Product Quote

Puma 2100SY

Doosan Infracore Machine Tools
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TECHNOLOGY PRODUCTIVITY VALUE

DOOSAN Doosan Infracore

PUMA 2100SY

High Performance Turning Center with Milling and Y-Axis

The PUMA 2100SY is designed for heavy and interrupted cutting, long-term high accuracy, and superior surface finishes. High speed turret indexing and fast rapid traverse rates minimize non-cutting time. Mill-drill capability and Y-axis with full C-axis sub spindle, greatly reduce the need for secondary operations, eliminating additional set-up and handling costs. Integral spindle motors on both main and sub spindles provide improved milling accuracy and faster spindle acceleration.

FEATURES

- **High speed 5,000 RPM spindle**
- **Powerful 30 HP high-torque integral main spindle motor**
- **Refrigerated temperature control system for main & Sub-spindle**
- **Milling, drilling, and tapping capabilities**
- **Heavy duty 12 station turret with 0.15 sec index time**
- **7.5 Hp rotating tool spindle motor**
- **Base mounted tooling (BMT) system**
- **Y-axis with 4.13" stroke**
- **Full contouring C-axis**
- **Rigid tapping on main spindle, subspindle and rotary tools**
- **Fast 5,000 rpm rotating tool speed**
- **3 standard rotating tool holders**
- **Tool monitoring system - wear and breakage detection**
- **One-piece 30î slant bed**
- **Turcite B anti-friction mating way surfaces**
- **Pretensioned X and Z axis ball screws**
- **Electric torque limiter crash protection**
- **Programmable part catcher**
- **Automatic tool setter**
- **Separate coolant tank**
- **65 PSI coolant system**
- **Way lube separation system**
- **High speed 6,000 RPM subspindle**
- **Heavy duty 20 HP integral subspindle motor**
- **Full programmable C-axis sub-spindle**
- **Part ejector/coolant flush**
- **Subspindle body positioning by ball screw & servo motor**
- **Sub spindle can be synchronized with main spindle**
- **Part conveyor**
- **Tower signal light**

SPECIFICATIONS

CAPACITY:

Swing over bed	30.7"
Swing over front door	26.8”
Swing over carriage	24.8"
Maximum bar capacity(Standard Chuck I. D.)	2.6”
Maximum turning diameter, main spindle	15.98"
Maximum turning length	20.47”
Distance between main & subspindle nose	33.46”
Maximum permissible weight (Chuck work)	264 lbs
(Shaft work)	705 lbs

MAIN SPINDLE:

Spindle speed	5,000 RPM
Spindle nose	ASA-A2-6
Draw tube I.D.	2.68"
Spindle bore diameter	2.99"
AC high torque spindle motor (15%)	30 HP
Maximum spindle torque (10%)	264 ft-lbs

MAIN SPINDLE C-AXIS:

Minimum programmable angle (degrees)	.001
Rapid traverse rate (RPM)	400
C-axis contouring torque	70 ft-lbs
C-axis braking torque	663 ft-lbs
C-axis repeatability	+/- .006 deg.
C-axis positioning accuracy	.0167 deg.

BED, SADDLE, & CROSS SLIDE:

X axis travel	10.2”
Z axis travel	23.2”
Angle of slant bed	30 degrees
X axis guideway span	9.5”
Z axis guideway span	17.2”
X & Z axis rapid traverse rate	1,181 IPM
X axis ball screw diameter	1.26"
Z axis ball screw diameter	1.42"
X axis repeatability	$\pm$ 0.00008"
Z axis repeatability	$\pm$ 0.00012"
X & Z axis feed thrust (continuous/intermittent)	1,520 / 2,432 lbs
Y axis feed thrust (continuous/intermittent)	1,520 / 2,432 lbs
B axis feed thrust (continuous/intermittent)	1,021/ 1,634 lbs

TURRET:

Number of tools	12
Number of index positions	24
Tool holder type	BMT 55P
Turning tool shank size	1.0"
Boring bar diameter, main spindle	1.5"
Boring bar diameter, sub spindle	1.0”
Turret index time (next station swivel time)	0.15 sec.
Tool selection	Bi-directional
Turret index repeatability	± .0005 degree

**** Refer to turret construction section for additional explanation***

ROTATING TOOLS:

Rotating tool RPM	50 - 5,000 RPM
Rotating tool spindle motor (15 min rating)	7.5 Hp
Rotating tool torque (15 min rating)	34.7 ft-lbs
Rotating tool collet type	ER25
Milling collet capacity	1/8” to 5/8"
Max. tool length facing sub-spindle with standard Z head	3.94”
Max. X-axis tool length with Y-axis in any position	3.8”

Y-AXIS:

Y-axis travel	4.13” (±2.065”)
Y-axis rapid traverse rate	394 IPM
Y-axis repeatability	.00012”

SUB-SPINDLES:

B axis travel (sub-spindle)	23.2”
Sub-spindle guideway span	13.2”
Spindle speed	6,000 RPM
Spindle motor (30 min. rating)	20 HP
Maximum torque (30 min. rating)	98 ft-lbs
Spindle nose	A2#5
Spindle bore	2.44”
Draw tube ID	1.97"
Rapid traverse rate	1181 IPM
Minimum programmable angle	.001 degree (full C axis)

COOLANT SYSTEM:

Coolant pump pressure	65 PSI
Coolant pump motor	1.2 HP
Coolant tank capacity	53 gallons

HYDRAULIC / LUBRICATION:

Hydraulic tank capacity	2.6 gal.
Hydraulic oil requirement (or equivalent)	Mobil DTE #24 or Shell Tellus 32
Way lubrication tank capacity	0.5 gal.
Way lubrication oil requirement (or equivalent)	Mobil Vactra #2 or Shell Tonna T68
Main / subspindle oil chiller tank capacity	6.1 gal.
Main / subspindle oil chiller oil requirement (or equivalent)	Mobil Velocite #6 or Shell Tellus C10

GENERAL:

Floor space (Length X Width)	125” x 74”
Machine height	85”
Height from floor to spindle center	43.7”
Net weight	13,000 lbs
Voltage required	205 - 235 volt / 3 phase
Power requirement:	49 KVA (129 amps at 220 volts)

Accuracy data in the specifications are measured using KSB4207

CONSTRUCTION

- **BED**

The bed is a one piece, heavily ribbed, Meehanite® casting that inhibits thermal deformation and twisting. The Meehanite® cast process produces a fine grain casting with excellent vibration dampening characteristics. The true slant bed design maintains a minimal and constant distance from the tool tip to the bed ways, regardless of the location of the turret along the X axis. This ensures maximum rigidity and virtually no deformation under heavy loads. The 30 degree slant angle diverts chips and coolant into the chip pan.

