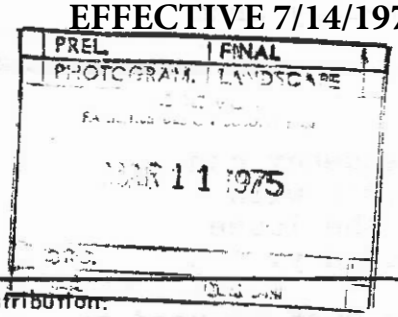
file

TO: **SUPERSEDED BY EI 78-038 EFFECTIVE 7/14/1978**



ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: Manufacturer's Data for the Rating of Vibratory Drum Compactors for Earthwork Construction

Subject Code: 7.41

Distribution: [A] Main Office [C] Regions [ ] Special

Code: EI 75-19

Date: Feb. 24, 1975

Supersedes: EI 74-45

APPROVED:

Lyndon H. Moore
Director, Soil Mechanics Bureau

The attached sheets give the necessary information to rate vibratory drum compactors produced by many manufacturers.

The rating methods are based on the 1973 Standard Specifications and Addendums 1 & 2. The basic machine data given has been authenticated by the individual manufacturers and, therefore, supersedes any data given in sales brochures where there is a conflict. For the listed machines, it is not necessary to obtain manufacturer's specifications and sales brochures. If the Contractor desires to use a machine not listed, he will be required to furnish the data necessary to rate it.

The curves shown at the top of the sheet give the maximum loose lift thickness of layers constructed with soils and select granular materials at the operating frequency of the roller. The curves are based on Figure 203-3(B) given on page 112 of the Specifications. The compactive effort is 6 passes at a speed of 4.5 fps.

The table at the bottom of the sheet lists the manufacturer's data for their various models. Machines, which have the words "high, medium or low" listed after the model number are able to have the dynamic force and/or the rated frequency varied. The acceptable frequency range and the corresponding curves apply when the machine is adjusted to the proper setting. Machines which do not meet the specifications are so noted.

Example 1 - (Earth fill)

The Contractor desires to use a Rexnord Model SP-1300 compactor. He notifies the Engineer of this and the Engineer checks the charts to determine if the machine is listed. The machine is listed and therefore no additional data or brochures are required.

For embankment lifts of soils and select granular materials (actually all suitable materials except blasted rock), curve 2 at the top of the page applies to the SP-1300. The Contractor must select an operating frequency, within the acceptable frequency range.

The maximum loose lift thickness for that frequency can then be determined. The dynamic force increases with increasing frequency and the curve indicates the loose lift thickness increases with increasing frequency.

For a lift of blasted rock, the basic machine data must be used to determine the PLI (the developed compactive force rating per linear inch of drum width) which is then used to determine maximum lift thickness, number of passes and compactor speed.

Example 2 - (Blasted rock fill)

Assume conditions similar to Example 1 except that the fill is constructed from blasted rock. The basic machine data for the SP-1300 is taken from the table as follows:

Unsprung Drum Wt.	= 10,200#
Dynamic Force	= 45,000#
Rated Frequency	= 1700 vpm
Drum Width	= 108 inches

The PLI can be determined at any frequency within the acceptable range and is based on the following given formulas:

$$F_2 = \frac{F_1 (V_2)^2}{(V_1)^2} \quad \text{and} \quad PLI = \frac{(\text{Unsprung Drum Weight} + \text{Dynamic Force})}{\text{Drum Width}}$$

Where:

F_1 = Dynamic Force at Rated Frequency

F_2 = Dynamic Force at Operating Frequency

V_1 = Rated Frequency

V_2 = Operating Frequency

Unsprung Drum Weight = Static weight of drum and appurtenances without any reaction transmitted to the drum from the main chassis of the compactor.

Dynamic Force = F_2 (see above)

Drum Width = Width of the vibrating drum

Suppose the Contractor desires to run at 1400 vpm. The PLI is therefore determined as follows:

$$F_{1400} = \frac{45{,}000\#\ (1400\ \text{vpm})^2}{(1700\ \text{vpm})^2} = 30{,}519\#$$

$$\text{PLI} = \frac{10{,}200\# + 30{,}519\#}{108\ \text{inches}} = 377\#/\text{in.}$$

Using a PLI of 377#/in., there are two lift thicknesses and compactive efforts given in Figure 203-3 (C):

1. Thickness = 1.8 feet.
   Compactive effort = 4 passes @ 3.0 fps.

2. Thickness = 2.9 feet.
   Compactive effort = 6 passes @ 3.0 fps.

Example 3 - (Machine not listed)

The Contractor desires to use a machine which is not listed in the charts. He must furnish the basic machine data necessary to rate it. Assume the following data was supplied:

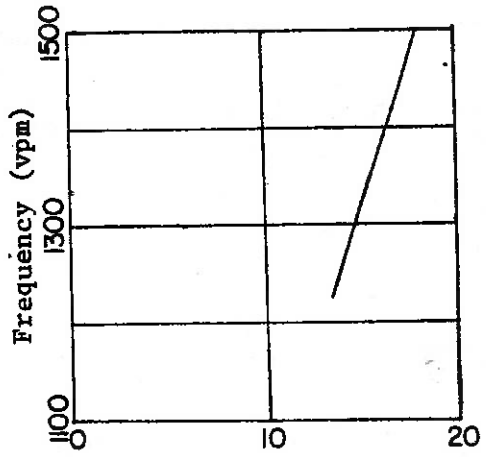
Unsprung Drum Wt.	= 9,500#
Dynamic Force	= 38,000#
Rated Frequency	= 1,550 vpm
Drum Width	= 84 inches

The minimum dynamic force = 2.5 x (9,500) = 23,750#. From the formula given in Addendum No. 1 and in Example 2, the minimum frequency can be determined which will produce a dynamic force of 23,750#.

$$F_2 = \frac{F_1(V_2)^2}{(V_1)^2} \quad \text{and} \quad (V_2)^2 = \frac{F_2(V_1)^2}{F_1}$$

$$(V_2)^2 = \frac{23{,}750\ (1550)^2}{38{,}000}$$

V_2 = 1225 vpm Note: this is less than 1500 and therefore the machine is acceptable if set to run between 1225 and 1500 vpm. If V_2 is greater than 1500 vpm, the machine does not meet the specifications.



