

**The International Comparison Program  
Equipment Goods Survey**

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## I. Introduction

Consumption goods, like a pair of shoes, or 200 gms of breakfast cereal, frequently differ in packaging, style, and other characteristics that have little to do with functionality of the product. Equipment goods also can differ in design, but in the case of equipment goods these differences in design typically serve a function in the task to be performed. Alternative solutions by design, functionality, productivity, performance, technology and execution are comparable if the work performance produces the desired effect for users. A methodology is necessary to provide a consistent template of equipment characteristics that will describe the function and value of the equipment designed to perform a specific task or range of tasks. The principles involved in the design of the enclosed PS/SPDs are set out in the next section, followed by a section explaining the format of the PS/SPDs. The following section is intended to serve as a guide to regional coordinators and national statistical offices to actually choosing the items and collecting prices. Finally, the PS/SPDs are provided with some introductory comments for the groups.

## II. Principles of Equipment Goods Function & Pricing

Some consumer goods, like personal computers, are identical with or resemble equipment goods in that there are several technical characteristics that are very important in determining the price. However, in developing a measurement system for equipment goods in the ICP, it is necessary to accommodate diverse equipment/tool categories yet remain consistent enough for survey execution without extensive training for the personnel conducting the survey. Based on meetings of the Regional Coordinators and discussions with experts in the field, it is not clear how feasible it will be to match exact product specifications for equipment like agricultural tractors even for all countries within a region. However, it is clear that a tractor in a particular size class will have the same task-related technical features anywhere it is purchased. The approach adapted is to recommend matching equipment goods whenever possible. But in actual price collection, the template has been designed to note the major price-determining characteristics of the particular piece of equipment. Then, if exact matching is not possible, it will still be feasible to make price comparisons, holding constant the main characteristics of the item. Because exact matching is problematic, the design of the equipment goods PS/SPDs focuses on comparable functions for the equipment user.

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In reviewing many machines across the diverse Basic Headings, five recurring characteristics that determine price of most equipment goods are identified as follows:

1. **Performance** measures the effort required to use the equipment or tool to achieve the work task. It is generally expressed in terms of power. For the purpose of uniformity, the units of power for the PS/SPD of large equipment are expressed in kilowatts. If the power specification is less than 5 kilowatts, the power rating is generally expressed in watts.
2. **Availability/Reliability** measures the robustness of the equipment to perform the intended work task when the user desires or requires the task to be performed, without failure to complete the task. This rating method is a combination of reliability as well as durability that measures not only if the tool or equipment will perform today, but if it will perform every day over its projected design life.
3. **Function** measures the integrity of the equipment or tool to achieve the intended work task by providing a range of flexibility to adjust performance to meet the demands of local requirements. This measurement is really the description of task limits on the equipment or tool.
4. **Productivity** measures the degree of confidence that the tool or equipment instills in the user to exploit the maximum performance available. Safety and comfort are very significant measures that impact productivity. Fatigue induced by excessive noise, control forces, high/low temperature exposure, and operator space are restrict productivity.
5. **Technology** measures the level of scientific and engineering technology in providing efficiency, utility, reliability, safety, and durability with respect to accepted state-of-the-art equipment or tools.

These five attributes of equipment goods have a certain timeless quality that should survive mergers, changes in features, entry of new producers and the like. In developing this framework, what has been created is a hybrid of a PS and SPD that can be used as a PS in some cases, but also serves as an SPD in other cases, thereby allowing countries to price a product with some characteristics that differ from or are absent in the baseline product specification. The five characteristics provide enough consistent detail to permit hedonic price comparisons where exact matching is not possible.

An important aspect of this approach is that a region can customize an available machine to achieve the functional characteristics described by the ICP survey. There are, for example, no readily recognized regional product differences with respect to operator comfort and protection or engine emission compliance. Adding basic operator protection, engine and noise emission compliance, lights and control interlocks, can result in a 30% or greater difference in price for the same tractor functionality. These add-ons are likely to be region or sub-region specific and often will be taken into account in regional PSs. Yet in terms of the Ring Comparison, it is likely that functional equivalents can be found, such as a basic no-

frills farm tractor, or that allowance can be made in the comparisons for the additional cost of such special features, a practice common in European comparisons.

### **III. Globalization & Harmonization of Standards**

Although globalization is not a new trend, expanding trade has always led to the harmonization of products and processes. Activities in the entire 20th century have moved at an increasing pace toward globalization as the world consolidates its resources. Regional labor shifts within a generation are moving the work and technology from region to region on the globe, but control of the technology and production capacity has been consolidated in global corporations with a wealth greater than some regions. Using agriculture as an example, three companies account for over US\$30 billion volume globally. This represents the bulk of the money spent globally for new equipment annually in production agriculture. The same is true for earthmoving machinery, which comprises the Big Two and everyone else. In fact, the sales figures for 2004 in hydraulic excavators reveals that Caterpillar commands about 40% of market share globally, followed by Komatsu and Hitachi which split a 40% share of the global market. That leaves 20 % of the global market for the remaining players. This consolidation intensified in these industries over the past 50 years, thus creating harmonized products for global consumption. This is useful knowledge because industry has communized products into like groups, thus reducing the need to sample every machine. In fact, one machine from each product grouping will suffice for the comparison survey.

