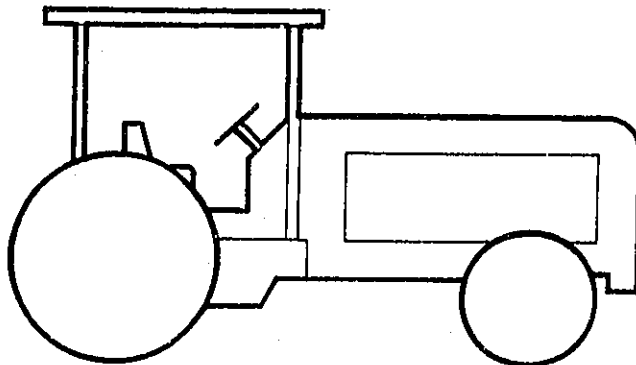




7-96-01
II-A-594

PRODUCT INFORMATION SUPPLEMENT No. 7
PRODUCT NOISE INFORMATION SERIES
JUNE, 1980

INFORMATION ON NOISE LEVELS, NOISE MEASUREMENT METHODS AND "BUY QUIET" EXPERIENCES ASSOCIATED WITH WHEEL AND CRAWLER TRACTORS



Wheel Tractor

AN INFORMATION SUPPLEMENT FOR GOVERNMENTAL PURCHASING
AGENTS IN DEVELOPING "BUY QUIET" PROGRAMS

THE NATIONAL INSTITUTE
OF
GOVERNMENTAL PURCHASING
1001 CONNECTICUT AVE. N. W.
WASHINGTON, D. C. 20036

Preface

This supplement contains information for the use of government purchasing officers and other officials in purchasing quieter Wheel and Crawler Tractors. It is a companion document to the Guide to Purchasing Quieter Products and Services¹ which describes in general terms how noise considerations can be incorporated into purchasing decisions. Together, these documents and others available through the Quiet Product Data Bank maintained by the National Institute of Governmental Purchasing (NIGP) can help you develop a "Buy Quiet" Program for your government.

1. Issued by NIGP, May 1980.

CONTENTS

Introduction

Section 1. Description of the Product

Section 2. Noise Level Output Information

Section 3. Preparation of the Product Specification

Section 4. A Suggested Method of Award

Appendices

A. List of Manufacturers

B. Buy Quiet Experience

C. Sources of Additional Information

INTRODUCTION

The "Buy Quiet" Program is a new concept in which governments cooperate with each other to buy quiet models of equipment. It is being extended with the help of the National Institute of Governmental Purchasing, the National League of Cities, other national organizations and various local and state agencies. This type of local noise control:

- . costs very little;
- . requires little additional effort;
- . begins the community quieting process;
- . establishes market pressures.

Surveys have shown that noise is the most frequently identified undesirable neighborhood condition in urban areas. Scientists and the medical profession now tell us that noise is no longer a mere irritant, but that in fact it has a very adverse impact on our health and well being. You as a purchasing officer can reduce noise in your community by purchasing quieter products. State and local governments and large private organizations spend billions of dollars each year on equipment such as compactors, chain saws, typewriters, lawnmowers, trucks, motorcycles, pneumatic drills, and buses. If these governments can become more selective so as to purchase quieter products, cities and neighborhoods will be quieter.

Section 1. DESCRIPTION OF THE PRODUCT

There are six broad classes of wheeler and crawler tractors: 1) wheel loaders, 2) crawler tractors, 3) wheel tractors, 4) wheel dozers, 5) skid-steer loaders, and 6) integral backhoe-loaders. These comprise the wheel and crawler tractor industry for which the major activities of loading, leveling, and shallow excavating are product design objectives. They are pictured in Figure 1.

Wheel Loaders

Wheel Loaders are characterized by a loader bucket linkage which is an integral part of the machine. They are normally four-wheel drive with articulated steering. An articulated steer loader is hinged midway between the front and rear axles. The front end axle can swing to either side of the straight forward position. Wheel loaders usually have diesel engines. Transmissions are designed for forward and reverse cycling and as a general rule have three or four gears in both forward and reverse. Bucket sizes range from less than 1 cu. yard to as much as 25 cu. yards. The bucket is used to dig, load, lift, carry, and dump earth and other workable materials. At construction sites, loaders are used to load materials for hauling, excavating, clean up, and other similar tasks.