- **GUIDEWAYS**

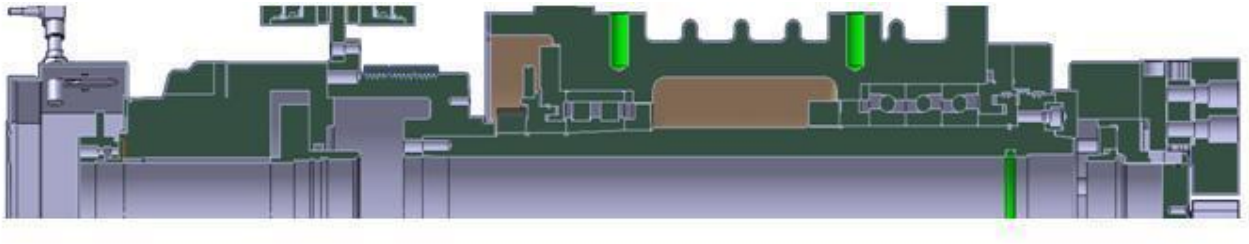
All guideways are wide wrap-around rectangular type for unsurpassed long-term rigidity and accuracy. The guideways are widely spaced to ensure stability. Each guideway is induction hardened and precision ground. Induction hardening ensures a more consistent hardness and depth of hardness than the less expensive flame hardening process. Turcite B (a fluroplastic resin) is bonded to mating way surfaces and then hand scraped for perfect fit and accurate center height. This material provides a low friction surface which virtually eliminates guideway wear. It also provides vibration dampening for better surface finishes. Turcite B has superior deformation, wear, and friction characteristics compared with other brands. Friction rate decreases as load increases. The bed guideways are protected by a one-piece heavy gauge stainless steel cover.

- **BALL SCREWS AND AXIS DRIVES**

Each axis is driven by a large diameter double-nut ball screw. The high precision ball screws have been specifically selected to achieve the outstanding combination of high accuracy, high rapid traverse rates and high feed thrust. Both ball screws are supported on each end. Both X and Z axis ball screws are pretensioned for accurate positioning and thermal stability. The thrust bearings are precision class PN7A angular contact type. Ball screws are centered between the guideways and are directly mounted to the AC servo motors without intermediate gears or belts to minimize backlash. The Z axis servo motor is mounted on the headstock end of the ball screw. Each axis has an electric torque limiter to protect the ballscrew and minimize damage in case of a crash. Upon impact, the electric torque limiter senses the abnormal load and immediately reverses the servomotor and stops the axis movement. The electric torque limiter can reset quickly which minimizes downtime.

- **MAIN SPINDLE AND HEADSTOCK**

The robust headstock casting is mounted on the same ground surface as the tailstock or sub spindle, to maintain perfect alignment and center height regardless of the bed temperature. The headstock has a refrigerated temperature control system to minimize thermal growth. The heavy duty cartridge type spindle is supported by triple row angular ball bearing design in the front and a double row cylindrical roller bearing in the rear. This design provides reduced heat and increased accuracy while ensuring the highest rigidity for heavy loads and high surface finishes.



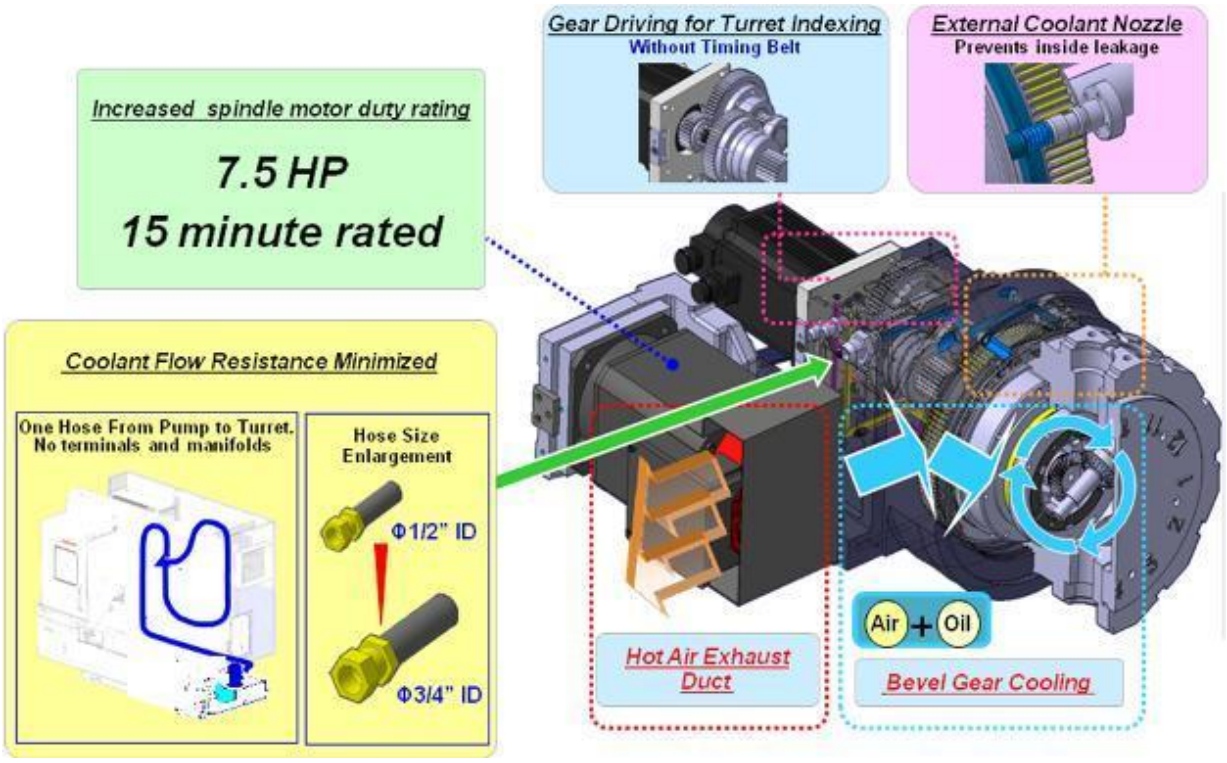
All spindle bearings are precision class P4 (AFBMA-B7) and are permanently grease lubricated. The precision NTN bearings and perfectly balanced spindle allow a high maximum RPM.

