
Area $= \frac{1}{2}bh$
Example: h = 3; b = 5
Area $= \frac{1}{2}(3 \times 5) = 7.5$ Ans.

REGULAR POLYGONS

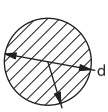


Area $\begin{cases} 5 \text{ sides} = 1.720477\ s^2 = 3.63271r^2 \\ 6 \text{ sides} = 2.598076\ s^2 = 3.46410r^2 \\ 7 \text{ sides} = 3.633912\ s^2 = 3.37101r^2 \\ 8 \text{ sides} = 4.828427\ s^2 = 3.31371r^2 \\ 9 \text{ sides} = 6.181824\ s^2 = 3.27573r^2 \\ 10 \text{ sides} = 7.694209\ s^2 = 3.24920r^2 \\ 11 \text{ sides} = 9.365640\ s^2 = 3.22993r^2 \\ 12 \text{ sides} = 11.196152\ s^2 = 3.24920r^2 \end{cases}$

n = number of sides; r = short radius;
S = width of sides; R = long radius

Area $= \frac{n}{4}S^2\cot.\frac{180^\circ}{n} = \frac{n}{2}R^2\sin.\frac{360^\circ}{n}$
$= nr^2\tan\frac{180^\circ}{n}$

CIRCLE



A = Area; d = diameter; p = circumference or periphery; r = radius.
$p = \pi d = 3.1416d.$
$A = \pi r^2 = 3.1416r^2$

EQUIVALENT TEMPERATURE READINGS

Celsius and Fahrenheit Scales

C°	F°	C°	F°	C°	F°	C°	F°
0	32	45	113	91	195.8	137	278.6
1	33.8	46	114.8	92	197.6	138	280.4
2	35.6	47	116.6	93	199.4	139	282.2
3	37.4	48	118.4	94	201.2	140	284
4	39.2	49	120.2	95	203	141	285.8
5	41	50	122	96	204.8	142	287.6
6	42.8	51	123.8	97	206.6	143	289.4
7	44.6	52	125.6	98	208.4	144	291.2
8	46.4	53	127.4	99	210.2	145	293
9	48.2	54	129.2	100	212	146	294.8
10	50	55	131	101	213.8	147	296.6
11	51.8	56	132.8	102	215.6	148	298.4
12	53.6	57	134.6	103	217.4	149	300.2
13	55.4	58	136.4	104	219.2	150	302
14	57.2	59	138.2	105	221	151	303.8
15	59	60	140	106	222.8	152	305.6
15.5	60	61	141.8	107	224.6	153	307.4
16	60.8	62	143.6	108	226.4	154	309.2
17	62.6	63	145.4	109	228.2	155	311
18	64.4	64	147.2	110	230	156	312.8
19	66.2	65	149	111	231.8	157	314.6
20	68	66	150.8	112	233.6	158	316.4
21	69.8	67	152.6	113	235.4	159	318.2
22	71.6	68	154.4	114	237.2	160	320
23	73.4	69	156.2	115	239	161	321.8
24	75.2	70	158	116	240.8	162	323.6
25	77	71	159.8	117	242.6	163	325.4
26	78.8	72	161.6	118	244.4	164	327.2
27	80.6	73	163.4	119	246.2	165	329
28	82.4	74	165.2	120	248	166	330.8
29	84.2	75	167	121	249.8	167	332.6
30	86	76	168.8	122	251.6	168	334.4
31	87.8	77	170.6	123	253.4	169	336.2
32	89.6	78	172.4	124	255.2	170	338
33	91.4	79	174.2	125	257	171	339.8
34	93.2	80	176	126	258.8	172	341.6
35	95	81	177.8	127	260.6	173	343.4
36	96.8	82	179.6	128	262.4	174	345.2
37	98.6	83	181.4	129	264.2	175	347
38	100.4	84	183.2	130	266	176	348.8
39	102.2	85	185	131	267.8	177	350.6
40	104	86	186.8	132	269.6	178	352.4
41	105.8	87	188.6	133	271.4	179	354.2
42	107.6	88	190.4	134	273.2	180	356.2
43	109.4	89	192.2	135	275	181	357.8
44	111.2	90	194	136	276.8	182	359.6