Crawler Tractors

Crawler tractors can be equipped with or without integral linkage for dozer blades or loader buckets. In construction, dozers are used for land clearing, loosening and moving earth, filling, backfilling, compacting, and clean up. Horsepower ranges from under 50 to over 500 hp. Engines are usually diesel, with from three to six cylinders. Machines are offered with the option of power shift or direct drive transmissions and typically provide three to four forward and reverse operating speeds. Crawler tractors with loader buckets are used when the site terrain is too rough or muddy for wheel loaders to operate. They are usually less than 300 horsepower and their loader buckets are on the lower end of the range of bucket sizes.

Section 1. Description of the Product-Continued

Wheel Tractors

These machines may also be called industrial tractors or utility tractors. They are general purpose machines usually designed for use with bucket, blade, and/or backhoe attachments for light construction work, and other attachments for operations such as mowing, snowblowing, street cleaning, and landscaping. The design features are rigid frame, front engine, rear cab, two wheel drive, large tires in the rear, and small front tires for steering. Most models are offered with gasoline and diesel engine options. Engines are typically four cylinder, with horsepower ranging between 20 and 100 hp. The transmission is often direct drive and provides up to eight operating speeds.

Wheel tractors commonly used in construction are very similar in design to agricultural tractors and one may be confused for the other. No specific engineering distinctions have currently been established which have consensus acceptance by industry, to clearly define the agricultural tractor. There are, however, some general characteristics which distinguish the agricultural type tractor from the utility/industrial wheel tractor. Agricultural tractors are characterized by a rear power takeoff, draw bar, and design features for the towing of farm implements in the cultivation of crop fields. Frequently there are as many as eight to twelve forward gear speeds with one to four reverse speeds. The transmission of the agricultural tractor is designed for constant speed rather than the forward and reverse cycling required of tractors used in construction. The machine is not manufactured with the heavy casting around the radiator and engine component necessary to protect construction equipment from debris and vandalism.

The agricultural tractor is more likely to have direct drive transmission. The tractor is likely to ride higher for crop clearance and wheel separation is typically adjustable.

Because the agricultural tractor need not be designed for large overload and the ranges of operating conditions necessitated by construction work, the tractors are lower in weight and cost when compared with wheel tractors of similar horsepower.

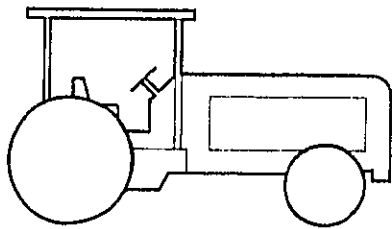
Description of the Product-Continued

Skid Steer Loaders

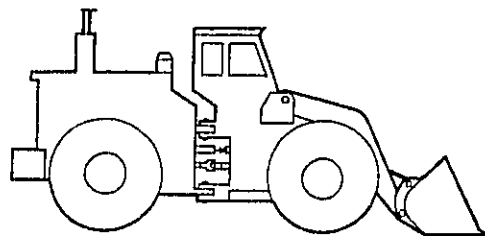
These machines are small loaders that are maneuvered by varying the speed and/or direction of rotation of the right or left set of wheels independently of each other. The frame of the machine is rigid and the wheel base is shorter than that of other loader types. Engines are small -- 40 hp. or less -- and are usually aircooled and gasoline powered. Loader linkages are integral to the frame. Skid steer loaders find limited use in construction. Their lightweight design is optimized for materials handling applications. They are not usually able to compete economically with the larger machines in loading operations.

Integral Backhoe-Loaders

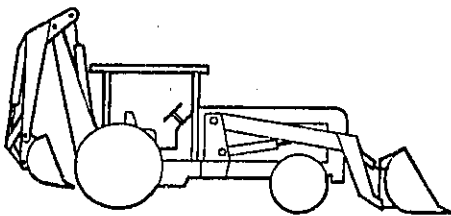
This refers to a wheel tractor with both an integral loader bucket apparatus and an integral excavating bucket (backhoe apparatus). The loader bucket is generally placed on the front and the excavating bucket (backhoe) generally located on the rear of the machine. The machine can perform loading operations but its primary use is for excavating. Manufacturer and construction contractor estimates indicate that the loader/backhoe is used 60 to 80 percent of operating time for excavating purposes.