- **INTEGRAL MAIN SPINDLE MOTOR**

A high-torque spindle motor provides power for heavy stock removal, reducing the number of roughing passes required. The spindle motor is built into the headstock casting. The motor armature is on the spindle O.D. This maintenance free design eliminates drive belts and associated vibration to ensure the highest surface finishes. The powerful dual winding integral motor provides fast 2 second spindle acceleration and plenty of power at low RPM. The motor is a spindle/servo type, controlling both the spindle in 2-axis mode and the full contouring C-axis in the 3-axis mode. The belt-less design guarantees no backlash or feedback error between the motor and spindle. Switching between the two modes is instantaneous.

- **SERVO TURRET**

The non-lifting design eliminates the possibility of contamination reaching the coupling. This heavy-duty turret with a 9.05” curvic coupling and 11,915 lbs of hydraulic clamping force, provides high rigidity for heavy stock removal, fine surface finishes, long boring bar overhang ratios, and extended tool life. Indexing repeatability is ±.0005 degree. A high-torque servo motor and heavy duty gear drive provide reliable high speed turret indexing. Turret indexing is non-stop bi-directional, with a fast 0.15 second adjacent station index time. Turret clamp is confirmed by a proximity switch. Turret indexing is possible during the rapid traverse move away from the work piece. Standard turning tool holders utilize 1" square shank tooling and ID tool holders have a maximum diameter of 1.5". Coolant is delivered through one continuous ¾” ID hose from the coolant pump to the turret. Coolant is delivered to the turret head through an inducer that is external to the drive gears.



- **ROTATING TOOLS**

The 7.5 Hp rotating tool motor delivers 34.7 ft-lbs. of low end torque. The Fanuc spindle motor has a 15 minute duty rating for sustained cutting capability. Power is transmitted through the turret center shaft and then through bevel gears to the milling heads. Air / oil bevel gearing cooling provides lubrication and reduces heat. It takes just 0.5 seconds for the turret to engage the rotating tools. The standard rotating tool holders have a maximum RPM of 5,000. These base mounted tool holders are bolted directly to the periphery of the turret for maximum rigidity and feature precision grease lubricated bearings. The holders are pre-lubed for 1,000 hours of operation. The BMT-55 holders use readily available ER 25 collets. The mounting system allows these holders to be used on the main or sub spindle. Optional rotary tools are available with through the spindle coolant. Polar coordinate interpolation is provided for easy C-axis contouring and rotary tool rigid tapping is standard. Helical interpolation and cylindrical interpolation are both standard.

- **24 POSITION TURRET INDEXING**

The turret has 24 position indexing to accommodate optional double and triple holders, increasing the number of available tools. The turret head is the same as on previous models and tool holders from older machines can be used on the 24-position turret.

- **TOOL HOLDERS 24 POSITION (optional)**

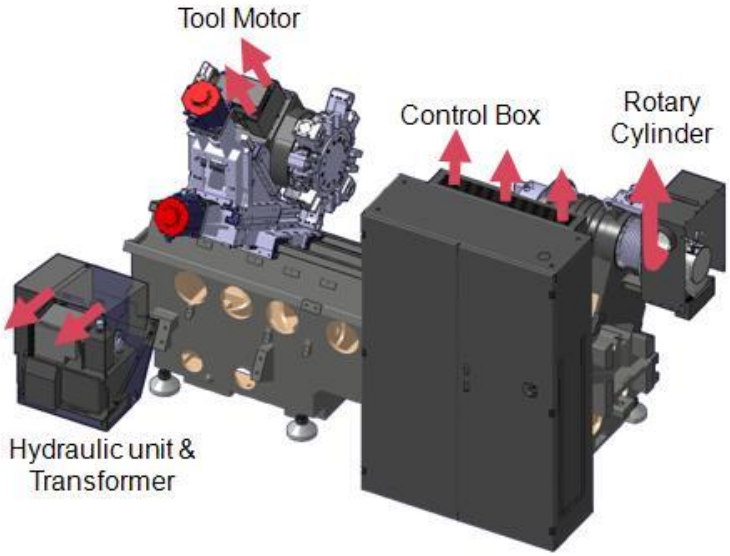
To utilize the 24 positioning turret indexing, optional holders are required. Double and triple tool holders are available which locate one of the cutting tools at the half station index position. These multi holders use .75" square shank O.D. tools or have 1" I.D. bores. If single tool holders are to be mounted next to the special multi holders, they need to be the smaller .75" square shank and 1.25" ID boring holders (main spindle) that are available as options. The single 1.25" ID boring holder also has an extended length to reduce overall tool interference. Boring holders for the sub-spindle and triple boring holders are 1" diameter I.D.

- **PRECI-FLEX® TOOL SYSTEM**

The two standard milling heads are Preci-Flex® ready. Preci-Flex® is a tooling system made by Eppinger that utilizes the existing ER collet taper in the rotary holders. The spindle face is precision ground relative to the taper and there are four drilled and tapped holes in this face. The Preci-Flex® adapters are attached with four bolts and locate on both the taper and the spindle face for maximum rigidity. A variety of Preci-Flex® adapters are available for special applications. These include extended collet chucks for smaller diameter drills and to reach cross holes on small diameter work pieces. End mill adapters are available for heavier cutting without potential slippage.

- **HEAT ISOLATION DESIGN**

Thermal stability is an important factor for consistent machining accuracy. Isolating or preventing heat sources from reaching the bed or headstock improves thermal stability. At each heat source there are covers that prevent heat from being transmitted directly to the machine or fan motors that exhaust the heat outside the machine.



Automatic work light off is another heat reduction feature that substantially reduces heat in the work area. The halogen light can be set to automatically turn off a few seconds after cycle start and then turn on when the door opens. A manual override switch is provided.

- **SUB-SPINDLE**

The subspindle enables the complete machining of parts in one setup. The full C-axis design allows, milling, drilling, and tapping on the back side of parts. The sub spindle body is accurately positioned by a ball screw and servo motor. The Puma 2100SY has a powerful 20 HP spindle, 6,000 RPM motor integral to the sub spindle headstock and has no drive belts. The integral design provides fast 3 second acceleration and 98 ft-lbs of torque. The spindle is supported by angular contact bearings in the front and cylindrical roller bearings in the rear. The sub spindles can be synchronized with the main spindle at speeds up to 4,000 RPM for "on the fly" part transfer. Parts can be automatically ejected into the standard parts catcher. The maximum chuck size is 8.0".

