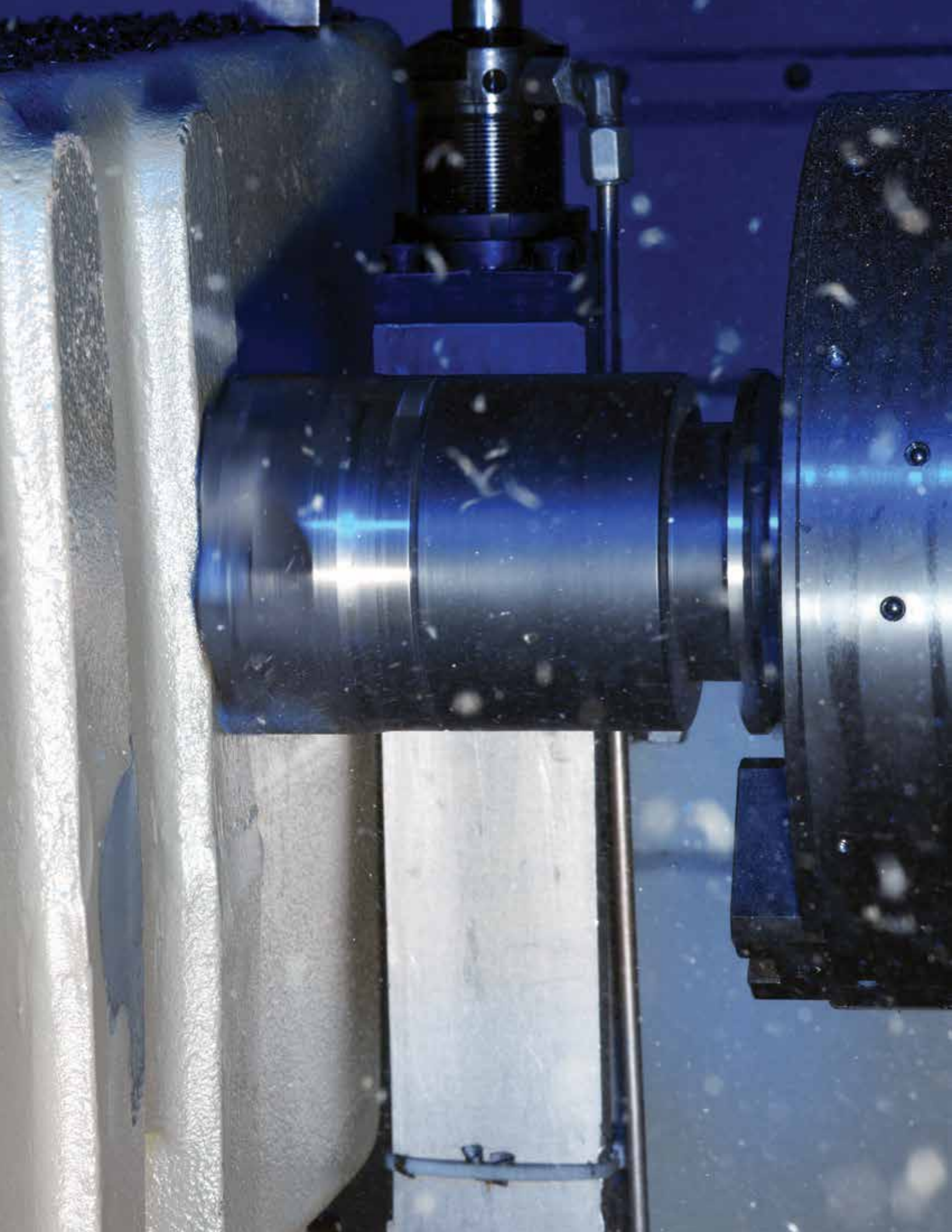




MAKINO MACHINING COMPLEX
MODULE MMC2





GET UP TO 95% SPINDLE UTILIZATION.

