

CURRENT INDUSTRIAL REPORTS SERIES

2007

MA333N — FLUID POWER PRODUCTS FOR MOTION CONTROL (INCLUDING AEROSPACE) (SHIPMENTS)

DEFINITIONS AND SPECIAL INSTRUCTIONS

1. Scope of survey

This survey covers fluid power products manufactured in the United States. Fluid power productions use compressed fluid (liquid or gas) as a medium for transferring power and controlling motion. The focus of this report is fluid power products for motion control applications (some additional categories for non-motion control products are included to help ensure data integrity by keeping any of these products that may be reported separate).

The following products should be **excluded** from reporting:

- plumbing and heating valves and specialties (3329191100);
- metal fittings, flanges and unions for piping systems (3329193100)
- automatic regulating and control valves (332911F100);
- solenoid-operated valves not used in a fluid power motion control system (332911H100);
- nuclear valves (332911D100);
- other industrial valves (3329111100-332911B100);
- non-fluid power industrial pumps and pumping equipment;
- pumps for farm and home use (3339111100-3339115100);
- constant speed drivers (3336123100 and 3336127100).

2. Figures to be reported

Companies with more than one establishment manufacturing the products covered by this survey are requested to complete a separate report form for each location. If you have not received a separate form for each of your establishments, please call the contact listed on the report form or write to the U.S. Census Bureau for additional forms.

a. Resales

Products bought and resold without further manufacture should not be included in shipments (this is regardless of whether or not they were imported). Further manufacture includes assembly of parts into finished fluid power products (pumps, valves, cylinders, etc).

b. Quantity and value of shipments

The figures on quantity and value of shipments should include physical shipment of products sold or shipped, whether for domestic or export sale. The value represents the net sales price, f.o.b. plant, net of discounts, allowances, freight charges and returns.

Do not combine product lines.

In addition, these figures should include:

- Physical shipments of products manufactured and shipped from the reporting location to customers and distributors.
- Physical shipments of products manufactured and shipped for private labeling by another company.

The figures on quantity and value of shipments should **NOT** include:

- Physical shipments of products received from another division of your company and resold without further manufacture should not be included in shipments (this is regardless of whether or not they were imported). Further manufacture includes assembly of parts into finished fluid power products (pumps, valves, cylinders, etc).

Note: The quantity and value of hydrostatic transmissions and power units should be reported into their respective categories. The quantity and value for the pumps, motors, valves, and prime mover used in the hydrostatic transmissions and power units should also be reported into their respective categories for these products if manufactured in the U.S. by your company. The quantity and value of hydrostatic transmissions and power units will not be added into overall report totals.

c. Columnar structure of report

When entering your figures on the original report, please be sure to report the information in the correct columns.

Column 1 — Total Quantity

Column 2 — Total Shipments Value

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DEFINITIONS AND SPECIAL INSTRUCTIONS — Continued

2. Figures to be reported - c. Columnar structure of report - Continued

Section I — Report all fluid power valves for motion control, including parts.

Section II — Report all fluid power fittings and assemblies for motion control.

Section III — Report all fluid power filters for motion control, including parts.

Section IV — Report all fluid power cylinders, rotary actuators, accumulators, cushions, and non-vehicular shock absorbers, including parts.

Section V — Report all fluid power pumps and motors for motion control, including parts.

3. Definitions

Accumulators (hydraulic only) — Devices that store hydraulic fluid under pressure as a source of fluid power

Actuators — Devices that convert fluid power into linear or rotary mechanical force. Linear types are typically referred to as cylinders. Rotary types are referred to as rotary actuators and motors. Motors have shafts that rotate continuously in the same direction. Rotary actuator shafts do not rotate continuously. Typically, the shafts rotate a certain number of degrees before rotating in the opposite direction to their point of origin.

Air dryer — A device for reducing the moisture vapor content of the compressed air in a pneumatic system

Bulk hose — A hose and/or tubing to which fittings have not been attached.

Assembly — A length of hose and/or tubing that fittings have been attached to.

Cushion — A device that provides controlled resistance to non-linear motion.