- **Y-AXIS**

The Y-axis greatly increases the number of work pieces that can be machined complete without using expensive custom rotary tool holders. The Y-axis enables the milling cutter, drill or tap to machine above or below centerline. A few of the operations possible with Y-axis are drilling and tapping of off-center cross holes, milling of flats, and rough and finishing of key-ways. The Y-axis is a double slide wedge type. When a Y-axis move is commanded, the X-axis and the wedge both move automatically to produce the up or down Y-axis movement. The wedge has its own guideways, ballscrew and 4.0 hp Fanuc servo motor. The Y-axis stroke is 4.13", 2.065" above and 2.065" below center.

- **SUB-SPINDLE PART EJECTOR / COOLANT FLUSH**

The sub-spindle part ejector is a tube mounted inside the sub-spindle drawtube. The ejector tube has a stroke of 4.7" and is actuated by a pneumatic cylinder mounted behind the hydraulic cylinder used for chuck clamping. The part is ejected with less velocity than a conventional spring actuated part ejector. This could help eliminate surface marring. The long stroke of the ejector tube allows longer parts to be swallowed and removed. The coolant flush allows coolant to be applied through the bore of the ejector tube and it is used to remove chips from the work holding area. It can also provide coolant to for I.D. cutting on the sub-spindle.

- **LUBRICATION**

Automatic forced lubrication is provided to all guideways, ball screws, and the tailstock quill. Maintenance free piston distributors deliver a precise quantity of oil to each lubrication point. The piston distributors are non clogging and the design allows way lube consumption to be minimized. The 1/2 gallon reservoir, mounted on the front of the machine lasts up to 100 hours. A low-level alarm prevents machine from restarting until oil reservoir is replenished. System pressure is monitored to detect open or broken lube lines.

- **PART CATCHER**

The part catcher permits unattended operation with a barfeeder. Maximum part size is 2.6" diameter x 5" long and maximum part weight is 10.5 lbs. The part catcher design allows the basket to remain vertical until just before part is discharged through an opening under the machine door. On the Puma 2100SY the parts are dropped onto a part conveyor. Part catcher is standard on the Puma 2100SY.

- **PART CONVEYOR**

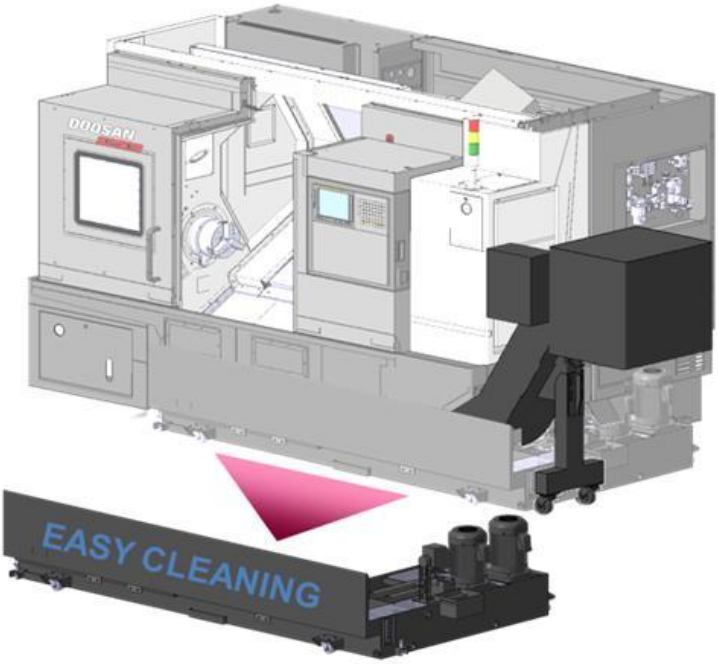
A part conveyor is available for more advanced part handling. Parts are deposited onto the part conveyor and then moved to the right hand side of machine where they can be offloaded manually, dropped into a box, or through a robotic application. The belt can be set so it moves incrementally each time a part catcher is used.

- **COOLANT SYSTEM**

A 1.2 Hp high capacity multistage centrifugal pump delivers a high volume coolant through the turret to ball nozzles at each turret station. The pump delivers 65 PSI of pressure, which meets the requirements of most insert drill manufacturers. The high pressure flushes chips out of the drilled holes and reduces the need for time consuming peck drilling cycles. High coolant pressure also significantly increases tool life. A flow control valve located at the coolant pump allows pressure and flow rate to be reduced if necessary. Screen filters prevent small chips from reaching the coolant pump.

- **SEPARATE COOLANT TANK**

The large coolant tank is separate from the machine bed, preventing heat transfer from the coolant to the machine casting. The chip pan or chip conveyor are direct mounted to the machine. The coolant tank is mounted on rollers and can be slid out easily for cleaning while the conveyor or chip pan stays with the machine. This design ensures a tight seal for the coolant regardless of the floor level and is the ultimate design for quick access and cleaning of the tank.



- **145 PSI COOLANT (option)**

Higher pressure coolant can improve cycle times, improve finishes and increase tool life. A larger 145 PSI multistage coolant pump is available as an option. This pump replaces the existing 65 PSI flood coolant pump and more then doubles the coolant pressure. 145 PSI flood coolant is helpful in removing chips from deep holes, ensuring that coolant is reaching the cutting edge and removing more heat from the process.

- **1,000 PSI COOLANT (option)**

1,000 PSI coolant is an available option. With flood coolant, a vapor blanket forms over the cutting area and prevents the coolant from actually reaching the tool tip. Heat is removed by radiating through this blanket and by conduction from areas around the cut. 1,000 PSI coolant pressure can be directed to penetrate the vapor blanket and reach the tool tip. Chips will break better and finishes will improve. Tool life can be significantly longer, even with increased and feeds and speeds. The 1,000 PSI pump options in this quotation allow both high pressure and normal flood coolant (M-code selectable).

- **WAY LUBE SEPARATION SYSTEM**

The bed casting has channels which deliver way lube from the Z axis into a separate reservoir. A belt oil skimmer picks up remaining waste oil from the coolant tank and deposits it into the same reservoir. As a result the coolant is kept clean and coolant life is extended. Waste oil tank can be conveniently drained.

- **AUTOMATIC TOOL SETTER**

Tool offsets can be quickly and conveniently set with the automatic tool setter. The tool setter arm is brought down either by switch or program function. The tool offsets are made by touching the tool tip to the touch sensor. As tools are touched-off on the sensor, tool offset values are automatically calculated and entered. The arm is then returned to its storage position. The tool setter arm is made from tubular steel to minimize thermal expansion and is mounted next to the chuck. A four position touch sensor mounted on the end of the arm allows tool setting in any direction. The automatic tool setter design will clear most chucks up to 10" diameter.