Like everything we offer, the Makino Machining Complex 2 (MMC2) is designed to help you get quality products to market faster. Our MMC2 system will allow you to eliminate the impact of part setup time and reduce your non-value-added costs by providing a constant flow of parts to the machines to keep the spindles cutting.

This is automatically achieved, as each machine has more capability due to the increased number of pallets available in the MMC2 system. A stand-alone machine is equipped with only two pallets, while the MMC2 allows you to have a pool of up to 200 pallets that are capable of going into any machine in the MMC2 system. With this pool of pallets and the machines running, set up time can be eliminated. This means no one job has to be dependent on one machine or one pallet for production operation, offering flexible production management.

The MMC2 is a modular, automated material handling system that links Makino horizontal machining centers, pallet loaders and operators. A servo-controlled vehicle transports material to and from machines, with little if any operator intervention. Each system is completely flexible and can be designed for your facility using standard components. Because of this modular flexibility in layout design, future expansion is always possible.

Because the MMC2 allows spindle utilization of up to 95 percent and our machines virtually eliminate out-of-cut time, you can dramatically increase production without adding staff or equipment. The automated MMC2 system also lets you conduct unattended operations, so you end up with more parts, faster, and a high-speed return on investment.

TYPICAL SPINDLE UTILIZATION

UP TO

MANUAL HAND CRANK	15%
MANUAL TOOL CHANGE CNC	30%
AUTO TOOL CHANGE CNC	50%
AUTO PALLET & TOOL CHANGER CNC	80%
MAKINO MACHINING COMPLEX 2 (MMC2)	95%



MODULAR DESIGN PROVIDES FLEXIBILITY

Makino's MMC2 connects superior machines.

The foundation of the MMC2 is Makino's superior horizontal machining centers. With Makino technology, any part produced by traditional vertical machining can now be machined on a horizontal machining center faster, with fewer setups, at far lower labor costs, to higher accuracies and superior finishes. The new horizontal machining centers can reduce total processing lead time by 20 to 25 percent.

That all sounds good, but the obvious question is, how? By allowing rough and finish machining, as well as peripheral operations, to be performed on a single machine, often in one continuous operation, high-speed horizontals reduce the possibility of a "stack up" of errors and eliminate a great deal of the manual effort and wasted time inherent in traditional methods.

"WE THOUGHT WE'D SEE BIG IMPROVEMENTS IN CYCLE TIME. BUT IN SOME CASES, WE'VE REDUCED 30-40% MORE OUT OF OUR CYCLE TIMES THAN WE EXPECTED."

JOHN GILL
MANUFACTURING MANAGER, EATON

"WE HAVE INCREASED OUR PRODUCTIVITY DRAMATICALLY, GOING FROM THREE TO FOUR PARTS PER HOUR ON STAND-ALONE MACHINES TO SIX PARTS PER HOUR ON THE MMC2. THAT IS A 50 PERCENT INCREASE"

MARK PALUCH
VICE PRESIDENT OF OPERATIONS, PRINCE INDUSTRIES





MAKINO MACHINING COMPLEX
MODULE MMC2

Designed specifically for “quick adaptation to changes.”
For advancing shop automation and labor savings

- Flexible manufacturing systems (FMS) that support versatile, high-efficiency production in response to constantly changing manufacturing demands
- Single source and single responsibility

Makino designs and manufactures all the machines, auxiliary units and software and is also solely responsible for maintenance.