$C° = \frac{5}{9}(F° - 32°)$ $F° = \frac{9}{5} C° + 32°$

DECIMAL AND MILLIMETER EQUIVALENTS of 4ths, 8ths, 16ths, 32nds and 64ths

Fraction	Decimal Equivalent	Millimeter Equivalent
4ths and 8ths		
1/8	.125	3.175
1/4	.250	6.350
3/8	.375	9.525
1/2	.500	12.700
5/8	.625	15.875
3/4	.750	19.050
7/8	.875	22.225
16ths		
1/16	.0625	1.588
3/16	.1875	4.763
5/16	.3125	7.938
7/16	.4375	11.113
9/16	.5625	14.288
11/16	.6875	17.463
13/16	.8125	20.638
15/16	.9375	23.813
32nds		
1/32	.03125	.794
3/32	.09375	2.381
5/32	.15625	3.969
7/32	.21875	5.556
9/32	.28125	7.144
11/32	.34375	8.731
13/32	.40625	10.319
15/32	.46875	11.906
17/32	.53125	13.494
19/32	.59375	15.081
21/32	.65625	16.669
23/32	.71875	18.256
25/32	.78125	19.844
27/32	.84375	21.431
29/32	.90625	23.019
31/32	.96875	24.606
64ths		
1/64	.015625	.397
3/64	.046875	1.191
5/64	.078125	1.984
7/64	.109375	2.778
9/64	.140625	3.572
11/64	.171875	4.366
13/64	.203125	5.159
15/64	.234375	5.953
17/64	.265625	6.747
19/64	.296875	7.541
21/64	.328125	8.334
23/64	.359375	9.128
25/64	.390625	9.922
27/64	.421875	10.716
29/64	.453125	11.509
31/64	.484375	12.303
33/64	.515625	13.097
35/64	.546875	13.891
37/64	.578125	14.684
39/64	.609375	15.478
41/64	.640625	16.272
43/64	.671875	17.066
45/64	.703125	17.859
47/64	.734375	18.653
49/64	.765625	19.447
51/64	.796875	20.241
53/64	.828125	21.034
55/64	.859375	21.828
57/64	.890625	22.622
59/64	.921875	23.416
61/64	.953125	24.209
63/64	.984375	25.003

AREAS AND CIRCUMFERENCES OF CIRCLES

Dia.	Area	Cir.
1/8	0.0123	.3926
1/4	0.0491	.7854
3/8	0.1104	1.178
1/2	0.1963	1.570
5/8	0.3067	1.963
3/4	0.4417	2.356
7/8	0.6013	2.748
1	0.7854	3.141
1 1/8	0.9940	3.534
1 1/4	1.227	3.927
1 3/8	1.484	4.319
1 1/2	1.767	4.712
1 5/8	2.073	5.105
1 3/4	2.405	5.497
1 7/8	2.761	5.890
2	3.141	6.283
2 1/4	3.976	7.068
2 1/2	4.908	7.854
2 3/4	5.939	8.639
3	7.068	9.424
3 1/4	8.295	10.21
3 1/2	9.621	10.99
3 3/4	11.044	11.78
4	12.566	12.56
4 1/2	15.904	14.13
5	19.635	15.70
5 1/2	23.758	17.27
6	28.274	18.84
6 1/2	33.183	20.42
7	38.484	21.99
7 1/2	44.178	23.56
8	50.265	25.13
8 1/2	56.745	26.70
9	63.617	28.27
9 1/2	70.882	29.84
10	78.54	31.41
10 1/2	86.59	32.98
11	95.03	34.55
11 1/2	103.86	36.12
12	113.09	37.69
12 1/2	122.71	39.27
13	132.73	40.84
13 1/2	143.13	42.41
14	153.93	43.98
14 1/2	165.13	45.55
15	176.71	47.12
15 1/2	188.69	48.69
16	201.06	50.26
16 1/2	213.82	51.83
17	226.98	53.40
17 1/2	240.52	54.97
18	254.46	56.54
18 1/2	268.80	58.11
19	283.52	59.69
19 1/2	298.64	61.26
20	314.16	62.83
20 1/2	330.06	64.40
21	346.36	65.97
21 1/2	363.05	67.54
22	380.13	69.11
22 1/2	397.60	70.68
23	415.47	72.25
23 1/2	433.73	73.82
24	452.39	75.39
24 1/2	471.43	76.96
25	490.87	78.54
26	530.93	81.68
27	572.55	84.82
28	615.75	87.96
29	660.52	91.10
30	706.86	94.24
31	754.76	97.38
32	804.24	100.5
33	855.30	103.6
34	907.92	106.8
35	962.11	109.9
36	1017.8	113.0
37	1075.2	116.2
38	1134.1	119.3
39	1194.5	122.5
40	1256.6	125.6
41	1320.2	128.8
42	1385.4	131.9
43	1452.2	135.0
44	1520.5	138.2
45	1590.4	141.3
46	1661.9	144.5
47	1734.9	147.6
48	1809.5	150.7
49	1885.7	153.9
50	1963.5	157.0
51	2042.8	160.2
52	2123.7	163.3
53	2206.1	166.5
54	2290.2	169.6
55	2375.8	172.7
56	2463.0	175.9
57	2551.7	179.0
58	2642.0	182.2
59	2733.9	185.3
60	2827.4	188.4
61	2922.4	191.6
62	3019.4	194.7
63	3117.2	197.9
64	3216.9	201.0
65	3318.3	204.2
66	3421.2	207.3
67	3525.6	210.4
68	3631.6	213.6
69	3739.2	216.7
70	3848.4	219.9
71	3959.2	223.0
72	4071.5	226.1
73	4185.3	229.3
74	4300.8	232.4
75	4417.8	235.6
76	4536.4	238.7
77	4656.0	241.9
78	4778.3	245.0
79	4901.6	248.1
80	5026.5	251.3
81	5153.0	254.4
82	5281.0	257.6
83	5410.6	260.7
84	5541.7	263.8
85	5674.5	267.0
86	5808.8	270.1
87	5944.6	273.3
88	6082.1	276.4
89	6221.1	279.6
90	6361.7	282.7
91	6503.8	285.8
92	6647.6	289.0
93	6792.9	292.1
94	6939.7	295.3
95	7088.2	298.4
96	7238.2	301.5
97	7389.8	304.7
98	7542.9	307.8
99	7697.7	311.0