- **CHIP GUARDING**

Chips and coolant are contained by the fully enclosed guarding made of heavy gauge sheet metal. The door moves effortlessly on a round steel rail. The double-layer viewing window features tempered safety glass on the inside which resists scratching and an outside layer of lexan which is virtually impenetrable.

- **CONVENIENT OPERATION**

The operator's panel is located on the right hand side and swivels up to 87 degrees for easy viewing during setup. To minimize set-up time, manual controls are provided for turret indexing, spindle, and feed functions. Chuck and tailstock pressure can be viewed and adjusted from the front of the machine. A storage shelf is included for operator convenience.

- **TOOL MONITORING SYSTEM**

The tool monitoring system is integrated in the CNC control. This system monitors spindle and axis load while the axis is feeding. Both overload and underload conditions are monitored. Up to 16 tools or tool life management tool groups can be set. There are independent wear and breakage limits. Motor or axis loads exceeding the wear settings will either create an alarm or, if tool life management is used, switch to a redundant tool. Exceeding the breakage load stops the machine. All settings are easily adjustable and there is a simple teach mode that can be used to set initial values.

- **FANUC EMBEDDED ETHERNET FUNCTION**

The Fanuc Embedded Ethernet Function allows convenient exchange of NC programs, tool offset data, and system parameters between the Fanuc control and either a single personal computer (PC) with a network card, or with a network station. A directory page on the Fanuc control displays all the files in an assigned folder located on the PC or network station. Data transfer can only be started at the Fanuc control. Data transfer cannot be started at the PC or network station. An RJ45 Ethernet/Network port is provided on the side of the operator's panel. LAN or Crossover cable is not included.

STANDARD EQUIPMENT

- Fanuc control
- Digital AC spindle and servo drives
- Integral main spindle motor
- Main spindle and sub-spindle temperature controlled chiller
- Hydraulic main spindle actuator (SH17068C with 1.0” stroke and 2.68” thru hole)
- Subspindle actuators (SH15052D with .86” stroke and 2.047” thru hole)
- Heavy duty 12 station turret with 24 station indexing
- Y-axis with 4.13” travel
- Sub-spindle with ball screw positioning and full C-axis
- Integral subspindle motor
- Programmable sub spindle part ejector
- Samchully PowerGrip 8” 3-jaw chuck for main spindle - with 2.6” hole
- Samchully PowerGrip 6.5” subspindle 3-jaw chuck – with 2.047” hole
- Part ejector for 6.5” subspindle 3 jaw chuck
- Programmable coolant through sub spindle
- Programmable chuck air blast for main and sub chucks
- Programmable part catcher
- Part conveyor
- Complete set of tool holders for turret including:

  Puma 2100SY (for normal 12 station use)
  - 2 pcs. Eppinger Preci-Flex ready X-axis (straight) milling heads
  - 1 pc. Eppinger Preci-Flex ready Z-axis (angular) milling head
  - 1 pc. Eppinger Preci-Flex ER25 collet chuck adapter (PN: 2501-0081)
  - 1 pc. Eppinger Preci-Flex 5/8” Weldon type end mill holder (PN: 2503-0102)
  - 1 pc. Eppinger Preci-Flex shell mill adapter with 3/4” arbor (PN: 2507-0262)
  - 3 pcs. Single OD Tool Holder (1.0” sq shank)
  - 2 pcs. Double OD Tool Holder (1.0” sq. shank)
  - 2 pcs. Single ID Tool Holder (1.5” ID)
  - 3 pcs. Double ID Tool Holder (1.0” ID)
  - 1 pc. Cut-Off Tool Holder (RH) (1.0” sq. shank)
  - 1 pc. Face Tool Holder (1.0” sq. shank)
  - 2 pc U-Drill Cap ID holder for 1.5” ID holder
  - 2 pc U-Drill Cap for Sub-spindle (1.0” ID holder)
  - 6 pcs. Boring Bar Sleeve – 1.5” OD - (3/8, 1/2, 5/8, 3/4, 1, 1-1/4")
  - 4 pcs. Boring Bar Sleeve for Sub-spindle - 1.0” OD – (3/8, 1/2, 5/8, 3/4")
  - 3 pcs. U-Drill Sleeve – 1.5” OD - (3/4, 1, 1 1/4”)
- Chuck clamp / unclamp proximity switches (main and subspindle)
- Tool monitoring system
- Automatic tool setter
- 3 color tower signal light
- Automatic metered lubrication system
- 65 PSI multi-stage coolant pump

- High precision tubeless ball screws
- TAC class PN74 angular thrust bearings
- NTN class P4 spindle bearings
- Electric torque limiter protection
- Way lube recovery system
- 725 PSI hydraulic unit
- Tool box with necessary operating tools
- Work light (with auto off feature)
- Leveling bolts and plates
- Factory test report
- Operation and maintenance manuals
- Parts list and electrical drawings
- One year machine warranty / two year control warranty
- Safety features:
  - -Fully enclosed work area
  - -Door interlock
  - -Hydraulic pressure safety switch
  - -Spindle interlock
  - -Program protect
  - -Chucking signal

OPTIONAL ACCESSORIES

Chip conveyors:

4475-8805	**Turbo** side discharge chip conveyor for Puma **2100S** with variable speed drive and M-code capability	5,900.00
HNG-101697	**Hennig** side discharge chip conveyor for the Puma **2100S** with M-code capability (with built in chip stripper bar)	4,700.00
42-2715	**Jorgensen** side discharge chip conveyor for Puma **2100S** with variable speed drive, M-code capability, built in chip stripper bar and new *Jam Manager*® technology for automatic clearing of minor conveyor jams	5,450.00
CC-OPT-01H	Optional variable speed drive for Hennig conveyors	400.00
CC-OPT-02	Air header for Turbo chip conveyor – helpful for fine chips	500.00
CC-OPT-04	Chip stripper bar for Turbo – suggested option for long stringy chips	200.00

All above conveyors are non-perforated hinge belt type with a 42" discharge height. Chip conveyor prices shown do not include freight. These conveyors are general purpose and will not be the most effective for every application. If the conveyor will be used for a high percentage of fine chips (some examples: cast iron, aluminum or brass fines, and plastics) a special conveyor may be required. Special conveyors include magnetic, drag type, filtering and rear discharge. Please discuss your application with the conveyor manufacturer so they can quote price and delivery for the appropriate conveyor. Turbo Conveyors (www.lnsamerica.com) is the recommended source for special conveyors.