Cylinder, electrohydraulic — A hydraulic, linear actuator that produces a continuously variable mechanical output, as a function of a continuously variable electronic input signal (voltage or current).

Cylinder, mill type — A linear actuator that has circular flanges welded to the cylinder barrel ends. This type of

cylinder is used in severe duty applications like the steel mills from which it derived its name.

Cylinder, rodless (shuttle) — A linear actuator with a rod that never leaves its case, that is sealed lengthwise. Typically used in position control applications.

Cylinder, telescoping — A linear actuator with nested tubular rod segments that provide a long working stroke in a short retracted envelope.

Cylinder, threaded/weld fused combination — A linear actuator with one threaded end and one weld fused end.

Cylinder, tie rod — A linear actuator with head and cap end closures that are secured by tie rods.

Filter (filter assembly) — A device whose primary function is the retention of insoluble contaminants in a fluid by a porous media.

Filter element — That part of a filter that retains contaminants. Some elements are permanent (reusable or cleanable) and others are disposable (nonreusable). Disposable elements must eventually be replaced.

Fittings — Devices used to connect hoses and tubing to components (valves, cylinders, motors, pumps) of a fluid power system. They are constructed from metal or plastic, and are sometimes referred to as connectors or couplings.

Gerotor/Gerolor — A special type of internal gear motor where the internal gear is always in sliding contact with the external gear.

Hydrostatic transmission — A device that combines a hydraulic pump with an hydraulic motor. The quantity and value of hydrostatic transmissions should be reported to the hydrostatic transmission line. The quantity and value of pumps and motors sold together as hydrostatic transmissions should also be reported separately in the relevant pump and motor categories, if manufactured in the U.S. by your company.

Intensifier — Devices driven by a low pressure fluid to produce fluid at a higher pressure.

Lubricator — A device that adds controlled or metered amounts of lubricant into a pneumatic system.

Manifold (manifold assembly) — A fluid conductor that can provide multiple connection ports. In a fluid power

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3. Definitions — Continued

system, manifolds are typically used as housings for cartridge valves.

Motor — A device that transforms fluid power into rotary mechanical force. Motors can be hydraulic or pneumatic.

Motor, axial piston — A motor with several parallel pistons arranged around a common axis.

Motor, external gear — A motor that has only external gears and no internal gear.

Motor, internal gear — A motor with an internal gear that meshes with one or more external gears. See also gerotor/gerolor.

Motor, radial piston — A motor with several pistons arranged to operate radially.

Motor, vane — A motor with multiple vanes that cause rotation of internal member when under pressure.

Power unit — A device that combines a hydraulic pump with a prime mover (usually an electric motor), and hydraulic valves. As is done for hydrostatic transmissions, the quantity and value of power units should be reported to the power unit line. The quantity and value of pumps, prime movers and valves should also be reported to those respective categories, if manufactured in the U.S. by your company.

Pump, axial piston — A reciprocating pump with several parallel pistons arranged around a common axis.

Pump, external gear — A rotary pump that has only external gears, and no internal gear.

Pump, internal gear — A rotary pump that has an internal gear in engagement with one or more external gears. An internal gear pump generally has external gears that rotate on a fixed axis. A gerotor pump differs from other internal gear types in that its internal gear is always in sliding contact with the external gear.

Pump, radial piston — A reciprocating pump with several pistons arranged radially within the pump chamber.

Pump, reciprocating — A pump that uses pistons to create a partial vacuum to draw hydraulic fluid through the pump inlet. The return strokes of the pistons unseat outlet check valves and force the fluid through the pump outlet.

Pump, rotary — A pump that uses gears or vanes to cause rotary motion that moves hydraulic fluid from the pump inlet to the pump outlet.

Pump, vane — A rotary pump with multiple vanes within a supporting rotor.

Reservoir, hydraulic — A container for storage of hydraulic fluid under pressure.

Sealing devices — A dynamic or static device for preventing fluid leakage (air or liquid) to the external environment or within sections of a component.

Valves, cartridge — Valves with working parts contained in a cylindrical body. The body must be inserted into a housing (usually a manifold) for use. Ports through the body of the valve align with ports in the housing.

Valves, electrohydraulic — Valves that use continuously variable electronic input (voltage or current) to produce a continuously variable hydraulic output.