An illustration of this grouping is apparent in agricultural tractors. The compact tractor segment uses volume-produced engines, gears, shafts, clutches, differentials, electrical steering and controls in proprietary castings and weldments. Utility tractors are larger than compact tractors, and are basically refinements of designs that in one instance dates back to 1939.

Harmonized global standards for performance and safety have been the strategy of manufacturers. The only exception has been telecommunications, where markets have been protected. The rest of the products in the Equipment Basic Headings have moved toward harmonization.

Earthmoving and surface mining machines use standards developed by industry working with ISO TC127 that reflects a portfolio of over 100 standards. ISO refers to the International Organization for Standardization ([www.iso.org](http://www.iso.org)), a manufacturers' organization that works on setting common global technical standards for equipment. Agreements have been reached to suspend regional standard development and use the technical resources of regional standards developers in a non-competitive distribution of the work. This has permitted a status update program ensuring that every standard is reviewed for validity every five years. If no longer relevant, a standard will be revised or dropped based on consensus from the global members voting on the action.

The transport industry is not quite as mature, but ECE WG29 has advanced the work of ISO TC22 to a higher global acceptance.

Agricultural manufacturers are also moving to put the industries standards under ISO. Currently, the ISO sub-committees are progressing through ISO4254 to provide standards for safety in agricultural machines. Agriculture tractors are accepted globally by design consensus. The European Old Approach Directive still requires that a third party approved within the European Union must review and approve the tractor for marketability. However, there is virtually no difference between the developed-country tractor standards and the European requirements. Typically, all off-highway machines driven on European public roads require a third party approval certificate before they can use the public roads. This is an isolated requirement in other parts of the world but, to date, the German road certificate has been accepted in lieu of a local examination (South Africa).

Standard consolidation is occurring for commercial and political reasons as the global economy starts to move through the 21<sup>st</sup> century. The EU has adopted the CEN (Communitie European Normes) Standards and abandoned the regional standards in the 25 member countries. This was a political decision as well as a commercial decision. The Vienna agreement with ISO is a strong endorsement to harmonize CEN standards with ISO. ISO has had the same influence globally as regional standards such as GOST, SASSO, JIS, SAE, ASAE, ANSI, AS, CS, ABNT and more have accepted ISO standards in place of updating obsolete regional standards. With fewer corporations supporting standards work and government budgets squeezed to provide more money for social programs, streamlining standards has been a method to reduce support cost while improving standards performance for users. Both the OECD and WTO benefit when the world accepts a single standard to measure the performance of a machine or device and reinforces a single test to confirm that performance.

## **IV. Format of PS/SPDs**

### **1. The Expenditure Framework**

The organization of the PS/SPDs follows the ICP expenditure classification. The relative importance of these headings will differ greatly by country even within the same region. In addition, larger countries will have domestic production and may export some of these items, while smaller countries will predominantly import the items. Further, importing used machinery is a common practice and the format of the PS/SPDs takes such purchases into account. As discussed further below, the diversity of countries means that while a target number of items to price is suggested, it can be only a suggestion. Countries may not have expenditures in some basic headings in a particular year, or may not use a particular type of capital equipment.

### **Basic Headings**

The Equipment Goods cover seven ICP Basic Headings, under the “155” Classification of Final Expenditure on GDP:

1. Fabricated Metal Products, except Machinery & Equipment (15.01.11.1)

2. General Purpose Machinery (15.01.12.1)
  - Engines, Turbines, Pumps & Compressors
  - Other General Purpose Machinery
3. Special Purpose Machinery (15.01.13.1)
  - Agriculture and Forestry Machinery
  - Machine Tools
  - Metallurgy, Mining, Quarrying and Construction Machinery
  - Food, Beverages & Tobacco Processing Machinery
  - Textile, Apparel and Leather Production
  - Other Special Purpose Machinery
4. Electrical & Optical Machinery (15.01.14.1)
  - Office Machinery
  - Computers & Other Information Processing Equipment
  - Electrical Machinery & Apparatus
  - Radio, TV, and Communications Equipment & Apparatus
  - Medical, Precision & Optical Instruments, Watches & Clocks
5. Other Manufactured Goods (15.01.15.1)
6. Motor Vehicles, Trailers & Semi-Trailers (15.01.21.1)
7. Software (15.01.23.1)

## **2. The PS/SPD Layout**

The following paragraphs will describe the PS/SPD layout content by section. A general point to note is that some PS/SPDs encompass a wide range of capacity, such as air conditioners. These range from window units that are likely to be priced for household use, up to whole house, or whole building units. Countries are requested to generate more than one PS for an SPD if it is appropriate to their economy. The following paragraphs will describe the PS/SPD layout content by section.

- **Basic Heading and Product Names & Codes:** An ICP classification divides equipment goods into the above seven Basic Headings within the ICP 155 heading framework. Each Basic Heading is given a code and unique name. Similarly, products within each basic heading are coded and named.
- **Brief Description:** A brief text description of the machine, tool or commodity follows the classification. A description of the intended function is included to clarify the PS/SPD that is being measured. Specific performance and physical characteristics are reserved for subsequent sections and not stated in this section.
- **Product Images:** A picture or illustration is also provided to reinforce the product description. Visuals will not only quickly convey the nature of the equipment, tool

or commodity to a user unfamiliar with the subject, but also allow price collectors to efficiently illustrate their data needs to dealers and distributors.