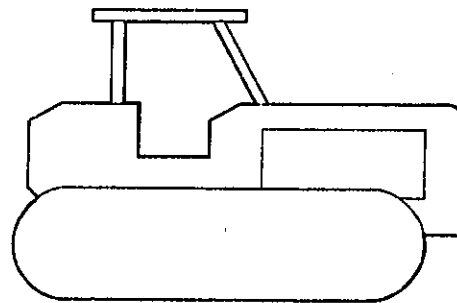
WHEEL TRACTOR



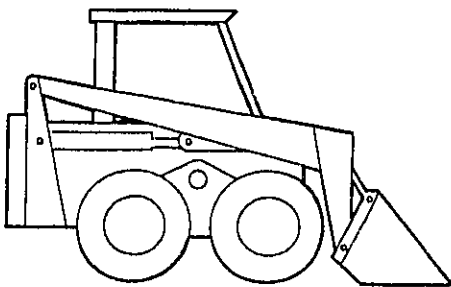
WHEEL LOADER



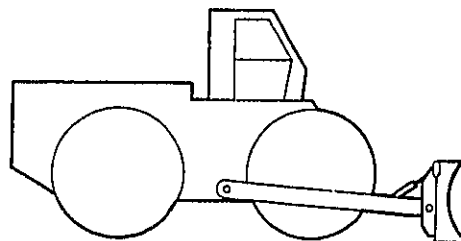
BACKHOE LOADER



CRAWLER TRACTOR



SKID STEER LOADER



WHEEL DOZER

FIGURE 1. LINE DRAWING OF TRACTOR TYPES

Section 2. NOISE LEVEL OUTPUT INFORMATION

Definitions of Terms

NOISE: Any undesired sound.

SOUND LEVEL METER: An instrument, consisting of a microphone, an amplifier, an output meter, and frequency-weighted networks, that is used for the measurement of sound levels in a specified manner.

DECIBEL: The intensity of a sound often abbreviated dB. The decibel scale was devised to measure the smallest difference in sound which is detectable by the human ear. Its graduations move up not in a simple arithmetic progression but in a multiple progression based on logarithmic calculations. This means that each increase of one decibel represents a much larger change of intensity than might be expected. Because of the logarithmic progression of the decibel scale, an increase of ten decibels, for example, reflects a ten-fold increase in sound energy, but is perceived as being approximately twice as loud. Thus a sound which is measured at 80 dB contains ten times the sound output and is perceived as being twice as loud as a sound that is measured at 70 dB.

dba: An expression of sound level taking into account the response of the human ear to sound.

Noise Level Output Information - continued

Noise level information is given in Table 1. When using it, please note:

- 1) the noise level range given for commercially available models of the product is for use as a guide only. It is not a definitive statement of noise measurements taken on all models currently available. Lower noise levels, for some models, are likely to be found.
- 2) when making comparisons among the noise levels of different products, it is very important that a single noise measurement method¹ is used. If this is not adhered to, very different noise levels will result and comparisons which are made may not be meaningful. Thus, in the chart the range of noise levels is expressed using one method from the known ones that are listed, to insure consistency when comparing noise level information. Selection of that particular method in no way constitutes NIGP endorsement of that method.
- 3) the table implies nothing in terms of product pricing. A quieter product does not necessarily cost more; in many cases, it may be less.

Measurement Procedures

Sound level measurement procedures generally prescribe instrumentation (e.g., the type of sound level meter to be used, other devices required), a description of the test site and measurement zone, a description of equipment operation (e.g. traveling on stationary mode, rpm setting), how measurements are to be made (e.g., setting of sound level meter, height and location of microphones), and general requirements (e.g., such as who should select testing equipment and conduct the tests).