Transformers:

MTAE003	75 KVA transformer for 480-208Y/120V	3,300.00
MTBB004	75 KVA auto transformer – from 208/216/230 volts	2,066.00

Coolant Pumps and Accessories:

K-145PSI-2	145 PSI coolant pump for lower turret (includes ENFBX0260R breaker and riser - not available together with 1,000 PSI)	1,450.00
K-D30-2100	ChipBlaster 1,000 PSI / 8 GPM coolant pump with 5 micron dual pleated filter	6,900.00
K-JV40-2100	**ChipBlaster variable flow** 1,000 PSI coolant system with 2 - 10 GPM 100 tank capacity, flow rate & 5 micron dual pleated filters - uses less energy and generates less heat, resulting in lower coolant temperature (price **includes** ChipBlaster installation)	14,900.00
K-CHBL-34BTU	34,000 BTU Coolant Chiller – Stand alone chiller with dual pleated 10 micron filter / interface and installation provided by ChipBlaster Separate 3 phrase power drop required – water base coolant only, oil base is available	9,350.00

Factory Installed Options:

Factory order	Automatic door with safety strip	3,950.00
Factory order	EZGUIDE I factory installation and manuals	4,000.00
Factory order	Sub-Spindle Draw Tube with 2.047 I.D. (parts ejector cannot be used) (standard drawtube in the right spindle has a honed ID of 1.97")	750.00
Factory order	X axis glass scales*	5,500.00
Factory order	Dual chucking pressure	1,500.00
Factory order	4 sets of Extra Soft Jaws for Samchully 6" chuck (must order 4 sets)	800.00
Factory order	4 sets of Extra Soft Jaws for Samchully 8" chuck (must order 4 sets)	900.00
Factory order	1 set of Extra Hard Jaws for Samchully 6" chuck	180.00
Factory order	1 set of Extra Hard Jaws for Samchully 8" chuck	220.00
Factory order	380v External Transformer	4,400.00

**** Absolute position encoders are not available with glass scales. All axis must be referenced at power up.***
Factory installed options must be installed on the machine during assembly at the factory. Machine delivery will be a minimum of three (3) months after order. Schedule depends on both machine and option availability. Please confirm the actual lead-time before ordering a machine with factory installed options.

Main spindle power chucks: *

K-B210A0600	10" Kitagawa 3 jaw chuck (maximum RPM is 4,200)	4,300.00
BB208A0647	8" Kitagawa 3 jaw chuck with 5,000 RPM rating (2.59" hole)	2,300.00
A6-S26H	ATS S-26 collet chuck – 2.625" bar capacity (6.25" OAL)	2,825.00
A6-S26TLS	ATS **push to close** dead length S-26 collet chuck – 2.625" bar capacity (5.5" diameter at nose / 7" OAL)	4,085.00
K-QG65-AL/A6	Royal Accu-Length **push to close** dead length collet chuck - 2.625" bar capacity (5.5" diameter at nose / 5.33" OAL) - includes QG-65 manual collet changer - uses one-piece QG-65 quick change collets (sold separately)	3,260.00
K-CB65-NDR/A6	MicroCentric **pull to close** dead length collet chuck - 2.625" bar capacity (6.48" diameter at nose / 6.725" OAL) - includes CM65 manual collet changer - uses one-piece vulcanized design 65-BZI quick change collets (sold separately)	5,300.00
RA6-16C	Royal 16C collet chuck – 1 5/8" bar capacity (6.0" OAL)	980.00
RA6-3J	Royal 3J collet chuck – 1.75" bar capacity (6.0" OAL)	1,040.00
RA6-5C	Royal 5C collet chuck – 1 1/16" bar capacity (6.0" OAL)	1,070.00
RA6-S26	Royal S-26 collet chuck – 2.625" bar capacity (6.25" OAL)	2,490.00
RA6-S26AL	Royal **push to close** dead length S-26 collet chuck - 2.625" bar capacity (5.5" diameter at nose / 7" OAL)	3,610.00

** To bar feed without a turret stop on servo driven barfeeders, the draw tube must pull back as the collet closes. A **push to close** dead length collet chuck can not be used when servo feeding without a turret stop. Normal pull back collet chucks can be used for servo feeding without a turret stop but the pushing length will vary and a face off will be required. For better bar length repeatability (approximately +/-.005") when feeding without a turret stop, a **pull to close** dead length collet chuck is required.*

Sub Spindle

RA5-16CAL	Royal 16C **push to close** dead length collet chuck – 1-5/8" bar capacity (3.25" diameter at nose 6.5" OAL)	2,850.00
RA5-3JAL	Royal sub-spindle dead length 3J collet chuck – 1.75" bar capacity (3.25" diameter at nose / 6.23" OAL)	2,610.00
A5-3JTLS	ATS sub-spindle true length 3J collet chuck - 1.75" dia. part capacity (6.5" OAL)	3,440.00
K-QG65-AL/A5	Royal Accu-Length **push to close** dead length collet chuck - 2.625" bar capacity (5.5" diameter at nose / 5.33" OAL) - includes QG-65 manual collet changer - uses one-piece QG-65 quick change collets (sold separately)	3,260.00

For applications involving the part being placed into the subspindle draw tube note hat the subspindle drawtube ID is 1.97"

Chuck Jaws:

SB06B1	Samchully soft jaws for standard 6.5" chuck (set of 3)	60.00
SB08B1	Samchully soft jaws for standard 8.25" chuck (set of 3)	80.00
SB10B1	Samchully soft jaws for standard 10" chuck (set of 3)	90.00
HB06A1	Samchully hard jaws for standard 6.5" chuck (set of 3)	350.00
HB08A1	Samchully hard jaws for standard 8.25" chuck (set of 3)	500.00
HB10A1	Samchully hard jaws for standard 10" chuck (set of 3)	500.00

TURRET TOOL HOLDERS (for normal 12 station use):