- **Manufacturer, Make & Model:** Lists of known manufacturers or the dominant manufacturer are provided in this section. To fill in this section, it is necessary to know if the suggested manufacturers serve the region and, if so, what model descriptions are used to designate the equipment, tool or commodity. Global manufacturers generally build a common global model that is sold in all regions. This is in contrast to many consumer durables. For some of the items, an ISO code is offered, such as ISO TC127 for earthmoving equipment. A CAT D11R bulldozer, for example, uses that model designation globally and it is the model for ISO TC127 standards. There are no derivative models, but attachments with distinct model numbers can be added to the equipment to expand its usefulness. This is a growing practice and WG29 of the European Economic Commission through ECE Standards is rapidly moving cars and trucks to single model designations. An open space is provided to insert, if applicable, the name of manufacturers that specifically serve a region. If the name of an additional manufacturer is supplied, a model description with the technical characteristics should also be provided.
- **Price Determining Characteristics:** The characteristic section has five sub-sections that correspond to the earlier statement explaining the measurement methodology. There are exceptions to the use of all five sections, and these will be highlighted in the introductory statements preceding each of the 7 ICP Basic Headings.
  1. **Value** asks for a number or quantity to identify a precise characteristic. A unit of measure is specified for each value to ensure consistent data.
  2. **Feature** provides a box followed by a description of a feature that may or may not be included in the equipment price. If the feature is included in the price, an “x” is entered in the box. If the feature is absent, leave the box empty.

### **3. Used Equipment**

Used equipment varies greatly in demand, value and unit of measurement used in the market to value the item. Typically, equipment that has been used to transport people or goods on public roads will be measured in terms of kilometers traveled, application history and current condition since being put into service. Equipment used for off-highway applications (agriculture, earthmoving and construction) is measured by the number of service hours since it was put into service, application history and condition. Off-highway machines are considered capital goods and, by the nature of use, are robust enough to be rebuilt and restored to original performance levels. Rebuilt and remanufactured equipment typically can be restored to its original performance, for a cost of 40 to 60 percent of a new machine.

Certain commodities such as rolled and extruded sections are not rebuilt or remanufactured. The cost to salvage and reuse exceeds the value of newly produced items. These items are recycled or scrapped depending on the economic assessment. Fabricated Trusses are very specific and are not reused unless the structure is identical. It is usually more economical to

use a new truss built for the installation. Hand tools also exhibit low desirability as used tools. Even in good condition, their value is less than 10 percent of the original price regardless of condition. An inoperative tool has residual value as a part source at approximately the same 10 percent value of a new tool. Reuse of light bulbs and light fixtures is highly dependent on regions. Generally, light bulb prices are reasonable and the user prefers new equipment. Most light fixtures are not candidates for resale, unless there is antiquity or high residual commercial value such as HID lights

Machine tools, generators and electric motors are likely candidates for remanufacture. The worn items can be economically replaced, and technology upgrades are easily adapted. The same can be said for medical devices where replacement cost has consistently outpaced inflation rate increases by 100 to 200 percent. Depending on the country, used equipment may be refurbished in the original country of use, in the country purchasing the equipment or a third country. As discussed below, the distributor within a country or region is likely to be the same outlet that sells new equipment of the same type.

The term ‘condition’ has been a part of the discussion of used equipment or tools. Inquiries revealed the following guidelines that can be applied in describing the condition of used equipment:

1. **Excellent** denotes performance equivalent to a new machine and appearance to match. This condition represents a slightly used or completely reconditioned machine. This machine is ready to work at peak performance.
2. **Good** denotes equipment or tools that will perform satisfactorily, but show signs of usage in terms of moderate wear and some paint damage. The equipment will appear well maintained and will sound smooth during operation.
3. **Average** denotes that the equipment or tool has less than 50 percent of its work life remaining. Reliability is diminished, and failure to perform due to minor breakdowns can be expected to increase throughout the remaining life of the equipment or the tool.
4. **Fair** denotes equipment or tools that can no longer perform at peak levels without excessive breakdown. The appearance will be rough and a general looseness in the working parts will be apparent when in use. Paint will be missing and damage will be evident on working parts. This equipment is generally reserved for light duty or short intermittent supplemental assistance to newer equipment on the work site.
5. **Poor** denotes equipment or tools that can no longer perform the intended function. Unless restored to operating condition the equipment or tool can be used for salvageable parts prior to scrapping.

#### **4. Prices to be Reported**

The pricing section deserves a brief comment. New equipment prices are usually set by the manufacturer. There are generally three levels of pricing starting with the manufacturer who sets an FOB freight on board, the price mark-up added by the distributor and the dealer mark-up to the final customer. Tariffs and taxes will be in addition. Larger distribution companies can operate as both the distributor and dealer, reducing the mark-up over the manufacturer's price. Global distribution is facilitated by distributors that deal with transportation, tax and import regulations. The local dealer is the selling agent making contact with the final purchaser. The dealer is basically a franchisee who makes delivery, familiarizes the user with the equipment (often including training), executes the warranty, arranges financing and settles the accounts owed. The dealer will be the principal to determine used equipment value. Governments usually opt to deal directly with the manufacturer.

Used equipment prices are market-driven, based on equipment reputation and the supply/demand relationship in the market place. The local dealer in a region will be the price setter in the local region because the local dealer knows the user and machine, and can accurately set the value based on residual life and condition. The local dealer may also know that another user is looking for that type of equipment.