Valves, manually operated — Valves actuated by means of a hand lever, or other manual energizing device.

Valves, mechanical — Valves that are actuated by cams, levers, rollers, screws, springs, stems or other mechanical energizing devices. Should not include hydraulically or pneumatically actuated valves for non-fluid power applications.

Valves, relief — Direct acting or pilot operated valves that are used to prevent a hydraulic system from exceeding its maximum pressure limits.

Valves, remote pilot — Pilot operated valves that are controlled remotely through the use of air pressure.

Valves, solenoid — Valves that are operated by a solenoid.

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4. Comparability

Data reported in this survey should correspond to data reported in the Economic Census - Manufacturing Sector form. The sum of values for item codes shown in column (a) should correspond to dollar values reported under product codes indicated in column (b) below.

Current Industrial Reports (Form MA333N) Item codes (a)	Economic Census - Manufacturing Sector Product codes (b)
1201 through 1219	3329125100
1221 through 1249	3329127100
1251 through 1269	3329129100
1271 through 1279	332912B100
1281 through 1289	3329121100
1291	3329123100
1293, 1295	332912D100
2201 through 2209	332912H100
2211 through 2221	332912J100
2241 through 2251	332912L100
2261 through 2265	332912N100
2271 through 2275	332912F100
3301 through 3309	3339993100
3311 through 3323	3339994100
3325, 3327	3339996100
3340, 3347	3339998870 3339998880
4501 through 4519	3339951100
4601 through 4619	3339953100
4841 through 4847, 4893	3339955100
4851 through 4877	3339957100
5504 through 5517	3339961100
5534 through 5537	3339963100
5545 through 5571	3339965100
5581 through 5586	3339967100
5591 through 5597	3339969100

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REFERENCE LIST

FORM MA333N		
FLUID POWER PRODUCTS FOR MOTION CONTROL (INCLUDING AEROSPACE) (SHIPMENTS)		
Product code	Item code	Item description
3329125100		<p>Section I — FLUID POWER VALVES (hydraulic and pneumatic valves and parts)</p> <p>(Report quantity in number of units)</p> <p>NONAEROSPACE TYPE HYDRAULIC DIRECTIONAL CONTROL VALVES, excluding cartridge, stack, logic and electrohydraulic types</p> <p>Manual:</p> <p style="padding-left: 20px;">3- & 4-way monoblock</p> <p style="padding-left: 20px;">3- & 4-way sectional</p> <p style="padding-left: 20px;">Other manual</p> <p>Solenoid:</p> <p style="padding-left: 20px;">2-way types</p> <p style="padding-left: 20px;">3- & 4-way types</p> <p style="padding-left: 20px;">Other directional control</p>
3329127100		<p>NONAEROSPACE TYPE HYDRAULIC VALVES (EXCEPT DIRECTIONAL CONTROL)</p> <p>Pressure control:</p> <p style="padding-left: 20px;">Relief valves</p> <p style="padding-left: 20px;">Other, including load sensing and manual types</p> <p>Flow control:</p> <p style="padding-left: 20px;">Manual types</p> <p style="padding-left: 20px;">Other flow control types</p> <p>Cartridge valves (except directional control)</p> <p>Electrohydraulic valves:</p> <p style="padding-left: 20px;">Pilot operated, torque motor servovalves</p> <p style="padding-left: 20px;">Other types, including proportional</p> <p style="padding-left: 20px;">Other nonaerospace type hydraulic valves, including stack and logic</p>
3329129100		<p>NONAEROSPACE TYPE PNEUMATIC DIRECTIONAL CONTROL VALVES</p> <p>Manual</p> <p>Solenoid:</p> <p style="padding-left: 20px;">Under 1/8" port diameter</p> <p style="padding-left: 20px;">1/8" up to and including 1/4" port diameter:</p> <p style="padding-left: 40px;">3-way types</p> <p style="padding-left: 40px;">4-way types</p> <p style="padding-left: 20px;">Over 1/4" port diameter:</p> <p style="padding-left: 40px;">3-way types</p> <p style="padding-left: 40px;">4-way types</p> <p style="padding-left: 20px;">All other solenoid</p> <p>Mechanical, remote pilot and all other types</p>