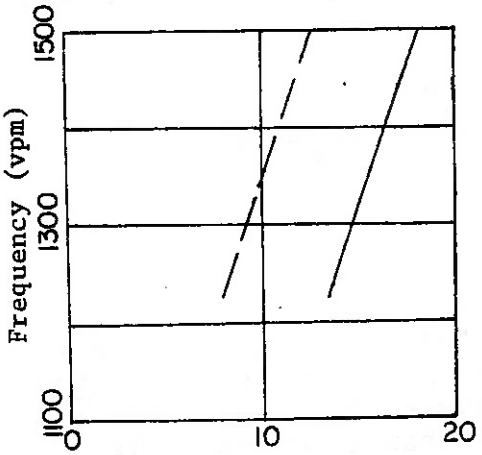
Maximum loose lift thickness (inches) Soils and select granular materials

The dynamic force, PLI and maximum lift thickness can be determined (see Example 2) at various frequencies to produce the curve shown. The maximum loose lift thickness can be read directly from the curve at the frequency selected by the Contractor.

Example 4 - (Non-centrifugal or vertical force only machines)

Generally, the dynamic forces on non-centrifugal machines are created by two eccentric weights rotating in opposite directions. The horizontal forces are thus cancelled out and the machines do not produce a kneading action.

Assume that the Contractor desires to use a non-centrifugal machine and its basic characteristics are the same as those given in Example 3. The same steps must be followed to determine its acceptability (minimum dynamic force and corresponding minimum frequency). The dynamic force and PLI are then calculated in the same manner. Before the maximum lift thicknesses are determined, the PLI's must be reduced by 175 due to the removal of the kneading action. If this is applied to the example in question, the following results:



Maximum loose lift thickness (inches) Soils and select granular materials

The dashed curve represents the non-centrifugal machine while the solid curve represents a standard centrifugal machine with the same machine characteristics.

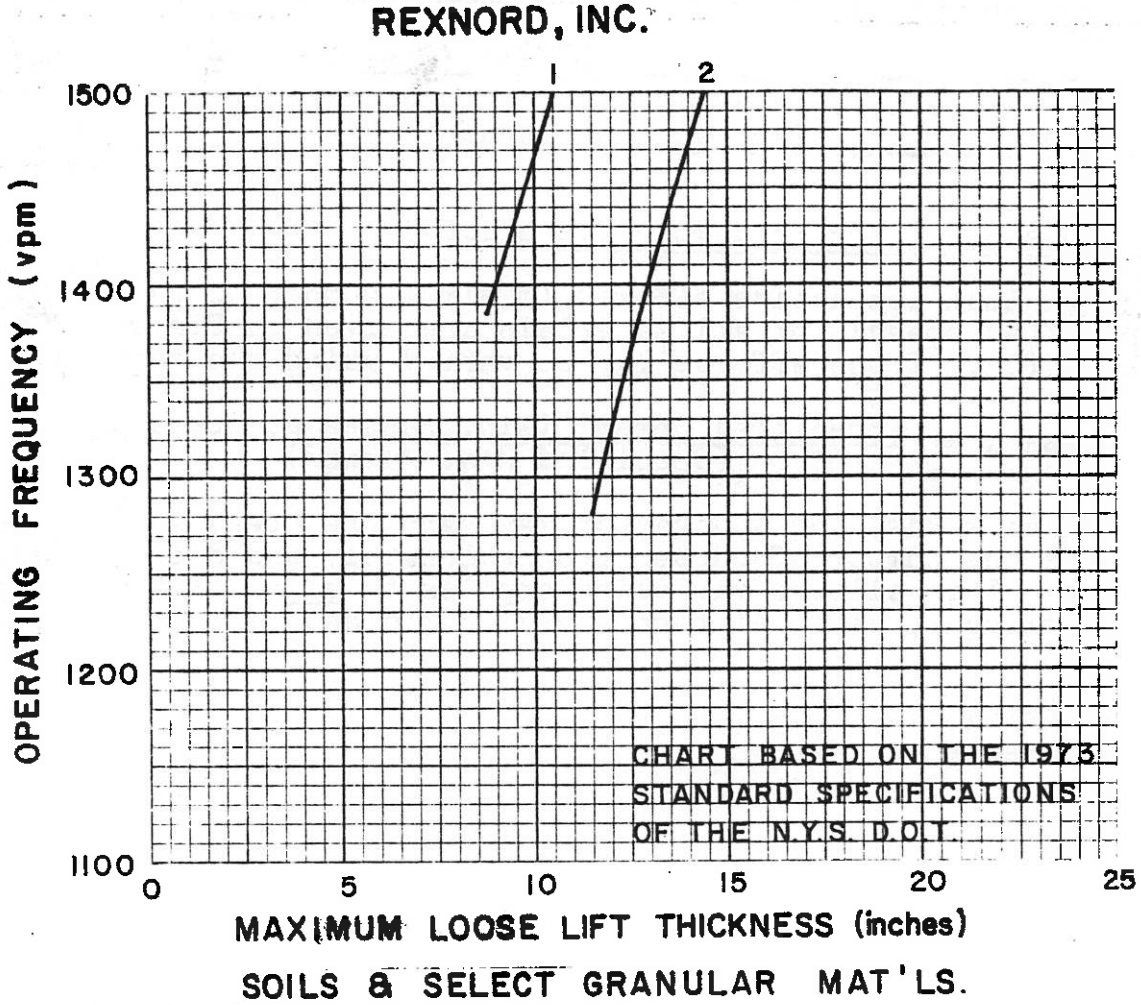
Example 5 - (Varying compactive effort)

The minimum compactive efforts (minimum number of passes at a specified speed) for all materials are given in Figures 203-3 (B) & (C). These efforts may be varied using the formula:

$$\text{Speed X} = \frac{\text{(Specified Speed) (Min. Passes at Speed X)}}{\text{(Specified Min. Passes)}}$$