Another source of price information that is becoming more common globally occurs when large contractors or rental companies elect to sell inventory rather than continue to use equipment in their business activity. Auction companies such as Ritchie Bros. operate globally, taking equipment consignments with and without reserve pricing. They move the equipment to regions where known demand exists, auctioning the consigned items for the owners. These organizations use phone, fax, websites and e-commerce to conclude the sales. They are big enough that letters of credit and export/import regulations are just a fact of business. The source of information for pricing is summarized as follows:

1. New equipment pricing is available from manufacturers, distributors and dealers.
2. Used equipment prices are determined by local dealers (sales agents), regional auction companies and global auction companies.
3. Industry summaries of new and used equipment prices are available on numerous websites and from weekly monthly publications reporting price activity on equipment.

A final space is provided on the PS/SPD to clarify the reviewer's summary in a comments section. Comments are not required, but encouraged if the additional information improves the accuracy of the survey.

## V. Choosing PSs and Collecting Prices

### 1. Considerations in Choosing Items

The PS/SPDs provide commonly purchased equipment, noting substantially different types such as air conditioning equipment that can vary greatly in capacity. In choosing PSs to price, it may prove efficient to start with the item illustrated, though often it may not be common in a country. Local availability is even more important for equipment than for consumption goods. A balance must be struck in terms of trading off the goal of matching items common in other countries with the equipment actually used in a country. A review of equipment items entering into wholesale, producers or import price indexes can help provide a guide as to available items. And a few inquiries on the web or of dealers and distributors can quickly determine if the type of equipment purchased locally is similar to the suggested models in the PS/SPDs. The Regional Coordinator may have substantial input into this process based on knowledge obtained about distribution practices within the region.

### 2. Who are the Experts?

#### 1. **Within a National Statistical Office:**

Those who compile a producer price, a wholesale price, or an import price index are most likely to have familiarity with the types of goods being compared for these basic headings. For some items, like automobiles or computers, the comparisons used for consumption may also work for equipment.

#### 2. **Within the Country:**

Distributors and dealers in equipment in a country will have the knowledge of the models and their detailed characteristics and price. It is important in obtaining prices from dealers to make sure all local taxes and any other charges are included.

#### 3. **Outside the Country:**

A separate listing of websites is provided as an appendix to this document that should be of value to both country and regional staff. Websites are often available in more than one language, and usually give all the technical information called for in the PS/SPDs that the Global Office has provided. Websites may be tailored to regions of the world and often provide names and contact information for dealers and distributors. In smaller countries, there may be regional distributors covering adjacent countries.

#### 4. **Local Purchasers:**

Departments of government, especially Public Works, purchase equipment on a regular basis. As noted, they may buy directly from manufacturers, but in many cases they will also have contacts with dealers and distributors.

### 3. Number of PSs and Quotations

Shares of expenditures in basic headings of consumption display much more regularity across time and across countries than do purchases of equipment. Specialization in

production means that some countries will purchase much more equipment in some headings than others. Further, in any particular year, there may be many more purchases of the same equipment than in another. For countries that import much of their equipment, trade data can be a guide to the number of PSs that should be sought in each basic heading.

In smaller countries, there may be only one or two dealers from whom price quotations can be obtained. This simplifies collection but provides little insight into errors involved. Where only 1 or 2 dealers can supply prices for equipment that is used in the country, then it is recommended that countries try to price more PSs than they would if it were possible to obtain many price quotes. Pricing a larger number of PSs will help to offset the small number of quotes per PS.

In countries that produce equipment or in large countries that may have a number of licensed dealers, more price quotes should be obtained. If countries import and produce the same functional equipment, albeit with different technical characteristics, both PSs should be reported.

#### **4. Additional Notes & Website References**

##### **A. FABRICATED METAL PRODUCTS**

This is a Basic Heading with great diversity. Within this heading are two general categories of products and/or machines.

**1. Fabricated Assemblies** vary from pressure vessels to structural trusses and even bridge supports. Due to regulatory requirements that are unrelated, comparing these products with precision in terms of function will not likely be successful. Conversely, the precise selection of like forms and materials from distributor inventory catalogues or websites enables the comparison of extruded and formed shapes in a variety of materials.

Rolled and Extruded Sections are commodities. The shape of the cross-section and the area represented by the cross-section are significant to pricing once the material specification has been described. The amount of tooling and energy to create the cross-section is defined. Adding a length of section completes the essential information to define mass, tooling and time to make the commodity. The rolled section PS/SPD suggests the material is steel, and the pricing length is one metre. Hence, the price of the commodity can be expressed in value per unit length or value per unit weight.

The same reasoning was used for the extruded shapes. The material assumption for extrusions was aluminum. The performance is not in the commodity itself, but the process to form the commodity. Reliability is also a function of process with influence from raw material integrity. Function is the commodity measurement. Productivity and technology are properties of the process to make the commodity or the process to refine the commodity for its final purpose. Price is heavily influenced by raw material and forming process.