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REFERENCE LIST—Continued

FORM MA333N		
Product code	Item code	Item description
332912B100		<p>Section I — FLUID POWER VALVES (hydraulic and pneumatic valves and parts)—Continued</p> <p>(Report quantity in number of units)</p> <p>NONAEROSPACE TYPE PNEUMATIC VALVES (EXCEPT DIRECTIONAL CONTROL)</p>
332912B110	1271	Filter-regulator combination units, integral types
332912B120	1273	Other FRs and filter-regulator-lubricator combo units
332912B130	1275	Regulators sold separately
332912B140	1277	Flow control valves
332912C000	1278	Nonaerospace-type pneumatic valves-for non-motion control applications
332912B150	1279	Check, shuttle, exhaust, needle, and all other types
3329121100		<p>AEROSPACE TYPE HYDRAULIC FLUID POWER VALVES</p>
3329121110	1281	2-, 3-, and 4-way directional control valves: Manually or mechanically operated
3329121120	1283	Solenoid operated
3329121130	1285	Motor operated
3329121140	1287	Electrohydraulic servovalves
3329121150	1289	Flow, pressure, and other types of hydraulic valves
3329123100		<p>AEROSPACE TYPE PNEUMATIC FLUID POWER VALVES</p>
3329123110	1291	Pneumatic valves (all types)
332912D100		<p>PARTS FOR FLUID POWER VALVES</p>
332912D110	1293	Parts for nonaerospace type hydraulic and pneumatic valves, sold separately
332912D120	1295	Parts for aerospace type hydraulic and pneumatic valves, sold separately
332912H100		<p>Section II — FLUID POWER FITTINGS AND ASSEMBLIES (fittings for and assemblies of tubing and hose used in fluid power transfer systems)</p> <p>NONAEROSPACE TYPE FLARED (METAL) FITTINGS AND COUPLINGS FOR, AND ASSEMBLIES OF TUBING USED IN FLUID POWER TRANSFER SYSTEMS</p>
332912H110	2201	Flared fittings: Brass and bronze (SAE 45 degrees and 37 degrees)
332912H120	2203	Carbon steel (JIC 37 degrees)
332912H130	2205	Other, including alloy steel
332912H140	2207	Assemblies of tubing
332912H150	2209	Assemblies of tubing and hose

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FORM MA333N		
Product code	Item code	Item description
<p>332912J100</p> <p>332912J110 332912J120 332912J130 332912J140</p> <p>332912J150</p>	<p>2211 2213 2215 2217</p> <p>2221</p>	<p>Section II — FLUID POWER FITTINGS AND ASSEMBLIES (fittings for and assemblies of tubing and hose used in fluid power transfer systems) —Continued</p> <p>NONAEROSPACE TYPE FLARELESS FITTINGS AND COUPLINGS, INCLUDING NONMETAL FITTINGS, USED IN FLUID POWER TRANSFER SYSTEMS</p> <p>Metal types: Brass and bronze Carbon steel Stainless steel Other, including alloy steel</p> <p>Nonmetal fittings, including plastic</p>
<p>332912L100</p> <p>332912L110 332912L120 332912L130 332912L140 332912L150 332912L160</p>	<p>2241 2243 2245 2247 2249 2251</p>	<p>NONAEROSPACE TYPE HYDRAULIC AND PNEUMATIC FITTINGS AND COUPLINGS FOR HOSE, AND MANIFOLDS</p> <p>Permanent hose end fittings (crimped and swaged) Hydraulic and pneumatic reusable end fittings Hydraulic quick connect and disconnect couplings Pneumatic quick connect and disconnect couplings Manifolds and manifold assemblies for fluid power systems All other, including steel adaptor, swivel, rotating, and extension fittings</p>
<p>332912N100</p> <p>332912N110 332912N120 332912N130</p>	<p>2261 2263 2265</p>	<p>NONAEROSPACE TYPE HYDRAULIC AND PNEUMATIC ASSEMBLIES OF HOSE</p> <p>Assemblies with permanent end fittings Assemblies with reusable fittings Nonaerospace-type hydraulic and pneumatic bulk hose</p>
<p>332912F100</p> <p>332912F110 332912F125 332912F130</p>	<p>2271 2272 2275</p>	<p>AEROSPACE TYPE HYDRAULIC AND PNEUMATIC HOSE OR TUBE END FITTINGS AND ASSEMBLES AND MANIFOLDS</p> <p>Assemblies of hose and/or tubing Hose and/or tube fittings, all types Manifolds for aerospace hydraulic systems</p>