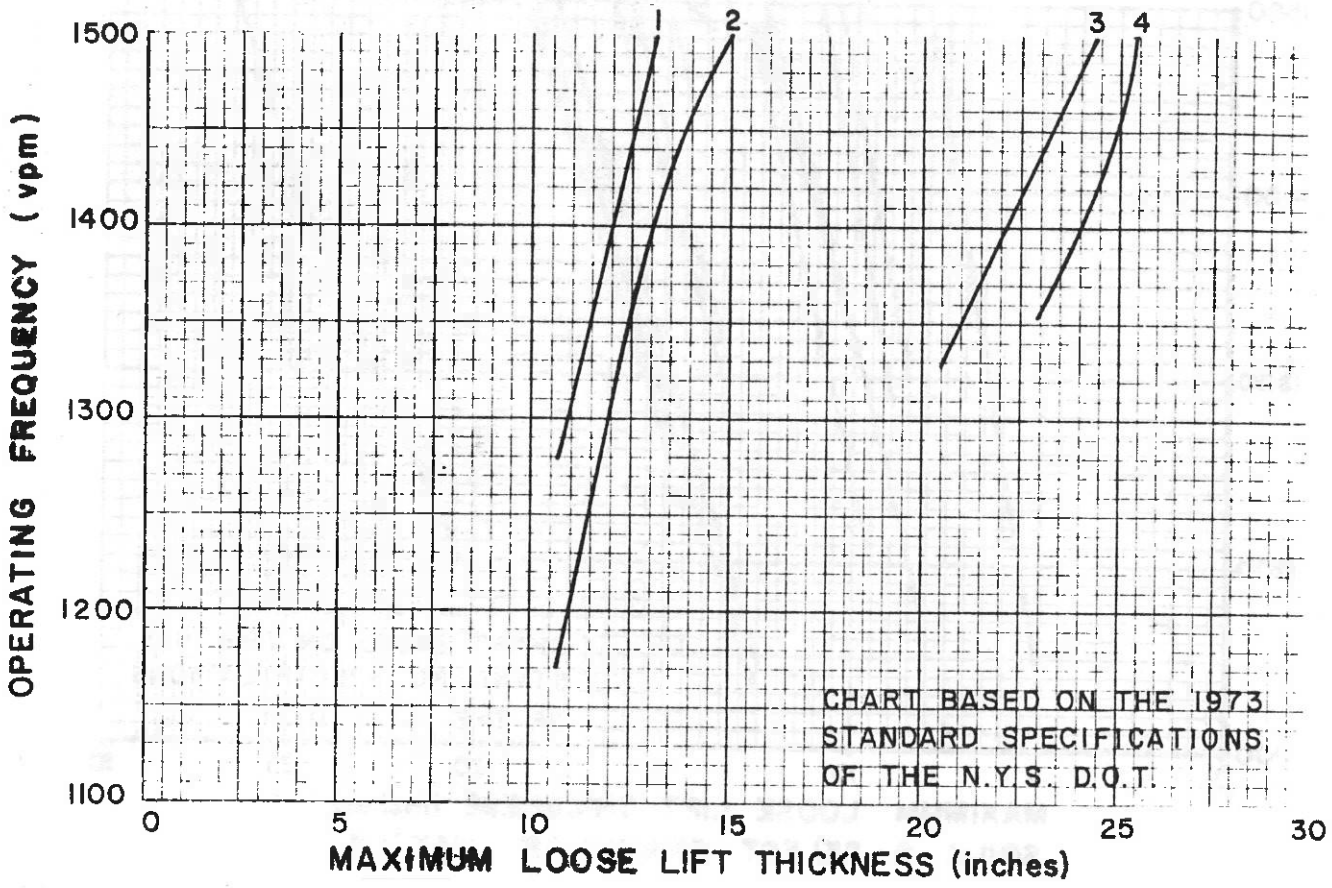
In other words, the Contractor may vary the speed as long as he varies the number of passes proportionately and does not exceed 6 fps. This allowed variation applies to all vibratory compactors (centrifugal, vertical force only, towed and self-propelled).

LHM:RPM:SAS
Attachments



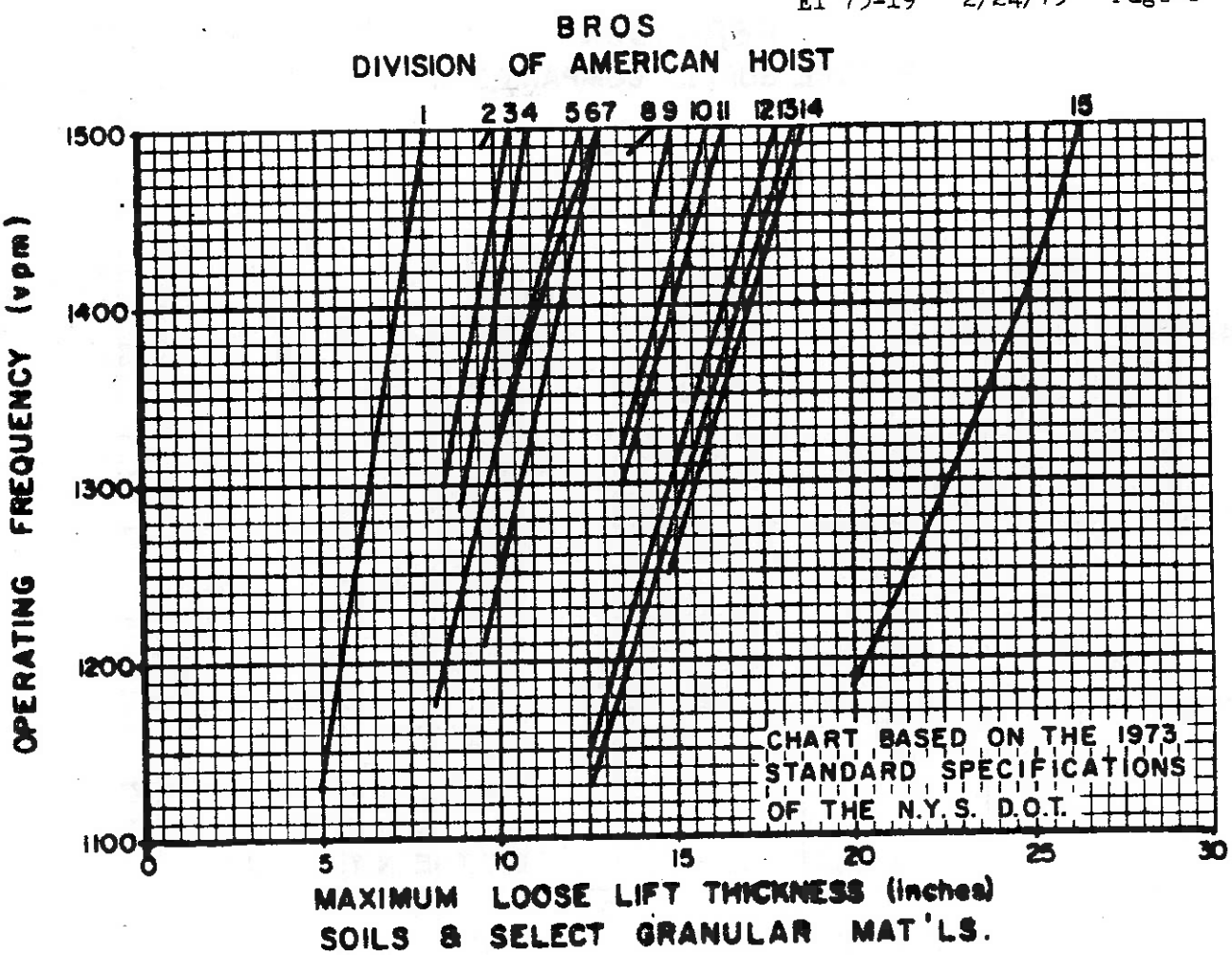
Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	SP-848	6,400	27,000	1800	84	1386-1500
1	SP-900	6,400	33,500	2000	84	1382-1500
2	SP-1300	10,200	45,000	1700	108	1280-1500

FERGUSON
SHOVEL SUPPLY COMPANY, INC.