850418-00074	OD Tool Holder (1.0" sq shank)	550.00
850418-00076	Double OD Tool Holder (1.0" sq shank)	750.00
L31560637D	Face Tool Holder (1.0" sq shank)	380.00
L61590467F	Cut-Off Tool Holder (1.0" sq shank)	450.00
850418-00080	ID Tool Holder (1.5" ID)	600.00
850418-00082	Double ID Tool Holder (1.0" ID)	650.00
L31563104	U-Drill Cap for 1.5" ID holder	90.00
L32563134C	U-Drill Cap for 1.0" ID holder	80.00
L31512713E	Boring Bar Sleeve – 1.5" OD - 3/8" ID	110.00
L31512723E	Boring Bar Sleeve – 1.5" OD - 1/2" ID	110.00
L31512733E	Boring Bar Sleeve – 1.5" OD - 5/8" ID	110.00
L31512743D	Boring Bar Sleeve – 1.5" OD - 3/4" ID	110.00
L31512753D	Boring Bar Sleeve – 1.5" OD - 1" ID	110.00
L31512763D	Boring Bar Sleeve – 1.5" OD - 1 1/4" ID	110.00
L32514713D	Boring Bar Sleeve – 1.0" OD - 3/8" ID	100.00
L32514723D	Boring Bar Sleeve – 1.0" OD - 1/2" ID	100.00
L32514733D	Boring Bar Sleeve – 1.0" OD - 5/8" ID	100.00
L32514743D	Boring Bar Sleeve – 1.0" OD - 3/4" ID	100.00
L31512683F	U-Drill Sleeve – 1.5" OD - 3/4" ID	105.00
L31512693F	U-Drill Sleeve – 1.5" OD - 1" ID	105.00
L31512703F	U-Drill Sleeve – 1.5" OD - 1 1/4" ID	105.00

TURRET TOOL HOLDERS (for optional 24 position indexing use):

L21590517C	OD Tool Holder (.75” sq shank) (R & L)	550.00
850418-00078	Double OD Tool Holder (.75” sq shank) (R & L)	750.00
L61580267	Double OD Tool Holder (.75” sq shank) (F-24 station)	670.00
L61580257	Double OD Tool Holder (.75” sq shank) (R-24 station)	670.00
L21590537C	Face Tool Holder (.75” sq shank) (R & L)	480.00
L21590587C	Cut-Off Tool Holder (.75” sq shank) (right hand)	450.00
L21590527B	ID Tool Holder (1.25” ID)	535.00
L61580277A	Triple ID Tool Holder (1.0” ID)	650.00
L21591114	U-Drill Cap for 1.25” ID holder	100.00
L21596513B	Boring Bar Sleeve – 1.25” OD - 3/8” ID	130.00
L21596523B	Boring Bar Sleeve – 1.25” OD - 1/2” ID	130.00
L21596533B	Boring Bar Sleeve – 1.25” OD - 5/8” ID	130.00
L21596543A	Boring Bar Sleeve – 1.25” OD - 3/4" ID	130.00
L21596553A	Boring Bar Sleeve – 1.25” OD - 1” ID	130.00
L32514713D	Boring Bar Sleeve – 1.0” OD - 3/8” ID	100.00
L32514723D	Boring Bar Sleeve – 1.0” OD - 1/2” ID	100.00
L32514733D	Boring Bar Sleeve – 1.0” OD - 5/8” ID	100.00
L32514743D	Boring Bar Sleeve – 1.0” OD - 3/4” ID	100.00
L21596913	U-Drill Sleeve – 1.25” OD - 3/4” ID	105.00
L21596923	U-Drill Sleeve – 1.25” OD - 1” ID	105.00

Rotary Tools:

7.073.118	**Eppinger** Preci-Flex® ready ER25 X-axis (straight) milling head	1,715.00
7.073.270	**Eppinger** Preci-Flex® ready ER25 Z-axis (angular) milling head	2,880.00
MD-0271525	MD ER25 X-axis (straight) milling head	1,550.00
MD-0240125	MD ER25 Z-axis (Angular) milling head	2,700.00
MD-0272232	MD ER32 X-axis (straight) milling head	1,600.00
MD-0240132	MD ER32 Z-axis (Angular) milling head	2,800.00

Special rotary tool holders, including through the spindle coolant, adjustable angle, slotting saw and woodruff key cutter, are available from Exsys Tool Inc. (www.exsys-tool.com) and MD Tooling (www.mdtooling.com). Various Preci-Flex adapters for the standard Eppinger rotary tools are available from Exsys Tools Inc. Please discuss specific applications with the rotary tool manufacturers they can quote price and delivery.

Barfeeders (short automatic)**:**

Servo Type

ATS-MD-565S	ATS-MD-565S – servo controlled - 2.625” max dia. **(2)**	19,400.00
ATS-ML2-565S	ATS-ML2-565S – servo controlled - 2.625” max bar dia. **(2)**	21,800.00
EDGE-REB80	Edge Rebel 80 – servo controlled - 3” max bar dia.	18,500.00
MTA-SUPER80	MTA Super 80- servo controlled - 3” max bar dia.	17,800.00
LNS-QLS80S2	LNS Quick Load Servo 65/80 – servo controlled - 3” max bar dia.	19,700.00
IEM-VIP65E2	IEMCA VIP65E II – servo controlled – 2.56” max bar dia.	19,100.00
IEM-VIP80E2	IEMCA VIP80E II – servo controlled – 3.15” max bar dia.	20,600.00
LNS-QLS301	LNS Quick Load Servo 3 – (rear load) - servo controlled -	

	4.75" max bar dia.	24,700.00
IEM–FLEX-6-L	IEMCA - I FLEX-6 – 3.15" diameter x 6' bar length capacity—operating as a bar loader - includes (3) bar pushers, 3 front split bushing and 2 spindle liners	31,200.00

Note **(2)** *Limited 2 year warranty - see manufacturer for details*

**** All above barfeeder prices include one spindle liner, cable, plug, barfeed interface and installation. Maximum bar diameter is set by the smallest bar capacity of either the barfeeded or machine drawtube size. Maximum bar length is limited by the length of machine spindle. Maximum bar length is 3'. Maximum end of bar remnant size and weight are limited by the chip conveyor design. Maximum remnant size is 3" diameter x 4.5" long. Maximum remnant weight is 6 pounds. See separate spreadsheet comparing barfeed features.*

Long Magazine Barfeeders (6' and 12' bar length):

IEM–FLEX-6-R	IEMCA – I FLEX-6 – 3.15" diameter x 6' bar length capacity—standard with remnant retract and one capacity set (everything required to one bar size including guide channel, bar pusher, rotating tip, collet, front split bushing)	31,200.00
EDGE-P551	Edge Patriot 5-51 – 1.75" diameter x 12' bar length capacity	31,500.00
LNS-QUICK6	LNS Quick 6 S2 – 3.125" diameter x 6' bar length capacity **with out** remnant retract	36,600.00
LNS-S565RR	LNS Hydrobar Sprint 565 – 2.5" diameter x 12' length capacity with remnant retract	52,000.00
IEM-M865MP	IEMCA Master 865-MP – 2.75" diameter x 12' bar length capacity with remnant retract **(3)**	49,100.00
IEM-M880MP	IEMCA Master 880-MP – 3.15" diameter x 12' bar length capacity with remnant retract **(3)**	56,100.00
LNS-SPRINT-S3	LNS Hydrobar S3 – 3.125" diameter x 12' length capacity with remnant retract	62,000.00

IEMCA FLEX 6 OPTIONS

IEM-FLEX-A	Additional capacity set(s) – working as a "standard 6 FT bar feeder" with remnant retraction capability -	3,000.00
IEM-FLEX-B	Add "short loader" capability hardware to IEM-FLEX-6-R - includes (3) bar pushers, 3 front split bushing and 2 spindle liners	1,600.00

All above long magazine barfeeders include barfeed interface, one guide channel or bearing set, cable, plug and installation. Spindle liner will be supplied if required for the bar size specified on your order. For technical details and selecting appropriate sizing of channels-collets-bushings including the maximum bar diameter possible with remnant retract, please discuss with the barfeed manufacturer.