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FORM MA333N		
Product code	Item code	Item description
<p>3339993100</p> <p>3339993110 3339993120 3339993130</p> <p>3339993140 3339993150 3339993160</p>	<p>3301 3302 3304</p> <p>3305 3307 3309</p>	<p>Section III — FILTERS FOR HYDRAULIC AND PNEUMATIC FLUID POWER SYSTEMS</p> <p>(Report quantity in number of units)</p> <p>NONAEROSPACE TYPE FILTERS FOR HYDRAULIC FLUID POWER SYSTEMS</p> <p>Hydraulic fluid filter assemblies, with or without filter element installed:</p> <ul style="list-style-type: none"> Low pressure (below 301 psi) Medium pressure (301 - 2,999 psi) High pressure (3,000 psi and above) <p>Filter replacement elements:</p> <ul style="list-style-type: none"> Reusable (cleanable) type Nonreusable type Strainers and separators, filter parts, and accessories
<p>3339994100</p> <p>3339994110 3339994120 3339994130</p>	<p>3311 3313 3323</p>	<p>NONAEROSPACE TYPE FILTERS FOR PNEUMATIC FLUID POWER SYSTEMS</p> <p>Air supply filter assemblies and filter replacement elements, excluding those shipped as part of a FR or FRL combo unit:</p> <ul style="list-style-type: none"> Coalescing types, including elements sold separately Other types, including elements sold separately Air exhaust mufflers, diffusers, filter parts and air preparation accessories
<p>3339996100</p> <p>3339996110 3339996120</p>	<p>3325 3327</p>	<p>AEROSPACE TYPE HYDRAULIC AND PNEUMATIC FILTERS</p> <ul style="list-style-type: none"> Hydraulic Pneumatic
<p>3339998870, 3339998880</p> <p>3339998A00 3339998880</p>	<p>3340 3347</p>	<p>COMPRESSED AIR AND GAS DRYERS, AND LUBRICATORS</p> <ul style="list-style-type: none"> Compressed air and gas dryers Lubricators for pneumatic systems, sold separately

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FORM MA333N		
Product code	Item code	Item description
<p>Section IV — HYDRAULIC AND PNEUMATIC CYLINDERS, ACTUATORS, ACCUMULATORS, CUSHIONS, NONVEHICULAR SHOCK ABSORBERS, AND PARTS</p> <p>(Report quantity in number of units)</p> <p>NONAEROSPACE TYPE HYDRAULIC FLUID POWER CYLINDERS AND ACTUATORS, LINEAR AND ROTARY</p> <p>Hydraulic cylinders, excluding electrohydraulic: Tie-rod types: Standard NFPA and JIC tie-rod types: Less than 1500 psi 1500 to 3000 psi Greater than 3000 psi Other tie-rod types</p> <p> 3339951110 4501 3339951120 4503 3339951130 4505 3339951140 4507</p> <p> 3339951150 4509 Threaded/weld fused combination 3339951160 4511 Telescoping 3339951170 4513 Mill type 3339951180 4515 Other, including those threaded at both ends 3339951190 4517 Electrohydraulic types 33399511A0 4519 Hydraulic rotary actuators</p>		
<p>NONAEROSPACE TYPE PNEUMATIC FLUID POWER CYLINDERS AND ACTUATORS, LINEAR AND ROTARY</p> <p>NFPA interchangeable cylinders: Steel Aluminum: Less than 1½" bore size 1½" bore size and over</p> <p>Rodless cylinders Other pneumatic cylinders: Less than 1½" bore size 1½" bore size and over</p> <p>Pneumatic rotary actuators</p> <p> 3339953110 4601 3339953120 4603 3339953130 4605 3339953140 4607</p> <p> 3339953150 4609 3339953160 4611 3339953170 4619</p>		
<p>PARTS FOR NONAEROSPACE TYPE HYDRAULIC AND PNEUMATIC FLUID POWER CYLINDERS, ACTUATORS, AND RELATED ITEMS N.E.C.</p> <p>Accumulators (bladder, piston, and other types) Shock absorbers, not for vehicle suspension, and cushions (hydraulic and pneumatic) Reservoirs, intensifiers, and other devices for fluid energy absorption and/or storage</p> <p> 3339955110 4841 3339955120 4843 3339955130 4845</p> <p> 3339955140 4847 Parts for nonaerospace type hydraulic and pneumatic cylinders, actuators, accumulators, cushions, and nonvehicular shock absorbers, sold separately</p>		