Major Components

Upper and Lower Rails Enable
Simultaneous, High-Speed Movement



Cableless Power Supply



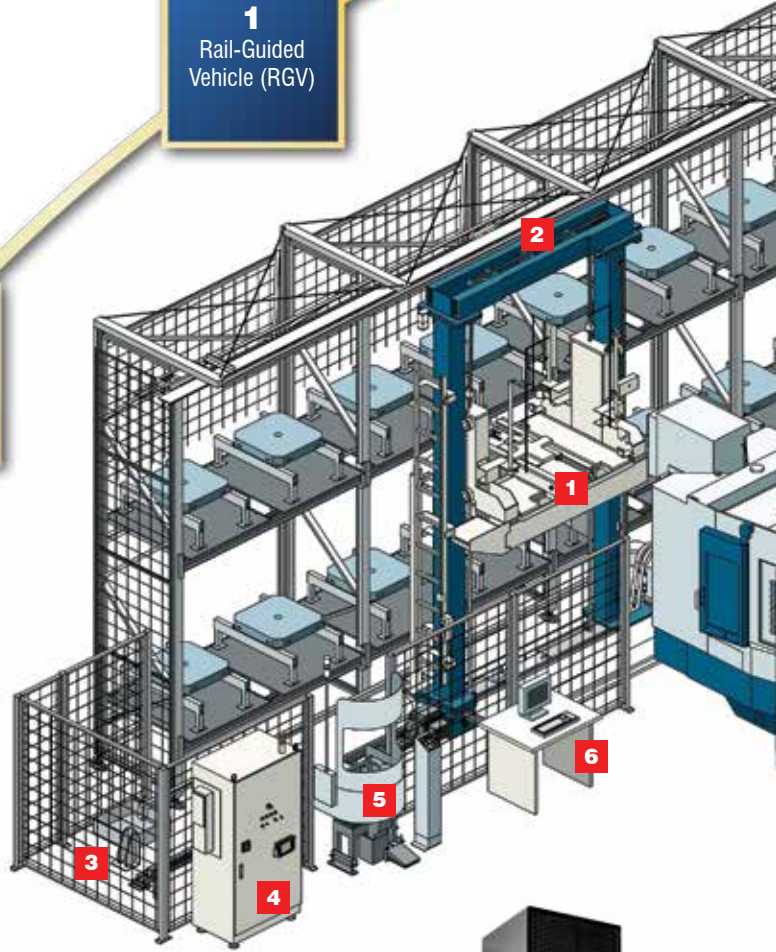
Cableless Data Communications

1
Rail-Guided
Vehicle (RGV)

2
Guide Rail
and Trolley

3
Floor Rail
and Optical
Communications

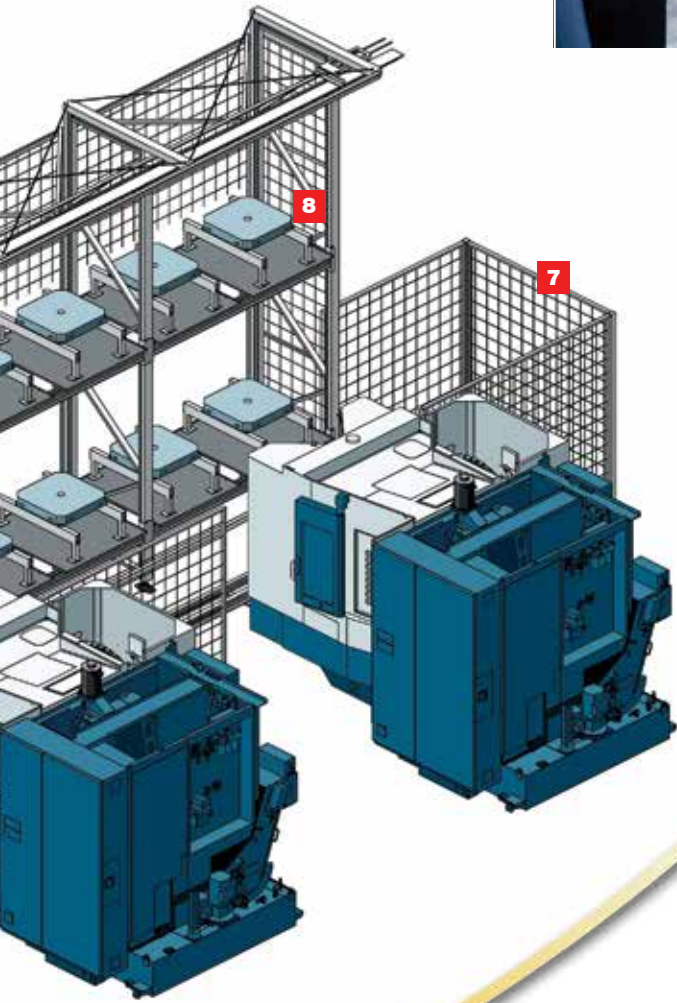
4
RGV
Controller



8
Pallet Stacker



Coolant is centrally collected to maintain a clean working environment



7
Guard Fence



6
PC-based
System
Controller



System Control
Software (MAS-A5)