Trusses are a fungible commodity used to support weight or mass. Applications can vary from roof and floor support to bridges. Truss materials can be selected from many materials with price and function being the deciding factor. Wood trusses are popular in small commercial buildings and residential homes. In many parts of the world, wood is still plentiful and economical to assemble into strong, light-load bearing structures. Light-weight welded steel and aluminum trusses are used in commercial buildings for strength, fire resistance, and large open spaces. Bridge design also uses many truss styles to span water or gullies. This type of truss is often erected on site to perform physical restraints on shipping weight and bulk. Obviously, trusses are a commodity and function is the key pricing factor. The span capacity for price is usually the basis for a specific truss design. A truss is a customized commodity and not easily standardized except to express the cost in terms of span and load capacity.

**2. Steam Heating Systems** are mature products and systems with a long history of regulation. Precise comparison within steam heating systems is similar to the extruded or formed shapes category. The information is readily available in a standard format globally.

**WEBSITE:**

[www.alcoa.com](http://www.alcoa.com) (aluminum extrusions)

## **B. GENERAL PURPOSE MACHINERY**

The PS/SPDs represented in this heading are measured by the five characteristics stated in the main instruction text.

**1. Engines, Turbines, Compressors and Pumps** is a category with mature technology and can be compared with a straightforward set of SPD's (Structured Product Descriptions). Overall, *Engines and Turbines* generate power, noise and pollution and they are measured on the basis of power density for the application. *Compressors* are easy to compare because their performance is based on the gas laws of physics. Price is a matter of scale based on volume of the gas medium delivered at a specified pressure.

*Compressors and Pumps* must be compared for the medium they transmit; that is, an air compressor is made with less exotic material than an ammonia compressor. Obviously, the same logic applies to pumps. Pumps are also measured on volume delivered at a specified pressure. Because pumps are transmitting a practically incompressible medium, the design must accommodate not only the steady state pressure and volume, but also effectively deal with transient motion and the resulting stress rise within the pump.

- **Engines:** The primary purpose of engines is to convert fuel to power as efficiently as possible. Engines are measured in terms of power density. Power density is the amount of net power generated by an occupied volume and weight. It is necessary to determine the reliability before finalizing the power density determination.

Reliability and life will increase volume and weight of an engine. Simply stated, two engines with identical power ratings will differ significantly if one is designed for 1000 hours at rated power and the second is designed to operate 10000 hours at rated power. No attempt was made in this PS/SPD series to describe packaged power units. In the functional section, there is a request to describe power take-off possibilities, starting options, air-charging methods and emission certification. Engine productivity is largely controlled by fuel quality and fuel management systems. Once an engine is integrated into a machine, the productivity engine productivity control is submerged into the machine systems. Engine technology is specific and very competitive. Three technologies are constantly under pressure for refinement; combustion science, fuel management and emission reduction (exhaust and noise). Engine diagnosis both at rest and in running state is a growing preference by users. Engine management systems can be linked through CANBUS to IT onboard systems that use satellite communication.

- **Industrial Gas Turbines** are another form of internal combustion engine providing constant and stand-by power for electricity generation, gas line pumping stations, water pumps and sewage/waste water pumping systems. Turbines provide high power density, but are suited to steady state running. Specific fuel consumption is greater than piston engines, particularly diesels. Gas turbines are measured by the five characteristics mentioned in the first paragraph of this appendix.
- **Air Compressors** are used globally. Since they are power absorbers they require a power source. All five characteristics are involved in describing the value of an air compressor regardless of size. The measured output is volume of air at pressure with respect to time.
- **Water Pumps:** Like compressors, water pumps are power absorbers and require a power source. Hence, the five characteristics are necessary to describe value regardless of size or installation. The measured output is volume of water (fluid) at pressure with respect to time just like an air compressor.

**2. Other General Purpose Machinery** is a category that includes lifting and handling equipment such as a variety of cranes, non-domestic cooling and ventilation equipment, and other general purpose equipment n.e.c.

- **Cranes** are larger and more complicated devices than many of the other General Purpose equipment. Cranes perform one function: they lift mass from one level or place to another. The distance they can move objects vertically is their major capability. They are complete machines with their own power source and controls to achieve the intended function. These machines can be mounted on mobility platforms such as track systems or tires to facilitate putting them where they are needed. The exception to this concept is the tower crane where the base is fixed in place and horizontal movement is restricted to the reach of the trolley boom. Specialty carriers are available to provide convenient public road transport from work site to work site.

- **Heating, Ventilating and Air Conditioning** equipment are measured by the five characteristics. Heating equipment can either convert fuel internally to provide heat or use an external source such as electricity to perform the intended function. Heating systems are measured in terms of the ratio of input energy to output energy. Ventilation is a form of air-handling system that is measured by the volume of air that can be moved at a pressure head in a specified time.