FUNCTIONS OF ANGLES

Angle	Sin	Cos	Tan	Angle	Sin	Cos	Tan
0	0.000	1.000	0.000				
1	0.017	0.999	0.017	46	0.719	0.695	1.04
2	0.035	0.999	0.035	47	0.731	0.682	1.07
3	0.052	0.999	0.052	48	0.743	0.669	1.11
4	0.070	0.998	0.070	49	0.755	0.656	1.15
5	0.087	0.996	0.087	50	0.766	0.643	1.19
6	0.105	0.995	0.105	51	0.777	0.629	1.23
7	0.122	0.993	0.123	52	0.788	0.616	1.28
8	0.139	0.990	0.141	53	0.799	0.602	1.33
9	0.156	0.988	0.158	54	0.809	0.588	1.38
10	0.174	0.985	0.176	55	0.819	0.574	1.43
11	0.191	0.982	0.194	56	0.829	0.559	1.48
12	0.208	0.978	0.213	57	0.839	0.545	1.54
13	0.225	0.974	0.231	58	0.848	0.530	1.60
14	0.242	0.970	0.249	59	0.857	0.515	1.66
15	0.259	0.966	0.268	60	0.866	0.500	1.73
16	0.276	0.961	0.287	61	0.875	0.485	1.80
17	0.292	0.956	0.306	62	0.883	0.469	1.88
18	0.309	0.951	0.325	63	0.891	0.454	1.96
19	0.326	0.946	0.344	64	0.898	0.438	2.05
20	0.342	0.940	0.364	65	0.906	0.423	2.14
21	0.358	0.934	0.384	66	0.914	0.407	2.25
22	0.375	0.927	0.404	67	0.921	0.391	2.36
23	0.391	0.921	0.424	68	0.927	0.375	2.48
24	0.407	0.914	0.445	69	0.934	0.358	2.61
25	0.423	0.906	0.466	70	0.940	0.342	2.75
26	0.438	0.898	0.488	71	0.946	0.326	2.90
27	0.454	0.891	0.510	72	0.951	0.309	3.08
28	0.469	0.883	0.532	73	0.956	0.292	3.27
29	0.485	0.875	0.554	74	0.961	0.276	3.49
30	0.500	0.866	0.577	75	0.966	0.259	3.73
31	0.515	0.857	0.601	76	0.970	0.242	4.01
32	0.530	0.848	0.625	77	0.974	0.225	4.33
33	0.545	0.839	0.649	78	0.978	0.208	4.70
34	0.559	0.829	0.675	79	0.982	0.191	5.14
35	0.574	0.819	0.700	80	0.985	0.174	5.67
36	0.588	0.809	0.727	81	0.988	0.156	6.31
37	0.608	0.799	0.754	82	0.990	0.139	7.12
38	0.616	0.788	0.781	83	0.993	0.122	8.14
39	0.629	0.777	0.810	84	0.995	0.105	9.51
40	0.643	0.766	0.839	85	0.996	0.087	11.43
41	0.656	0.755	0.869	86	0.998	0.070	14.30
42	0.699	0.743	0.900	87	0.999	0.052	19.08
43	0.682	0.731	0.933	88	0.999	0.035	28.64
44	0.695	0.719	0.966	89	0.999	0.017	57.28
45	0.707	0.707	1.000	90	1.000	0.000	Infinity

WEIGHTS OF STEEL PLATES AND FLAT BARS

To find weight per foot in lbs. of flat steel, multiply width in inches by figure listed below: (To find weight per square foot in lbs. of steel plates, multiply figures listed below by 12.)