5
Worksetting
Station (WSS)



Space-saving 180° Pivoting Door

Achieving automatic operation and higher efficiency for large-size workpieces

(Large Horizontal Machining Centers x 2) + (22 Pallets)





(Large Horizontal Machining Centers x 2) + (19 Pallets)



(5-Axis Machining Centers MAG3 x 3) + (12 Pallets)

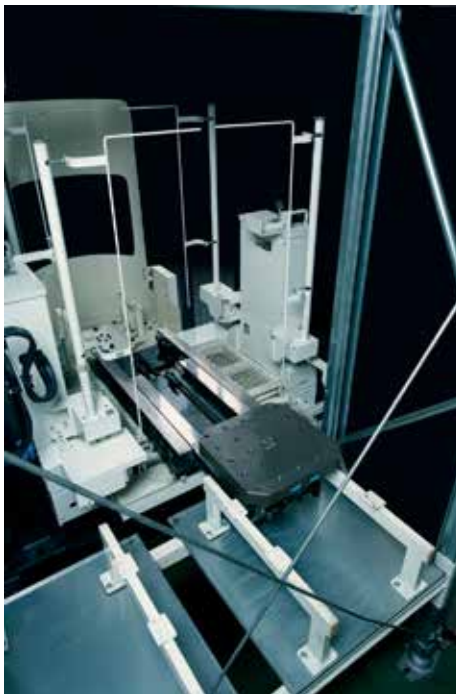
Major Hardware Specifications

RGV	Applicable Machines	M/C Model	a51nx	a61nx	a71nx	a81nx	a92	T1	a120nx
		Pallet Size	□400 (15.7")	□500 (19.7")	□500 (19.7")	□630 (24.8")	800 x 1000	□1000 (39.4")	□1000 (39.4")
	Allowable Carrying Capacity	Workpiece Diameter	∅630 (24.8")	∅800 (31.5")	∅900 (35.4")	∅1000 (39.4")	∅1500 (59.1")	∅1500 (59.1")	∅1900 (74.8")
		Workpiece Height	900 (35.4")	1000 (39.4")	1000 (39.4")	1300 (51.2")	1500 (59.1")	1500 (59.1")	1500 (59.1")
Maximum Pallet Load		400 kg (882 lbs)	700 kg (1543 lbs)	1000kg (2204 lbs)	1200 kg (2646 lbs)	2000 kg (4409 lbs)	3000 kg (6614 lbs)	3000 kg (6614 lbs)	
System Model	1-Level Spec	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	2-Level Spec	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	3-Level Spec	Yes	Yes	Yes	Yes	No	No	No	

Pallet Stocker	1 Level	2600 (102.4")	2715 (106.9")	3180 (125.2")	3180 (125.2")	3540 (139.4")	3540 (139.4")	4325 (170.3")
	Height* 2 Level	3940 (155.2")	3995 (157.3")	4855 (191.1")	4885 (192.3")	5490 (216.1")	5490 (216.1")	7050 (277.6")
	3 Level	5435 (214.0")	5155 (203.0")	6800 (267.7")	6800 (267.7")	--	--	--
	Depth	680 (26.8")	850 (33.5")	925 (36.4")	1050 (41.3")	1600 (63.0")	1900 (74.8")	1900 (74.8")
	Pitch	805 (31.7")	975 (38.4")	1070 (42.1")	1200 (47.2")	1650 (65.0")	2100 (82.7")	2100 (82.7")