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FORM MA333N		
Product code	Item code	Item description
<p>Section IV — HYDRAULIC AND PNEUMATIC CYLINDERS, ACTUATORS, ACCUMULATORS, CUSHIONS, NONVEHICULAR SHOCK ABSORBERS, AND PARTS — Continued</p> <p>(Report quantity in number of units)</p>		
3339957100		<p>AEROSPACE TYPE FLUID POWER CYLINDERS AND ACTUATORS, HYDRAULIC AND PNEUMATIC</p>
3339957110	4851	Hydraulic servo-actuator assemblies (linear and rotary):
3339957120	4853	Mechanical input
3339957130	4855	Electrical input Combination input
3339957140	4861	Hydraulic utility actuators:
3339957150	4863	Linear actuators (cylinders) Rotary actuators (limited rotation)
3339957160	4865	Shock absorbers, snubbers, and cushions (all types), excluding oleo strut assemblies
3339957170	4871	Pneumatic actuators (linear and rotary)
3339957180	4873	Accumulators (bladder, piston, and other types)
3339957190	4875	Reservoirs, intensifiers, and other devices for fluid energy absorption and/or storage
33399571A0	4877	Other aerospace type fluid power cylinders, rotary actuators, cushions and related items, n.e.c.
3339555150	4893	Parts for aerospace type hydraulic and pneumatic cylinders, actuators, accumulators, cushions, and related items, sold separately
<p>Section V — FLUID POWER PUMPS AND MOTORS, AND PARTS</p> <p>(Report quantity in number of units)</p>		
3339961100		<p>NONAEROSPACE TYPE RECIPROCATING PUMPS</p>
		Axial piston:
		Variable displacement types:
3339961110	5504	Closed loop
3339961120	5514	Open loop
3339961130	5515	Fixed displacement types
3339961140	5517	Radial piston types
3339963100		<p>NONAEROSPACE TYPE ROTARY AND OTHER FLUID POWER PUMPS</p>
		Gear type:
3339963110	5534	Internal, including gerotors
3339963120	5535	External type
		Vane type:
3339963150	5537	Fixed and variable displacement vanes

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FORM MA333N		
Product code	Item code	Item description
Section V — FLUID POWER PUMPS AND MOTORS, AND PARTS — Continued		
(Report quantity in number of units)		
NONAEROSPACE TYPE FLUID POWER MOTORS		
Hydraulic motors:		
Gear type:		
Internal, excluding gerotor types		
Gerotor types		
External		
Vane types, fixed and variable		
Radial piston types, fixed and variable		
Axial piston types:		
Fixed displacement		
Variable displacement		
Pneumatic (air) motors		
Prime movers shipped with pumps or sold separately		
AEROSPACE TYPE FLUID POWER PUMPS AND MOTORS		
Hydraulic pumps:		
Fixed and variable displacement types		
Pump/electric motor assemblies, fixed, and variable displacement types		
Other pump packages n.e.c.		
Motors:		
Aerospace type fluid power motors, all kinds		
PARTS FOR FLUID POWER PUMPS, MOTORS, AND HYDROSTATIC TRANSMISSIONS		
Hydraulic:		
Nonaerospace		
Aerospace		
Pneumatic:		
Nonaerospace		
Aerospace		
Nonaerospace hydrostatic transmissions		
Nonaerospace hydraulic power units		