SOILS & SELECT GRANULAR MAT'LS.

Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	SP-75-B	7,500	37,175	1800	84	1278-1500
	SP-75-B(MOD)	7,500	36,000	2400	84	Does not meet spec.
2	65	6,198	25,382	1500	72	1172-1500
3	230	14,400	46,031	1500	78	1327-1500
3	SP-230	14,400	46,031	1500	78	1327-1500
4	230T	15,886	48,786	1500	78	1353-1500



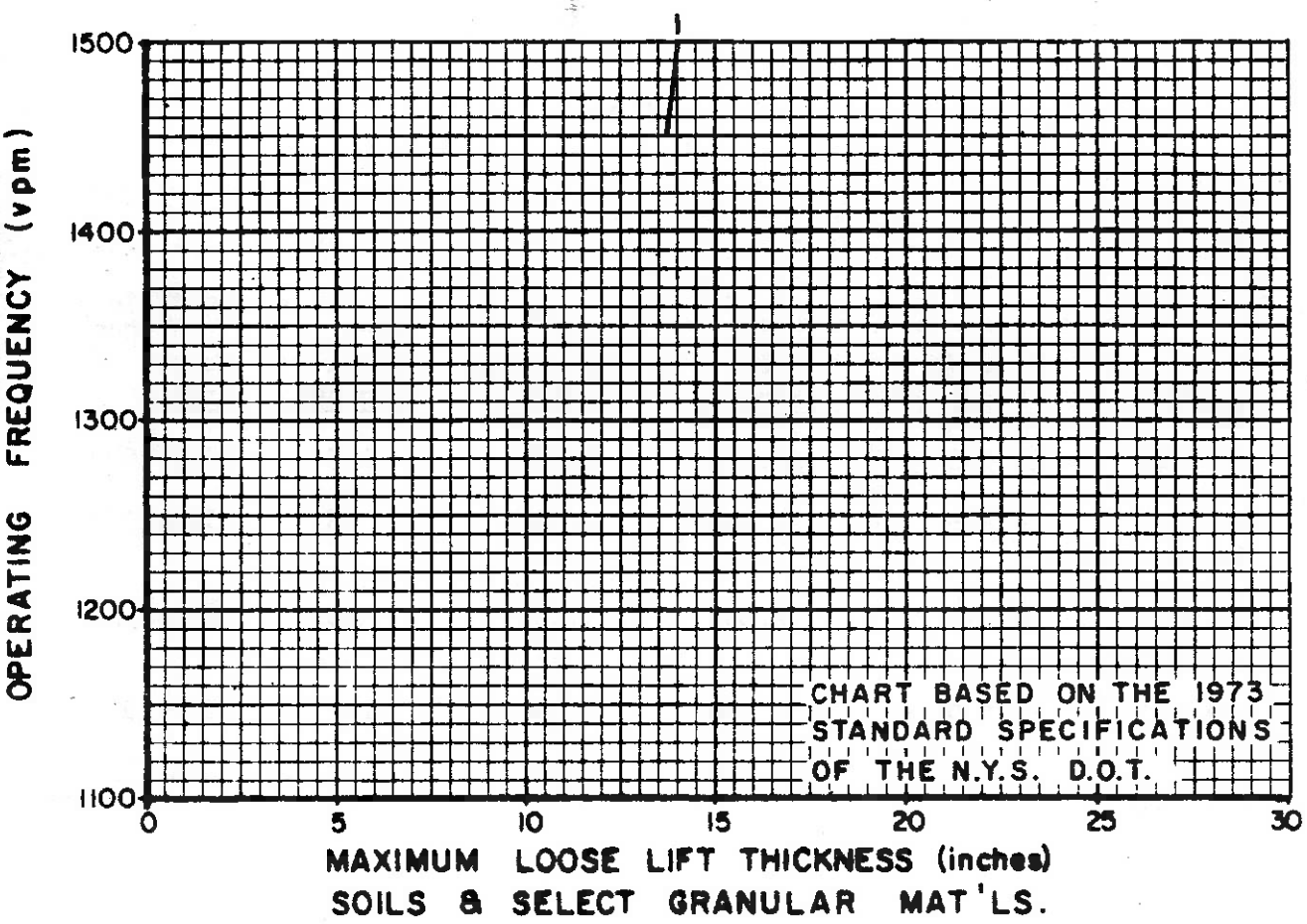
Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	VP-4D	2,569	10,000	1,400	60	1122-1500
2	SPV627VA	6,000	27,000	2,000	72	1490-1500
3	SPV-7	6,000	20,000	1,500	84	1299-1500
4	SPV727VA	6,200	27,000	1,700	84	1288-1500
5	SPV-725	6,000	25,000	1,550	84	1201-1500
6	SPV-727	6,000	27,000	1,575	84	1174-1500
7	SPV-627	5,500	27,000	1,700	72	1213-1500
8	SPV735VAII	9,800	35,000	1,750	84	1464-1500
9	SPV730VA	10,000	30,000	1,600	84	1461-1500
10	SPV-730	9,250	30,000	1,500	84	1317-1500
11	SPV-735	9,250	35,000	1,600	84	1301-1500
11	SPV735II	10,000	35,000	1,600	84	1352-1500

(continued)