Work Setting Station (WSS)	Height	2250 (88.6")	2250 (88.6")	2603 (102.5")	2603 (102.5")	2920 (115.0")	3070 (120.9")	3366 (132.5")
	Depth	760 (29.9")	930 (36.6")	1075 (42.3")	1075 (42.3")	1640 (64.6")	2085 (82.1")	2285 (90.0")
	Pitch	750 (29.5")	920 (36.2")	1080 (42.5")	1080 (42.5")	1680 (66.1")	2130 (83.9")	2330 (91.7")
	Option	Workpiece Washing Gun, Power Index**, Tiltable WSS, Automatic Door						

* Please inquire about height values for specific layouts
 ** Standard on a92, T1, & a120nx MMC2 WSSs



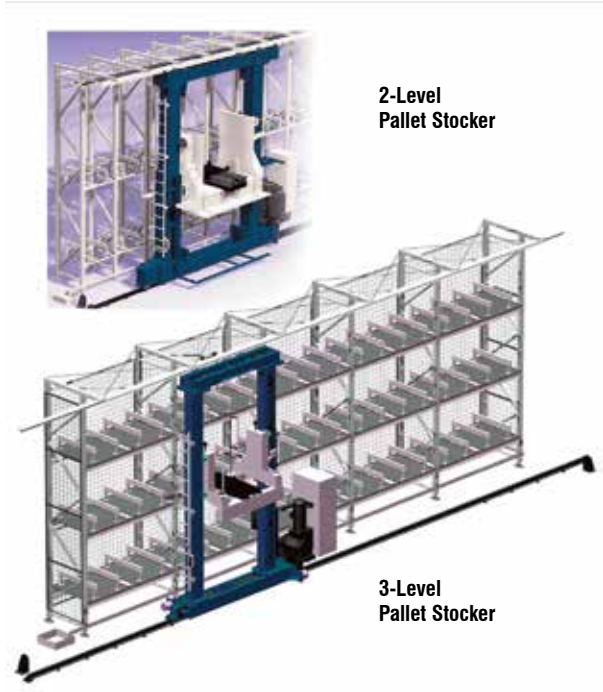
Portable Control Panel
 This unit connects to the RGV controller and to the RGV for handy use.





Pallet
Stocker

WSS



2-Level
Pallet Stoker

3-Level
Pallet Stoker



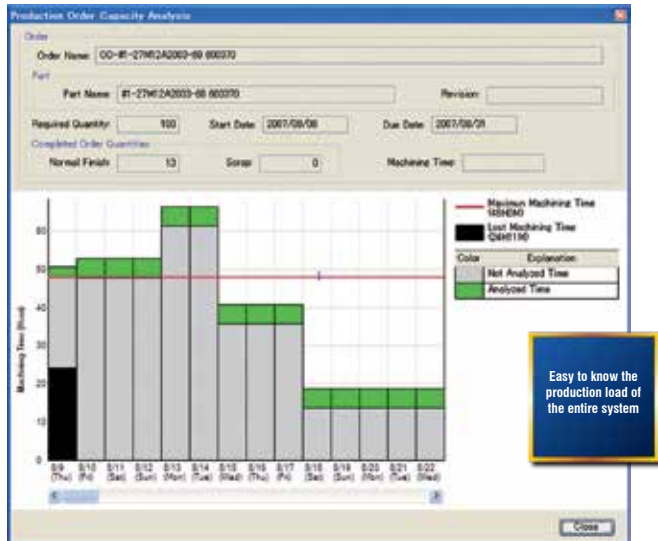
Tilttable WSS
(optional)



Makino Advanced System (MAS-A5) High-Performance System Control Software

System Capacity Information

(Production Order Capacity Analysis)



Before a production order is issued, an analysis is made of whether the system can produce the entire volume of that production order within the given lead time. This analysis takes into account the current progress of previously issued production orders and the types of machine making up the system. The production load of the entire system is displayed in easy-to-understand graphs.