**WEBSITES:**

[www.ingersol-rand.com](http://www.ingersol-rand.com) (cranes, compressors)  
[www.volvo.com](http://www.volvo.com) (cranes)  
[www.kawasaki.com](http://www.kawasaki.com) (gas turbines)  
[www.cat.com](http://www.cat.com) (engines, gas turbines)  
[www.johndeere.com](http://www.johndeere.com) (diesel engines)  
[www.komatsu.com](http://www.komatsu.com) (diesel engine, forklift)  
[www.cummins.com](http://www.cummins.com) (engines)  
[www.liebherr.com](http://www.liebherr.com) (cranes)  
[www.lindelifttruck.com](http://www.lindelifttruck.com) (forklift)  
[www.linkbelt.com](http://www.linkbelt.com) (cranes)  
[www.manitowoccranes.com](http://www.manitowoccranes.com) (cranes)  
[www.jlg.com](http://www.jlg.com) (cranes, forklift)  
[www.manitou-na.com](http://www.manitou-na.com) (cranes, forklift)  
[www.mit-lift.com](http://www.mit-lift.com) (forklift)  
[www.mustangmfg.com](http://www.mustangmfg.com) (forklift)  
[www.pettibone-mi.com](http://www.pettibone-mi.com) (cranes)  
[www.towercranes-usa.com](http://www.towercranes-usa.com) (tower cranes)  
[www.snorkelusa.com](http://www.snorkelusa.com) (truck mounted cranes)  
[www.tadanoamerica.com](http://www.tadanoamerica.com) (cranes)  
[www.technocrane.com](http://www.technocrane.com) (cranes)  
[www.terex-crane.com](http://www.terex-crane.com) (cranes)  
[www.yale.com](http://www.yale.com) (forklift)  
[www.airtechnical.com](http://www.airtechnical.com) (crane)  
[www.demag-us.com](http://www.demag-us.com) (crane)  
[www.noellcrane.com](http://www.noellcrane.com) (crane)  
[www.mantiscranes.com](http://www.mantiscranes.com) (cranes)  
[www.badgerequipment.com](http://www.badgerequipment.com) (cranes)  
[www.kobelcoamerica.com](http://www.kobelcoamerica.com) (cranes)  
[www.palfinger.com](http://www.palfinger.com) (crane)  
[www.positech-solutions.com](http://www.positech-solutions.com) (cranes)  
[www.stellarindustries.com](http://www.stellarindustries.com) (cranes)  
[www.altec.com](http://www.altec.com) (cranes)  
[www.lenox.com](http://www.lenox.com) (HVAC)  
[www.carrier.com](http://www.carrier.com) (HVAC)  
[www.rheem.com](http://www.rheem.com) (HVAC)  
[www.americanstandard.com](http://www.americanstandard.com) (HVAC)  
[www.granger.com](http://www.granger.com) (HVAC, tools, electrical, lighting, welders, generators, motors)  
[www.grovetworldwide.com](http://www.grovetworldwide.com) (cranes)

### C. SPECIAL PURPOSE MACHINERY

Earth-moving, mining, quarry, machine tools and hand tools are represented under this heading. The five characteristics are valid measures for these PS/SPDs. The variance of value versus feature identification is diverse under this heading. The magnitude of scale ranges from hundreds of tonnes to less than three kilograms. This is the heading in which big machines translate to big power. Users of agricultural, earth-moving, mining and quarrying equipment are always seeking more power to move more material faster. The two most significant ratios in this are power per unit of weight and the percent of availability over the useful design life of the equipment. The quality of these machines is often represented by the ratio of cost to unit of shipping weight. Machine and hand tool value is also measured by the same ratios.

- **Agricultural Machinery** is evolving from regional (ABNT, ASAE, BSI, CSA, CEN, GOST, etc.) to global standards under ISO4254. A major driver for globalization is the acceptance of common practices and the consolidation of agricultural equipment manufacturers. Currently, three companies provide a full line of equipment through global distribution networks for food and fiber production. In fact, only two of these three companies offer specialized harvesting machines for cotton, cane, grapes and coffee. These three companies are supported regionally through shortline suppliers, many of them actually using a full line manufacturer's distribution network locally. The regional product is generally similar in function or modifies an existing product for localized conditions.

At first glance, this category looks formidable to compare due to the broad range of models. In reality, industry has provided consistent grouping of categories in order to utilize manufacturing efficiencies. The product architecture within a specific product is comparable globally. Thus a presorting exercise can reduce the sample size without negatively impacting the survey results. The SPDs can provide precision comparisons.

- **Machine Tools** are commodities that can be priced by performance, accuracy and technology. Comparison of individual machine tools can be done with precision by restricting the function for comparison. For example, an engine lathe is the same globally, and differs only in capacity and technology. Creating the SPDs will be a tedious process and may well be beyond the scope of 2005 work budgets.
- **Machinery for Metallurgy, Mining, Quarrying and Construction.** Developing PS/SPDs for earthmoving machinery group is straightforward. The industry adopted strategies for global standards under ISO TC127 over 30 years ago and has built a standards portfolio exceeding 100 global standards. Construction machinery is a generic name for a large segment of infrastructure creation. In this instance, it was used to label earthmoving equipment.

- **Machinery for Food, Beverage and Tobacco Processing** is more difficult to compare because the individual machines are organized into a system using several machines in a continuous operation.
- **Machinery for Textile, Apparel and Leather Production** has been concentrated in low-cost labor markets. The textile and apparel machinery in North America is dated, due to the shift to production sites around the globe. The machinery has often been sold, moved offshore, and modified. It is a global industry dominated by Asia and the comparison will best be accomplished in that region.

Sewing Machines and other machines that make raw cloth from thread are measurable. A PS/SPD is incorporated into this heading for cotton, but it is a complex task for pricing. Very few regions will find this relevant as this manufacturing process has migrated to low-wage regions. Sewing machines can be commercial or domestic. The performance of either type is measured in the same manner. Technology of domestic units is equal to or exceeds commercial units. Domestic units are now available in software-driven versions that permit the user to design original creations.