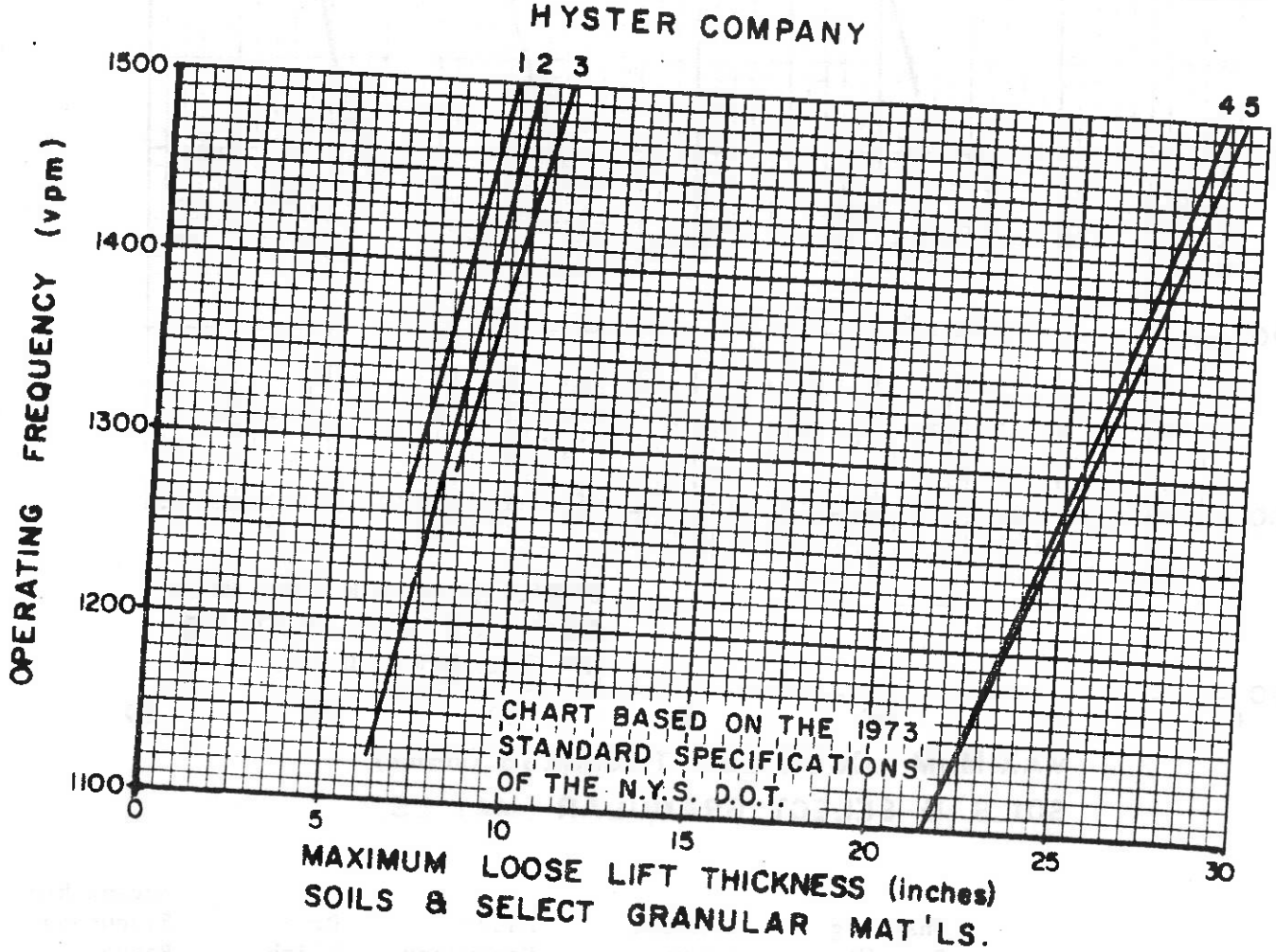
BROS (continued)

Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
12	SPV-845	10,550	45,000	1,500	102	1148-1500
13	VP-10 Smooth Drum	6,625	22,000	1,300	66	1128-1500
13	VP-10 Pad Drum	6,725	22,000	1,300	66	1136-1500
14	SPV-850	12,000	50,000	1,600	102	1239-1500
15	VP-22 Pad Drum	13,690	41,000	1,300	78	1188-1500
15	VP-22 Smooth Drum	14,690	41,000	1,300	78	1230-1500

GALION MANUFACTURING COMPANY

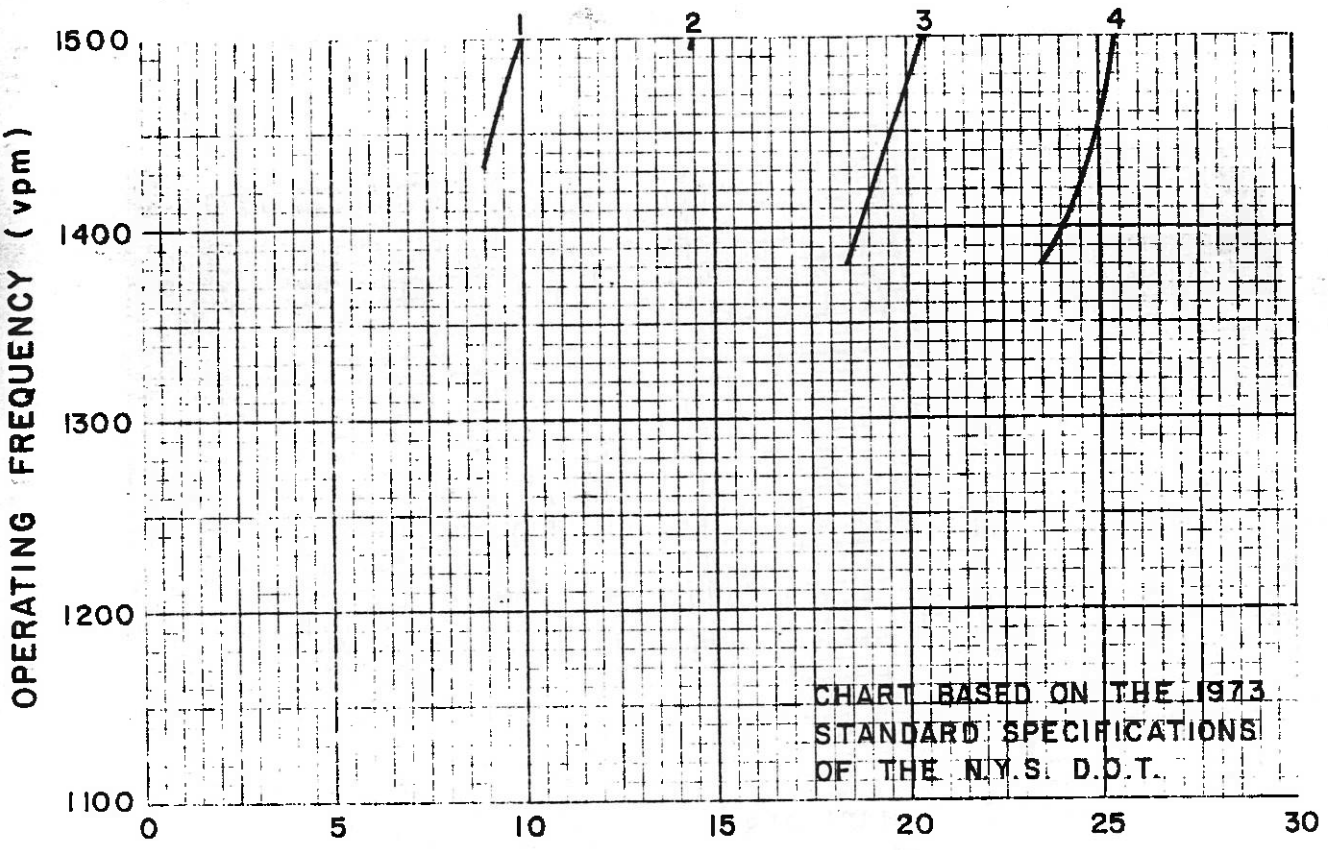


Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	VOS-84 Fixed Amp.	9,300	36,000	1,800	84	1447-1500
	VOS-84-A Dual-Low	9,300	20,000	2,300	84	Does not meet Specs.
	VOS-84-A Dual-High	9,300	40,000	2,300	84	Does not meet Specs



Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	C200	3,600	18,000	1,800	60	1273-1500
2	C610	3,900	25,000	1,800	72	1124-1500
2	C620	4,546	25,000	1,800	84	1213-1500
2	C625	5,000	25,000	1,800	84	1272-1500
3	C615	5,100	25,000	1,800	72	1285-1500
4	C255	11,300	49,000	1,200	80	1100-1500
5	C250	12,200	49,000	1,200	80	1100-1500
	C210	5,500	18,000	1,800	60	Does not meet Spec.

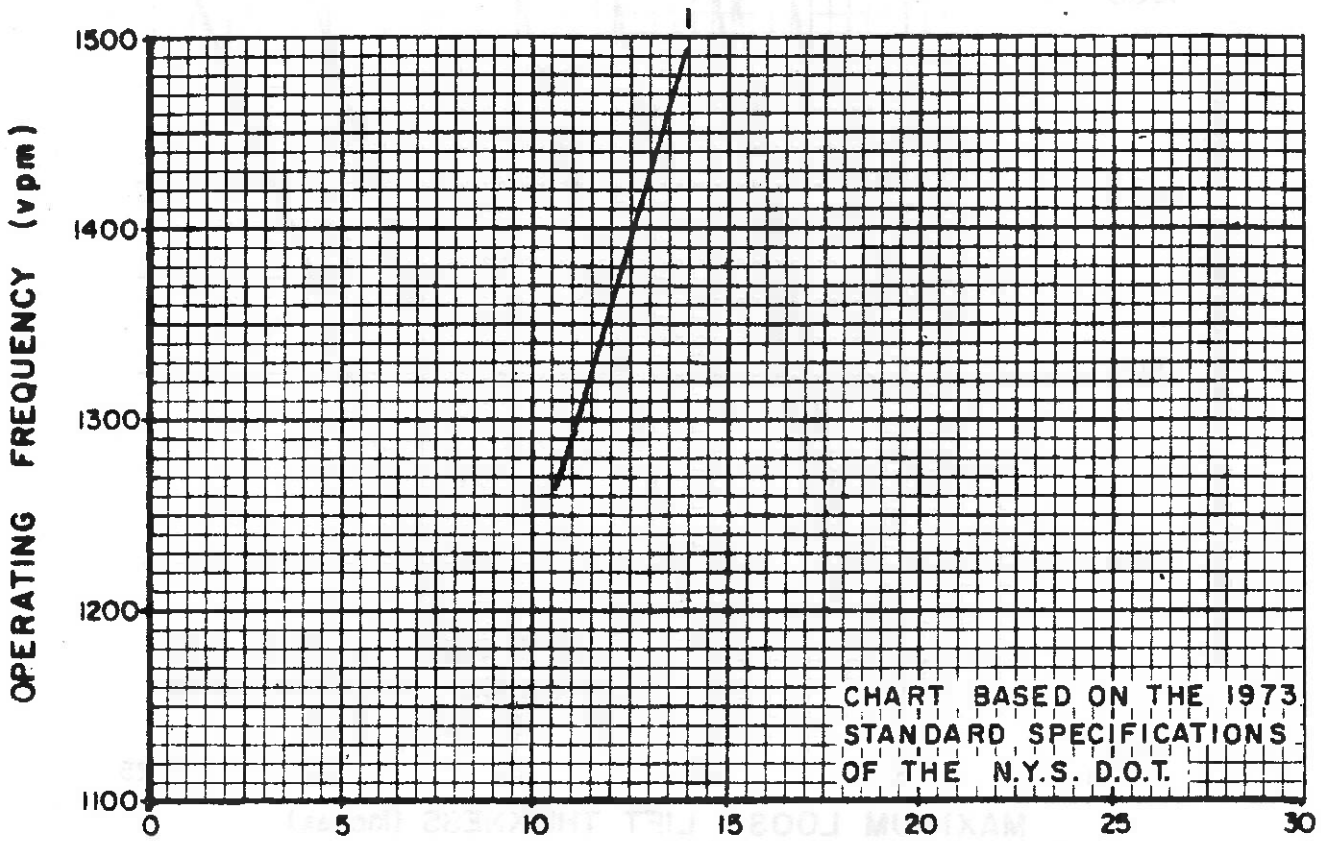
INGERSOLL-RAND COMPANY



Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
	SP-42	3,119	15,050	2100	72	Does not meet spec.
	SPA-42	3,119	15,050	2100	72	Does not meet spec.
1	SP-54	6,400	25,200	1800	85	1434-1500
2	SP-54(NY)	10,200	25,600	1500	85	1497-1500
	SPA-54	6,265	15,200	2150	85	Does not meet spec.
	SPA-54(NY)	11,000	19,300	2250	85	Does not meet spec.
3	SP-60	15,578	40,000	1400	100	1381-1500
4	SP-60(NY)	21,000	54,000	1400	100	1380-1500