Thickness	Weight	Thickness	Weight	Thickness	Weight
1/16"	.2125	7/8"	2.975	1 3/4"	5.950
1/8"	.4250	15/16"	3.188	1 13/16"	6.163
3/16"	.6375	1"	3.400	1 7/8"	6.375
1/4"	.8500	1 1/16"	3.613	1 15/16"	6.588
5/16"	1.0600	1 1/8"	3.825	2"	6.800
3/8"	1.2750	1 3/16"	4.038	2 1/8"	7.225
7/16"	1.4880	1 1/4"	4.250	2 1/4"	7.650
1/2"	1.7000	1 5/16"	4.463	2 3/8"	8.075
9/16"	1.9130	1 3/8"	4.675	2 1/2"	8.500
5/8"	2.1250	1 7/16"	4.888	2 5/8"	8.925
11/16"	2.3380	1 1/2"	5.100	2 3/4"	9.350
3/4"	2.5500	1 9/16"	5.313	2 7/8"	9.775
13/16"	2.7630	1 5/8"	5.525	3"	10.200
		1 11/16"	5.738		

WEIGHTS OF STANDARD STEEL BARS
(Wt. in lbs., per lineal foot)

Size	Rd.	Hex.	Sq.	Size	Rd.	Hex.	Sq.
1/16"	.010	.012	.013	27/32"	1.90	2.10	2.42
3/32"	.023	.026	.030	7/8"	2.04	2.25	2.60
1/8"	.042	.046	.053	29/32"	2.19	2.42	2.79
5/32"	.065	.072	.083	15/16"	2.35	2.59	2.99
3/16"	.094	.104	.120	31/32"	2.51	2.76	3.19
7/32"	.128	.141	.163	1"	2.67	2.95	3.40
1/4"	.167	.184	.212	1 1/16"	3.01	3.32	3.84
9/32"	.211	.233	.269	1 1/8"	3.38	3.73	4.30
5/16"	.261	.288	.332	1 3/16"	3.77	4.15	4.80
11/32"	.316	.348	.402	1 1/4"	4.17	4.60	5.31
3/8"	.376	.414	.478	1 5/16"	4.60	5.07	5.86
13/32"	.441	.486	.561	1 3/8"	5.05	5.57	6.43
7/16"	.511	.564	.651	1 7/16"	5.52	6.09	7.03
15/32"	.587	.647	.747	1 1/2"	6.01	6.63	7.65
1/2"	.667	.736	.850	1 5/8"	7.05	7.78	8.98
17/32"	.754	.831	.960	1 3/4"	8.18	9.02	10.41
9/16"	.845	.932	1.08	1 7/8"	9.39	10.36	11.95
19/32"	.941	1.03	1.20	2"	10.68	11.78	13.60
5/8"	1.04	1.15	1.33	2 1/8"	12.06	13.30	15.35
21/32"	1.15	1.27	1.46	2 1/4"	13.52	14.91	17.21
11/16"	1.26	1.39	1.61	2 3/8"	15.06	16.61	19.18
23/32"	1.38	1.52	1.76	2 1/2"	16.69	18.40	21.25
3/4"	1.50	1.66	1.91	2 3/4"	20.20	22.27	25.71
25/32"	1.63	1.80	2.08	3"	24.03	26.50	30.60
13/16"	1.76	1.94	2.24				

NUMERIC CONVERSIONS

U.S.Customary Unit	Divided By	Converts to (Metric)
Ounce (Liquid)	0.3381	Millilitre
Quart	1.05669	Litre
Gallon	.26417	Litre
Pound (Force)	.22481	Newton
Ounce (Mass)	.03527	Grams
Pound (Mass)	2.20462	Kilograms
Inch^3	.06102	Centimetre^3
Yard^3	1.30795	Metre^3
PSI (Gage)	14.50377	Bar
PSI (Stress)	145.0377	Megapascal
Pound Foot	.73756	Newton Metre
Pound Per Inch	5.71014	Newton Per Millimetre
Ounce Inch (Balance)	1.38874	Gram Metre
°Fahrenheit	–32 (1.8)	°Celcius
Mile	.62137	Kilometre

Metric Unit	Multiplied By	Converts to (U.S. Customary)
Litre	1.05669	Quart
Millilitre	.03381	Ounce (Liquid)
Centimetre^3	.06102	Inch^3
Metre^3	1.30795	Yard^3
Xilogram	2.20462	Pound (Mass)
Hectogram	3.52740	Ounce (Mass)
Gram	.03527	Ounce (Mass)
Newton	.22481	Pound (Force)
Bar	14.50377	PSI (Gage)
Megapascal	145.0377	PSI (Stress)
Gram Metre	1.38874	Ounce Inch
Newton Metre	.73756	Pound Foot
Newton Per Millimetre	5.71014	Pound Per Inch
°Celcius	1.8 + 32	°Fahrenheit
Kilometre	.62137	Mile
Decimetre	3.93701	Inch
Centimetre	.39370	Inch
Decilitre	3.381	Ounce (Liquid)

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