#### **WEBSITES:**

[www.agcocorp.com](http://www.agcocorp.com) (agricultural machinery brands- Challenger, Fendt, Massey-Ferguson, Valtra, Gleaner, Hesston, New Idea, Ideal, Sunflower, White planters, RoGator, TerraGator, Spra-Coupe, Farmhand, Glencoe, Sisu Diesel, TYE, Fieldstar, Lor\*al, Soilteq, Willmar)

[www.cat.com](http://www.cat.com) (earthmoving, mining, quarrying, material handling)

[www.cnh.com](http://www.cnh.com) (agricultural machinery brands-CASE IH, New Holland, Steyr) (construction machinery-CASE, New Holland, Kobelco)

[www.johndeere.com](http://www.johndeere.com) (agricultural, earthmoving, forestry and lawn care )

[www.ingersol-rand.com](http://www.ingersol-rand.com) (earthmoving)

[www.volvo.com](http://www.volvo.com) (earthmoving)

[www.komatsu.com](http://www.komatsu.com) (earthmoving)

[www.kawasaki.com](http://www.kawasaki.com) (earthmoving)

[www.jcb.com](http://www.jcb.com) (earthmoving, agriculture, forklifts)

[www.makita.com](http://www.makita.com) (power woodworking tools)

[www.black&decker.com](http://www.black&decker.com) (power woodworking tools)

[www.ryobi.com](http://www.ryobi.com) (power woodworking tools)

[www.portercable.com](http://www.portercable.com) (power woodworking tools)

[www.dewalt.com](http://www.dewalt.com) (power woodworking tools)

[www.bosch.com](http://www.bosch.com) (power woodworking tools)

[www.milwaukee.com](http://www.milwaukee.com) (power woodworking tools)

[www.skil.com](http://www.skil.com) (power woodworking tools)

[www.hilti.com](http://www.hilti.com) (power woodworking tools)

[www.hitachi.com](http://www.hitachi.com) (power woodworking tools)

[www.metabo.com](http://www.metabo.com) (metal working tools)

[www.ridgid.com](http://www.ridgid.com) (metal working tools)

[www.grizzly.com](http://www.grizzly.com) (power woodworking tools)

[www.festool.com](http://www.festool.com) (power woodworking tools)

[www.craftsman.com](http://www.craftsman.com) (power woodworking tools)  
[www.chicagopneumatic.com](http://www.chicagopneumatic.com) (power Tools)  
[www.universaltool.com](http://www.universaltool.com) (power tools)  
[www.woodworker.com](http://www.woodworker.com) (power woodworking tools)  
[www.jettool.com](http://www.jettool.com) (power woodworking tools)  
[www.unverferth.com](http://www.unverferth.com) (agricultural trailers)  
[www.balzerinc.com](http://www.balzerinc.com) (liquid manure haulers)  
[www.rotomix.com](http://www.rotomix.com) (semi solid manure hauler)  
[www.liebherr.com](http://www.liebherr.com) (earthmoving)  
[www.linkbelt.com](http://www.linkbelt.com) (earthmoving)  
[www.mustang.com](http://www.mustang.com) (earthmoving)  
[www.gehl.com](http://www.gehl.com) (earthmoving)  
[www.ditchwitch.com](http://www.ditchwitch.com) (earthmoving)  
[www.vermeer.com](http://www.vermeer.com) (earthmoving)  
[www.geartechnology.com](http://www.geartechnology.com) (gear tooth cutting)  
[www.gleason.com](http://www.gleason.com) (bevel gear cutting)  
[www.brown&sharpe.com](http://www.brown&sharpe.com) (metrology)  
[www.barber-coleman.com](http://www.barber-coleman.com) (gear cutting machines)  
[www.granger.com](http://www.granger.com) (tools, welders, woodworking)  
[www.hobart.com](http://www.hobart.com) (welding machines)  
[www.lincoln.com](http://www.lincoln.com) (welding machinery)  
[www.mitrowskiwelding.com](http://www.mitrowskiwelding.com) (welding machinery)  
[www.thermadyne.com](http://www.thermadyne.com) (welding and plasma cutting machines)  
[www.bernina.com](http://www.bernina.com) (sewing machines and sergers)  
[www.pfaff.com](http://www.pfaff.com) (sewing machines and sergers)  
[www.singer.com](http://www.singer.com) (sewing machines and sergers)  
[www.brother.com](http://www.brother.com) (sewing machines and sergers)

#### D. ELECTRICAL/OPTICAL/MEDICAL EQUIPMENT

This heading is a diverse group of equipment and devices. Lighting is an electrical device that is measured by the five characteristics, with the performance characteristic measuring the lumens per unit of input electricity. Four categories were created under lighting, because each category has advantages and disadvantages.

- **Incandescent Lights** are plentiful and inexpensive, but are the least efficient users of energy. Fluorescent lights are efficient and use charged gas to give soft diffused light. High intensity discharge (HID) lights use activated metals to generate light. They are very efficient, but expensive. With the exception of HID lighting, there is little if any demand for used equipment.
- **Electric Motors and Generators** are rotating equipment for utilizing electricity or generating it. It is not practical to compare all the possible variants of electric motors. Size and use provide measurement guidelines in terms of power density and cost for unit of power used /generated. Increasing cost per unit weight accompanied by diminished output is an indicator of longevity and reliability.