Note **(3)** *Multi Rack and Bundle magazines available for up to a maximum linear bar capacity equaling 5500lbs- see manufacturer for details*

*** Barfeed prices are special and only valid with the original machine purchase.**

All option prices listed include freight (USA and Canada only) except chip conveyors and bar feeders

FANUC 31*i*-A CONTROL FEATURES

Specifications:

4 simultaneously controllable axes
0.0001” minimum programmable increment
4,200 feet part program storage
Backlash compensation
Self-diagnostic functions
Pentium microprocessor
Digital AC servos and spindle drive
Up to 500 registered programs
Constant surface speed control
PCMCIA slot (for memory or modem card)

Standard programming features:

Spindle orientation
Background editing
Direct drawing (line/angle) programming
Peck drilling canned cycle (G83)
Circular interpolation by radius designation
Absolute/incremental programming
Helical interpolation (Y axis only)
Multiple repetitive cycles (G70 - G76)
G-code system B/C
F10/11/15 tape format
Reference point return (G27 - G30)
Subprogram - 4 holds nested
Continuous thread cutting
Programmable data input (G10)
Polar coordinate interpolation
Custom macro B
Cylindrical interpolation
Copy and merge edit functions (expanded edit)
Multi part program editing
Workpiece cord system (G54 - G59)
Tool nose radius comp (G40-42)
Inch/metric programming
Rigid tapping
Multiple repetitive cycle type(pocketing)
AI contour control 1 (30 block)
Canned cycles (G90, G92, G94)
Decimal point programming
Dwell (revolutions or seconds)
Skip function (G31)

Standard operation features:

High resolution 10.4” color LCD display
Tool monitoring system
32 pairs of tool offsets
Parts counter display
Additional block skip
Direct input of offset value measured
Keyboard type manual data input (MDI)
Incremental offset
On screen axis load meter display
Feed rate override
Operation history display
Help function
Geometry and wear offsets
Automatic data backup
Macro executor
Tool path graphic display
Tool life management
Run hour display
Thread cutting retract
Automatic tool offset calculation
Input/output interface (RS232C)
Program protect key
On-screen spindle load meter display
Rapid traverse override
Spindle speed override
Alarm history display
External message display
Clock function
Fanuc embedded Ethernet function
Program restart

Doosan Infracore America Corporation
LIMITED WARRANTY

Doosan Infracore America Corporation ("DIAC") warrants to the original purchaser, other than a purchaser for resale, (the "Purchaser") that DIAC's machine tools shall be free of defects in materials and workmanship. For a period of one (1) year from completion of installation, or for a period of fifteen (15) months from date of shipment, whichever is earlier, DIAC will, at its sole and exclusive discretion, either replace or repair any machine or part thereof defective in workmanship or material, at no charge to the Purchaser.

All warranty repairs must either be performed by or authorized by a DIAC Authorized Service Organization. To obtain warranty service, Purchaser must contact their local DIAC Authorized Service Organization. Purchaser must provide verification of the date of delivery/installation when requesting warranty service (dated installation report). Ground freight charges (UPS regular or common carrier truck) for all warranty replacement parts are paid by DIAC. If machine is not operational, the DIAC will pay next-day air shipment charges for necessary parts weighing 100 lbs. or less. Materials or parts alleged to be defective shall be returned to DIAC, at DIAC's request, transportation charges prepaid. After the warranty repair or replacement of a defective part, DIAC's warranty for such part shall continue for ninety (90) days or for the remainder of the original Limited Warranty, whichever is longer.

WARRANTY LIMITATIONS

This warranty shall remain in effect only if the machine is used and maintained in accordance with all operating and maintenance instructions set forth in the manuals and instruction sheets furnished by DIAC. DIAC shall have no liability to repair or replace defective parts until the Purchaser has fulfilled its payment obligations. No allowance will be made for repairs or alterations made without DIAC's prior written consent or approval. The limited warranty provided by DIAC excludes the following:

1. Damage, malfunction, or failure caused by or resulting from improper maintenance, misuse, neglect, accident or any other cause beyond the control of the DIAC.
2. Damage, malfunction, or failure caused by modification of the machine (mechanical or electrical) without written authorization by DIAC.
3. Damage, malfunction or failure caused by installation or use of accessories or peripherals not purchased through or authorized in writing by DIAC.
4. Paint, batteries, filters, fluids, fuses, light bulbs, or any commonly expendable item.
5. Damage to machines and/or components while being transported from DIAC's warehouse or facility to destination.
6. Accessories or peripherals not manufactured by DIAC, which shall be subject only to whatever warranty that is supplied by the manufacturer of such product.
7. Fanuc CNC control, Fanuc spindle motors and Fanuc servo motors, spindle and servo drives, which are covered by a two (2) year manufacturer warranty.

No person, agent, distributor, dealer or company is authorized to change, modify or amend the terms of this Limited Warranty in any manner. DIAC makes no warranties, guarantees or representations, express or implied with respect to the machine tool, or parts thereof, except to the extent such warranty is set forth herein. The equipment covered does not necessarily comply with any codes or standards unless specifically quoted, ordered, and so accepted.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE. DIAC's LIABILITY UNDER THIS WARRANTY IS EXPRESSLY LIMITED TO ITS PROMISE TO REPAIR OR REPLACE THE DEFECTIVE GOODS. DIAC SHALL HAVE NO FURTHER LIABILITY IN CONTRACT OR NEGLIGENCE OR UNDER ANY OTHER THEORY OF LAW OR EQUITY FOR ANY DAMAGES, DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL, OR ANY DELAY RESULTING FROM THE DEFECT.