KOEHRING ROAD DIVISION

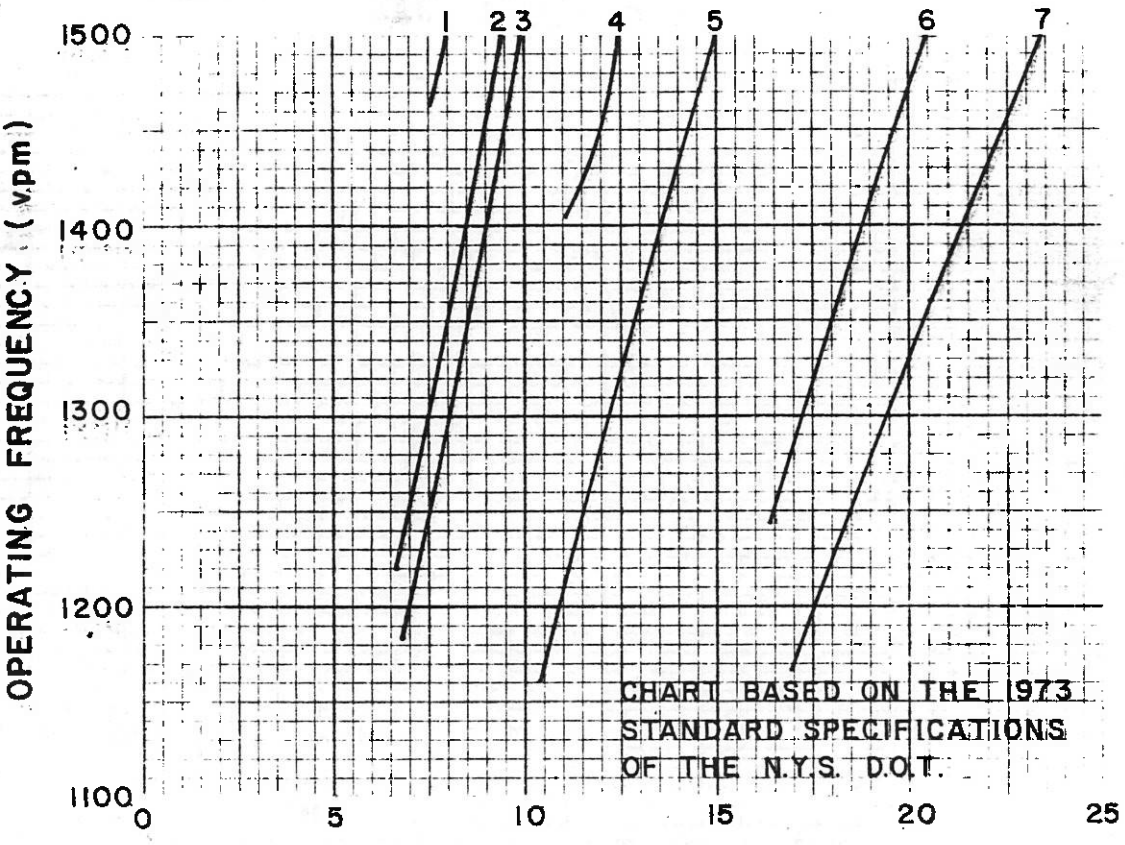
BUFFALO-BOMAG



Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	BW-210	7,500	40,000	1,850	84	1266-1500

BW-200 Classified for confined areas only

TAMPO MANUFACTURING CO., INC.



MAXIMUM LOOSE LIFT THICKNESS (inches)
SOILS & SELECT GRANULAR MAT'LS.

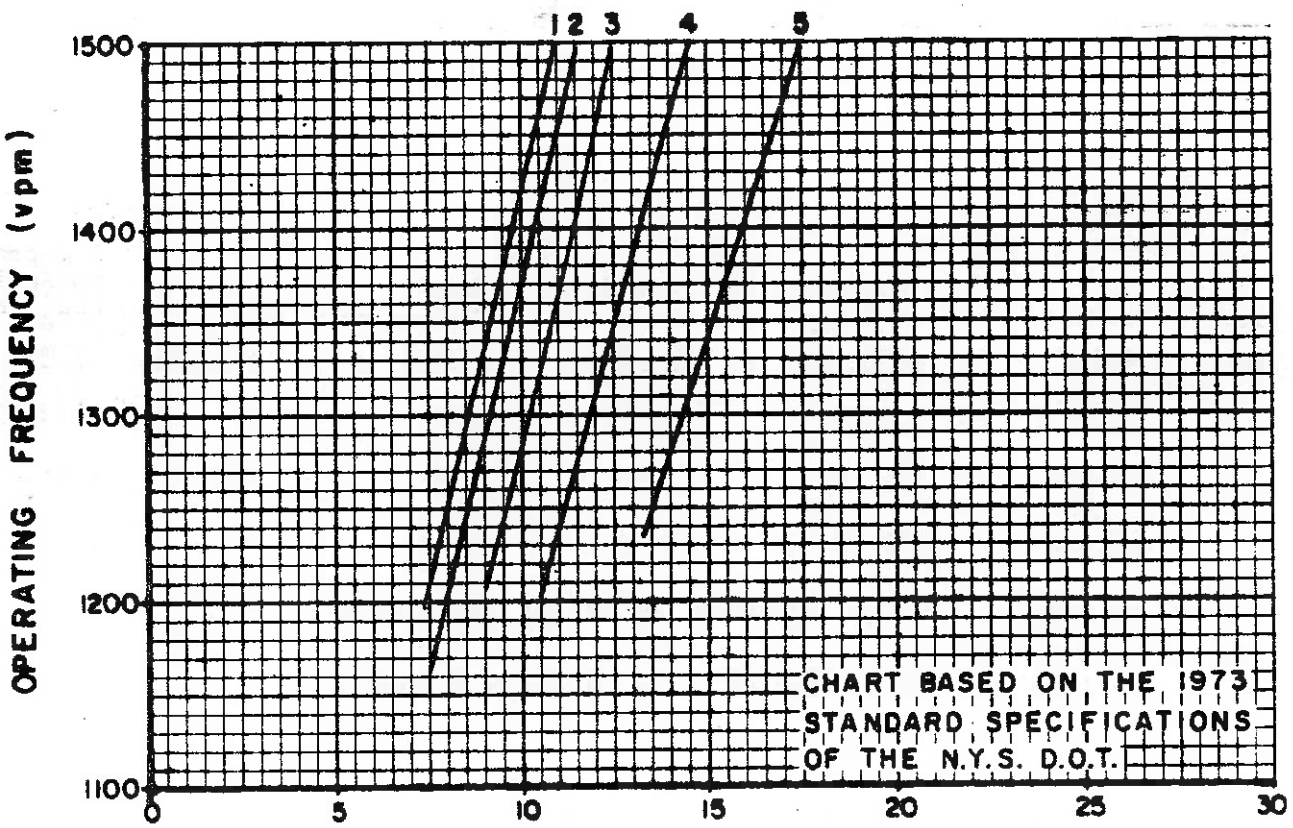
Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
	RS-16A Low	3,825	7,500	1600	60	Does not meet spec.
1	RS-16A Med	3,825	11,500	1600	60	1459-1500
3	RS-16A High	3,825	15,000	1600	60	1277-1500
3	RS-16	3,500	16,000	1600	60	1183-1500
2	VC-80	3,500	15,000	1600	60	1222-1500
	RS-28A Low	7,750	12,700	1700	84	Does not meet spec.
4	RS-28A Med	7,750	28,625	1700	84	1399-1500
5	RS-28A High	7,750	30,000	1500	84	1205-1500
	RS-288A	Same as RS-28A except that it is double drum.				