1. See discussion in Section 3.

TABLE 1. WHEEL AND CRAWLER
TRACTOR NOISE DATA SUMMARY

PRODUCT	RANGE OF NOISE LEVELS ¹	OVERALL MEDIAN NOISE LEVEL	POSSIBLE NOISE MEASUREMENT METHODS
1) Crawler Dozers 20 - 89 H.P. 90 - 199 H.P. 200 - 250 H.P. 260 - 450 H.P. Limit	76 dBA - 84 dBA 78 dBA - 82 dBA 81 dBA - 84 dBA 82 dBA - 86 dBA	80 dBA	1) SAE J88 2) SAE J88a
2) Crawler Loaders 20 - 89 H.P. 90 - 275+ H.P.	78 dBA - 85 dBA 79 dBA - 88 dBA	79 dBA	These two documents prescribe noise measurement procedures in both the stationary and moving machine modes at a 50 foot distance from the machine.
3) Wheel Loaders 20 - 134 H.P. 135 - 241 H.P. 242 - 348 H.P. 349 - 500 H.P. Limit	76 dBA - 86 dBA 80 dBA - 84 dBA 80 dBA - 86 dBA 84 dBA - 85 dBA	81 dBA	
4) Utility Tractors	74 dBA - 81 dBA	74 dBA	
5) Skid-Steer Loaders	66 dBA - 77 dBA	71 dBA	

1. Measured at Hi-Idle using noise measurement procedure at right. This is 1976 data; there is some evidence to suggest that current noise levels include those below the quietest reported here.

Section 3. PREPARATION OF THE PRODUCT SPECIFICATION

A good specification for any product will identify minimum performance and design requirements; list the reproducible test methods that may be used to determine compliance with these requirements; allow competitive bidding; permit an equitable contract award at the lowest possible evaluated price.

Therefore, a government seeking to purchase a quieter product should be sure that its specification describes a product that can be bid at a reasonable price by at least two, and preferably, three or more suppliers.

Noise Level Specification

The noise level portion of the product specification should contain the following three elements.

1. A maximum noise level referenced to a single measurement methodology.
2. A verification requirement, and
3. An incentive for offering products quieter than the maximum level established.

Maximum Noise Level

The maximum level should be low enough to disqualify the noisiest models on the market but high enough to insure competition among 2 or more suppliers.

In the absence of a recommended level from NIGP, a buyer should feel comfortable in using a level roughly midpoint in the range of noise levels presented in Table 1.

Section 3. Preparation of the Product specifications - Continued

Including Sound Level Measurement Procedures in the Specifications

A buyer must reference a reproducible sound level measurement procedure whenever it specifies a noise level requirement or any other performance requirement. For example, the noise level requirement in a specification for a quieter wheel or crawler tractor might say:

NOISE LEVEL: Noise level shall not exceed ___ decibels (A Scale) when measured in accordance with SAE J88 or SAE J88a.

A copy of the complete specification will be available from NIGP in the near future.

Verifying Compliance With Specifications

There are at least two ways that governments can assure themselves that they have been offered or sold products which conform to specified requirements. One involves laboratory and field testing. The other involves vendor submission of "certified" test data.

In some instances, it may be necessary for the government or its agent (e.g., a commercial laboratory) to actually test items when they are submitted for evaluation or when received after purchase. In most instances, however, it is more practical for the government to ask a written certification that the vendor's product conforms with a specified requirement. There are hundreds of private sector laboratories which could be approved to perform testing and certification services for manufacturers.

If a buyer must actually test the noise levels of product models offered in response to a "noise-conscious" invitation for bids, he or she should contact the Buy Quiet Program director at the NIGP national office for assistance, who may be able to arrange for essential testing through various cooperative programs.

INCENTIVES FOR QUIETER PRODUCTS

Section 4. A SUGGESTED METHOD OF CONTRACT AWARD

NIGP has developed an optimal method of contract award which allows a buyer to encourage a bidder to offer a product that is even quieter than required by the specification. In effect, it tells the bidder: "For each decibel¹ that your product is quieter than the loudest product bid (in conformance with the specification), we will subtract a fixed percentage of the average actual bid price from your actual bid price. The difference will be your evaluated bid price."