- **Transformers** are used in virtually any product, tool or piece of electrical equipment in use. They can invert alternating current to direct current. They can step up voltage for more efficient transmission over large distances and then reverse the process at the needed location. Switching gear and control panels are also essential to the use of electricity so it can be useful where and when needed.
- **Medical Devices** are measured by the information they give for diagnosis or the control provided for medicine monitoring. Devices are also part of patient recovery monitoring vital signs 24/7.

#### **WEBSITES:**

- [www.leviton.com](http://www.leviton.com) (switching devices)
- [www.squared.com](http://www.squared.com) (control and switching devices)
- [www.sylvania.com](http://www.sylvania.com) (controls, switching devices, lights)
- [www.siemens.com](http://www.siemens.com) (controls, switching devices, lights, transformers, motors, medical devices)
- [www.westinghouse.com](http://www.westinghouse.com) (controls switching devices, lights, motors)
- [www.ge.com](http://www.ge.com) (controls, switching devices, motors, generators, transformers, lights, medical devices)
- [www.basler.com](http://www.basler.com) (transformer, switching gear)
- [www.kirloskar.com](http://www.kirloskar.com) (generators)
- [www.marathonelectric.com](http://www.marathonelectric.com) (generators)
- [www.onan.com](http://www.onan.com) (generators)
- [www.lightinguniverse.com](http://www.lightinguniverse.com) (lighting)

### **E. MOTOR VEHICLES/TRAILERS/SEMI-TRAILERS**

The PS/SPDs under this heading are specifically aimed at vehicles for goods transport, not people movers. The vehicles in this heading are concentrated in the on-highway category. There is an optional ability to operate off-highway, when additional optional drive trains are included to provide all wheel propulsion.

Pickup trucks are popular in most regions with the exception of Europe. This form of transport vehicle provides a means for small contractors and landscapers to transport their tools of trade and small amounts of material. When equipped with a hitch, the user can increase the transport load by adding a trailer. They have also gained acceptance as towing vehicles for recreation such as boats and mobile homes (caravans in Europe).

Vans, cab/chassis, tractors, hauling-unit trailers and semi-trailers are universal throughout the regions. Small regional differences will be found to meet local traffic legislation and bridge load limits, but they will be recognizable and will function in the same manner.

Hauling units have been separated from the cab/chassis PS/SPD because the cab/chassis units are common until the hauling unit is added to create a purpose built hauler. Thus the value of the cab/chassis and hauling unit can be combined to make a value measurement of specific haulers such as fuel trucks, dump trucks, etc. In virtually all regions, a hauling unit is transferred to the new cab/chassis unit when the old cab/chassis unit is discarded. Now the

total value of the unit is a combination of new and used content, yielding yet a different value for the hauler.

Tractors are often treated like capital goods and are remanufactured to restore performance rather than expending the additional 40 to 50 percent more for a new tractor. Trailers and semi-trailers often survive the tractor population by a wide margin because forwarding companies disconnect the tractor and hitch it to another trailer to maximize tractor utilization. The trailer sits until it is unloaded and reloaded, before being hitched to yet another tractor.

Vans are closed vehicles used primarily for inter-city deliveries. They differ greatly in scale, but not in function.

### **WEBSITES:**

- [www.mack.com](http://www.mack.com) (cab/chassis, tractor)
- [www.paccar.com](http://www.paccar.com) (truck/tractor brands-Kenworth, DAF, Leyland, Peterbilt, Foden)
- [www.navistar.com](http://www.navistar.com) (cab/chassis, tractors)
- [www.gmc.com](http://www.gmc.com) (cab/chassis, van, pickup)
- [www.isuzu.com](http://www.isuzu.com) (cab/chassis, tractor, van, pickup)
- [www.misubishi.com](http://www.misubishi.com) (cab/chassis, tractor, van, pickup)
- [www.ford.com](http://www.ford.com) (cab/chassis, van, pickup)
- [www.zil.com](http://www.zil.com) (cab/chassis, tractor)
- [www.tatra.com](http://www.tatra.com) (cab chassis, tractor)
- [www.renault.com](http://www.renault.com) (cab/chassis, tractor)
- [www.iveco.com](http://www.iveco.com) (cab/chassis, tractor)
- [www.freightliner.com](http://www.freightliner.com) (van, cab/chassis, tractor)
- [www.sterling.com](http://www.sterling.com) (cab/chassis, tractor)
- [www.dodge.com](http://www.dodge.com) (van, pickup)
- [www.scania.com](http://www.scania.com) (cab/chassis, tractor)
- [www.volvo.com](http://www.volvo.com) (cab/chassis, tractor)
- [www.eastmfg.com](http://www.eastmfg.com) (semi-trailer, trailer)
- [www.fontainespecialized.com](http://www.fontainespecialized.com) (semi-trailers)
- [www.haletrailer.com](http://www.haletrailer.com) (trailers)
- [www.mausersteel.com](http://www.mausersteel.com) (semi-trailers)
- [www.vancotrailers.com](http://www.vancotrailers.com) (trailers)
- [www.wabashnational.com](http://www.wabashnational.com) (trailers)
- [www.fruefauf.com](http://www.fruefauf.com) (trailers)
- [www.nelsontrailers.com](http://www.nelsontrailers.com) (trailers)
- [www.heil.com](http://www.heil.com) (truck hauling units)
- [www.johsontruckbodies.com](http://www.johsontruckbodies.com) (truck hauling units)
- [www.knapheide.com](http://www.knapheide.com) (truck hauling units)