(continued)

Tampo Manufacturing Co., Inc. (Continued)

Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
5	RS-28	7,200	30,000	1500	84	1162-1500
6	RS-210	14,150	45,000	1400	104	1241-1500
7	VC-400	12,000	43,000	1400	84	1169-1500
	RS-166A	High, Medium & Low do not meet spec.				
	RS-188A	High, Medium - Low do not meet specs.				

VIBRO-PLUS PRODUCTS, INC.



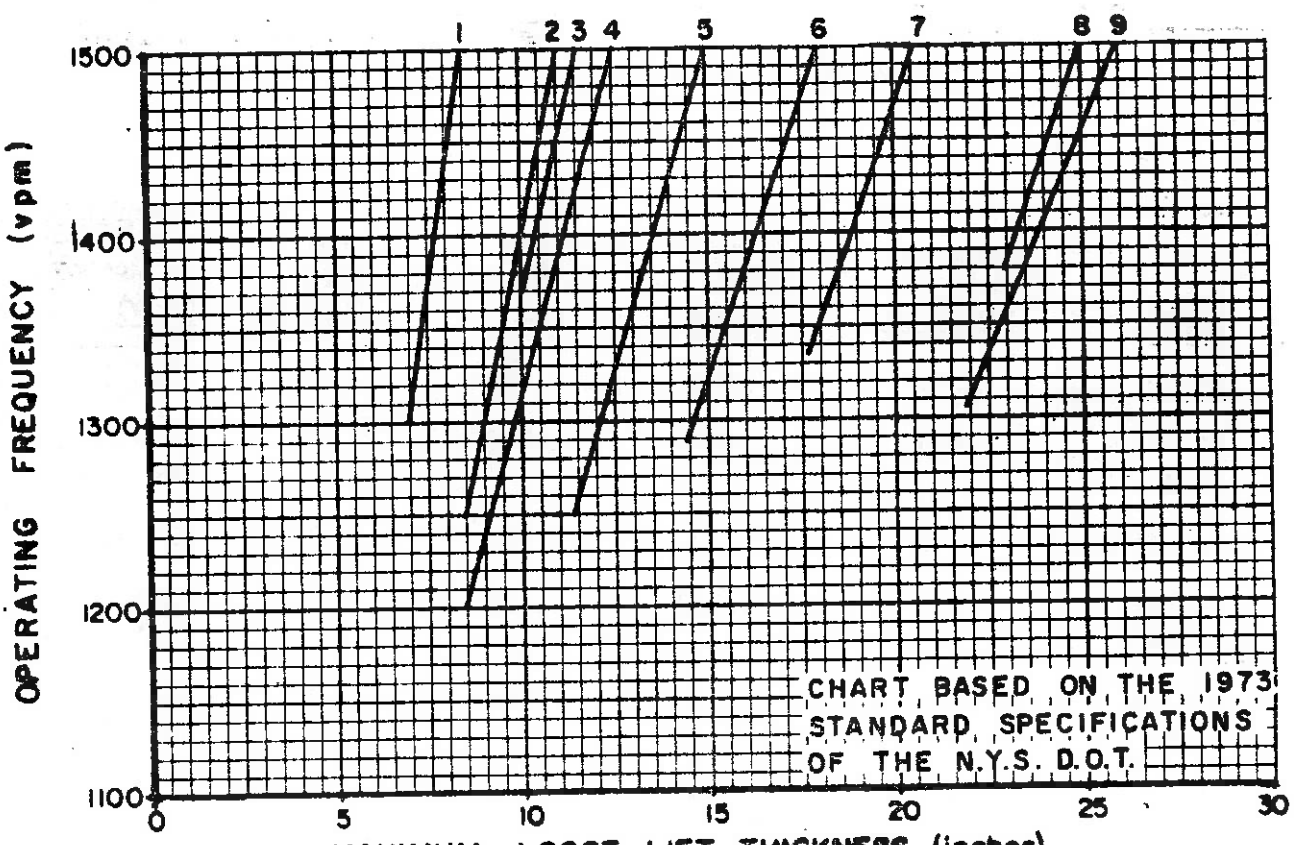
Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
1	CG-11	Classified for confined areas only				
	CK-11	Classified for confined areas only				
	CA-15	4,150	22,000	1,750	66	1202-1500
	CA-15A	4,150	22,000	2,500	66	Does not meet spec.
	CC-42A (Low)	4,150	24.000	2,500	66	Does not meet spec.
	CC-42A (High)	4,150	12,000	2,500	66	Does not meet spec.
2	CH-43	4,800	23,000	1,600	66	1206-1500
3	CA-15 PD	4,940	26,000	1,750	66	1206-1500
	CA-25 (Low)	7,200	18,000	1,700	84	Does nct meet spec.
4	CA-25(High)	7,200	36,000	1,700	84	1202-1500
	CA-25A	7,200	36,600	2,400	84	Does not meet spec.

VIBRO-PLUS PRODUCTS, INC. (continued)

Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
4	CA-25D	7,200	36,000	1,700	84	1202-1500
	CC-50 (Low)	7,200	18,000	1,700	84	Does not meet spec.
4	CC-50(High)	7,200	36,000	1,700	84	1202-1500
	CC-50A (High)	7,200	36,000	2,400	84	Does not meet spec.
	CC-50A (Low)	7,200	18,000	2,400	84	Does not meet spec.
5	CA-25PD	9,320	44,000	1,700	84	1237-1500
5	CA-25 (Super)	9,450	44,000	1,700	84	1246-1500

Note: Models CC-50 and CC-50A are double drum machines with each drum providing the same compactive force.

RAY GO, INC.



Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
	304-A (Low)	3,800	16,000	2,300	66	Does not meet spec.
1	304-A(High)	3,800	16,000	1,700	66	1309-1500
2	300-A	4,460	16,000	1,500	66	1252-1500
3	404-B(High)	7,000	27,000	1,700	84	1369-1500
	404-B (Low)	7,000	27,000	2,300	84	Does not meet spec.
4	320-A	4,150	16,000	1,500	60	1207-1500
5	400	8,000	27,000	1,450	84	1248-1500
5	404-A	8,000	27,000	1,450	84	1248-1500
5	410	8,330	27,000	1,450	84	1273-1500
6	420	10,130	32,000	1,450	84	1290-1500

(continued)

RAYGO INC. (continued)

Curve No.	Model	Unsprung Drum Wt. (Pounds)	Dynamic Force (Pounds)	Rated Frequency (vpm)	Drum Width (Inches)	Acceptable Frequency Range (vpm)
7	600	15,276	45,000	1,450	100	1336-1500
8	500	16,350	45,000	1,450	80	1382-1500
9	700	19,500	60,000	1,450	100	1307-1500