Evaluated bid prices, rather than actual bid prices, are compared in the selection of the contract recipient. As in Life Cycle Costing, the bidder with the lowest actual bid price may not necessarily be the bidder with the lowest "evaluated" bid price.

To insure against paying an excessive premium for increased quietness, buyers using this optimal method of contract award can state:

The purchaser will not pay a contract price more than X% in total above the average of the actual bid prices.² This amount represents the maximum additional amount that the government is willing to pay above the average actual bid price, for each quieter product.

1. Usually (but not always) A scale. A few product methodologies may use the C scale.

2. Not to be confused with the per decibel incentive in the formula.

Formula For Determining

Evaluated Bid Price

The formula for determining the Evaluated Bid Price (EBP) is:

$$EBP = P - Y\% (P_{AV}) (N_N - N) \text{ where:}$$

EBP = Evaluated Bid Price

P = Actual Bid Price

Y% = The percentage weight designated by the purchasing activity to "reward" the bidder for each decibel that his model is quieter than the noisier model bids.

P_{AV} = Average (actual) bid price of all models bid in response to the IFB

N_N = The noise level (in decibels) of the noisiest model bid in response to the IFB

N = The noise level (in decibels) of the model whose EBP is being determined

Sample Bid Tabulations

In order to illustrate the working of the formula the bid tabulations for a purchase of quieter product X might look like this:

BIDDERS:

<u>Bidder</u>	<u>Actual Bid Price</u>	<u>Noise Level (dBA)</u>	<u>(EBP)</u>	<u>Evaluated Bid Price:</u>
(A) Smith Co.	\$145.00	76		\$145.00
(B) Robert Co.	\$154.00	75		\$151.02
(C) Jones Co.	\$147.00	72		\$135.08
(D) Watkins Co.	\$150.00	71		\$135.10

Calculation of Evaluated Bid Price (EBP)

Assuming that the Purchasing Activity used a 2% "reward" factor for each decibel of increased quietness, the EBP for each bidder would be determined as follows:

(A) Smith Co.
EBP = \$145. - .02 (\$149) (76-76)
= \$145. - \$2.98 (0)
= \$145.

(B) Roberts Co.
EBP = \$154. - .02 (\$149) (76-75)
= \$154. - \$2.98 (1)
= \$151.02

Calculation of Evaluated Bid Price (EBP) continued

(C) Jones Co.
EBP = \$147. - .02 (\$149) (76-72)
= \$147. - \$2.98 (4)
= \$147. - \$11.92
= \$135.08

(B) Watkins Co.
EBP = \$150. - .02 (\$149) (76-71)
= \$150. - \$2.98 (5)
= \$150. - \$14.90
= \$135.10

Contract Award

Based on an evaluated bid price (EBP) of \$135.08, the contract should be awarded to Jones Co. (bidder "C") at its actual bid price of \$147 per unit for furnishing quieter product X with a (maximum) noise level of 72 decibels (A Scale).

APPENDIX A

Manufacturers of Construction Wheel and
Crawler Tractors

Allis - Chalmers, P.O.Box 521, Topeka, KS 66601

ATP

J.I. Case, 700 State Street, Racine, WI 53404

Caterpillar Tractor Co., Peoria, IL 61629

Clark Equipment Co., 324 E. Dewey Street, Buchanan, MI 49107

Deere & Co., John Deere Rd., Moline, IL 61265

Digmor Equipment & Engineering Co., Inc. 1435 West Park Avenue,
Redlands, CA 92373

Dynamic Industries Inc.

Eaton Corporation, 1 Trojan Circle, Batavia, NY 14020

Fiat-Allis, 300 S. 6th Street, Springfield, IL 62705

Ford Motor Co., The American Road, Dearborn, MI 48121

General Motors Corp., Terex Division, Hudson, Ohio 44236

International - Harvester, 10400 W. North Avenue, Melrose Park,
IL 60160

Hy-Matic Corp., 1635 Pittman Ave., Sparks, Nevada 89431

Massey Ferguson Limited, 12601 Southfield Rd., P.O. Box 322
Detroit, MI 48232

Owatonna Mfg. Co., Inc. P.O. Box 547, Owatonna, MN 55060

Manufacturers of Construction Wheel and
Crawler Tractors - Continued

Other Equipment Manufacturers and Contacts

Athey Products Corp., P.O. Box 69, Raleigh, N.C. 37602

AVCO Corp., 1275 King Street, Greenwich, Conn. 06831

Beacon Machinery, Inc.

Bucyrus-Erie Co., 1100 Milwaukee Ave., Milwaukee, WI 53172

Burrows Equipment Co.

Charles Machine Works, Inc., 1959 W. Ditch Witch Rd.
Perry, OK 73077

Dart Truck Company, Box 321, Kansas City, MO 64141

EIMCO Mining Machinery, P.O.Box 1211, Salt Lake City, Utah

Erickson Corp., Clear Run Rd., P.O.Box 527, Dubois, PA 15801

Gehle Co., 143 Water Street, West Bend, WI 53095

Gladden-Hass

Hydra Mac, Inc., Box N, Thief River Falls, MN 56701

Hyster Co., Lloyd Bldg., Portland, OR 97323

J.C.B. Excavators, Inc., P.O. Box 207, White March, MD. 21162

Koehring Co., Lorain Division, P.O. Box 4294, 409 Signal Mountain
Rd., Chattanooga, TN 37405

Koehring Co., Parsons Division, 200 N. 8th Ave., E. Newton, Iowa 50208

Komatsu American Corp., 555 California St., San Francisco, CA 94104

Koyker Mfg. Co., Hull, Iowa 51239

Lodal Inc., East Blvd, Kingford, MI 49801

Loed Corp., 738 S. 10th Ave., Warsaw, WI 54401

Long Mfg. N.C. Inc., 1907 N. Main St., Tarboro, N.C. 27886

Crawler Tractors - Continued

Other Equipment Manufacturers and Contacts

Lull Engineering Co., 3045 Hwy 13, St. Paul, MN 55111
Marathon Le Torneau Mfg., 600 Jefferson, Longview, TX 75657
Marion Power Shovel Co., Inc., 7336 Airfreight Lane, Dallas TX 75325
Midmart
MRS Mfg. Co., P.O.Box 199, Flora, MS 39071
Oaks Mfg. Co., Oaks, ND 58474
Pettibone Corp., 4710 W. Division ST., Chicago, IL 60651
Raygo-Wagner Inc., 9401 85th N., Minneapolis, MN 55440
Rexnord, Inc., 777 E. Wisconsin Ave., Milwaukee, WI 53202
Sanford Day Co., Inc.
Sian Equipment Co.
Sperry-New Holland, Franklin & Robers St., New Holland, PA 17557
Steigler Tractor Inc., 3101 First Ave., North, P.O.Box 6006, Fargo, ND 58102
Thomas Equipment Ltd.
Track Machinery Corp.
Utah International, 550 California St., San Francisco, CA 94104
Vermeer Mfg. Co., Box 200, Pella, Iowa 50217
Versatile Mfg., 1260 Clarence Ave., Winnipeg, Man., Canada
Wabco Construction Corporation & Mining Equipment, 2300 N.E. Adams St.,
Peoria, IL 61639
White Motor Corporation, 100 Erieview Plaza, Cleveland, OH 44144
Construction Equipment Div.
Farm Equipment Co.

June 1980

APPENDIX B

Governments Known to Have Had Buy Quiet
Experiences Associated With
Wheel and Crawler Tractors

The Buy Quiet concept is new and the program is just starting. It should not be surprising, therefore, that the NIGP Data Bank, as yet, has no experiences to report for these products. When experiences become known to us, the governments will be listed in this section.

June 1980

APPENDIX C

Sources of Additional Information

Information on any aspect of the Buy Quiet Program is available from:

Director
Buy Quiet Program
National Institute of Governmental
Purchasing, Inc.
1001 Connecticut Avenue, N.W.
Suite 922
Washington, D.C. 20036
Tel: 202/331-1357

For additional information on technical and programmatic matters relating to product noise, you may wish to contact your local or state noise control official.