Diagnostic Functionality

(Pallet Diagnosis)

The top screen shows 'Pallet Diagnosis - Pallet002' with fields for Pallet No., Pallet Name, Current Location, Home Position, and Status. It includes a table for 'Face Information / Select face number' and 'Feasible Device Information / Device / Machine'. The bottom screen shows 'Part Diagnosis' with fields for Part Name, Revision, and Resolution Date. It includes a table for 'Machine Job / Select Machine Job' and 'Machine Requirement / Select Machine Requirement'.

(Part Diagnosis)

(Reports)

The 'Machine Results by Pallet' report shows details for 'Pallet001'. It includes 'Report Generated: 2007/08/09 12:12:37', 'Part Period: 2007/05/11 12:00:00 to 2007/08/09 12:00:00', and 'Part Shift: 8:00:00 to 18:00:00 MTWTFSS'. The report lists 'Common Fixtures: MCW001' and provides 'Order Name', 'Part Name', 'Revision', 'Process No.', 'NC Program File Name', 'Start Time', 'Finish Time', 'Machining Time', and 'Spindle Time'.

A wide variety of report functions are provided, including ones showing the operating results of various pieces of equipment and alarm histories.

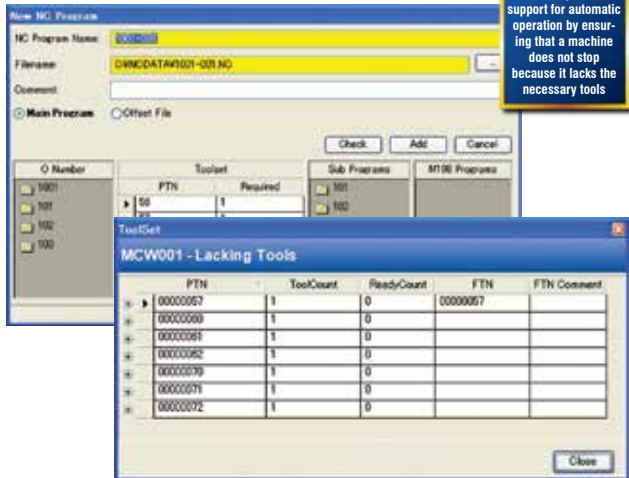
(Trouble Recovery - Machine Recovery Procedure)

The 'Machine Recovery' dialog box for 'Machine: MCW001' lists recovery options: 'Easy - The Machining Job is resumed.', 'Normal Finish - The Status of this Machining Job is set to Normal Finish.', 'Abnormal Finish - The Status of this Machining Job is set to Abnormal Finish (Setup).', 'Suspended Machine - The Status of this Machine Job is Reset, and the Fixture is Suspended.', 'Confirm - The System waits for the current operation to complete.', and 'Cancel - The current loaded processing step of this Machining Job is Skipped.' Buttons for 'Retry', 'Normal Finish', 'Abnormal Finish', 'Suspended Machine', 'Confirm', and 'Cancel' are visible. A callout box states: 'Interactive mode simplifies the recovery procedure'.

A host of diagnostic and trouble recovery functions are provided, making it easy to grasp the situation when the system cannot operate automatically for some reason. These functions support a quick return to automatic operation.

▪ **Tool Resource Management Function**

(Tools in-use data screen)



This function manages information on the tools to be used in machining the specified NC part program and information on the tools prepared for the machine, and automatically judges whether any tools are lacking.

Customizable Functions for Higher Performance

▪ **Tool Lifetime Prediction Function**

(Tool preparation information)

To facilitate unmanned operation at night, the remaining lifetime of the tools must be sufficient to finish all the workpieces scheduled for machining. This optional tool lifetime prediction function judges whether any tools will reach the end of their lifetime during machining and displays information on the spare tools that should be prepared.

Avoids stoppage of unmanned machining operations because a tool reached the end of its life

▪ **Tool Presetter Connection Function**

Measured tool data can be input to the PC-based controller on-line by connecting the tool presetter and PC via an RS232C cable. The input data for each tool are automatically sent to the machine when the tools are loaded on the machine, thereby avoiding data input errors by the operator.

▪ **Additional Operation Terminal Connection: 5 or 10 Licenses**

The standard specification allows the system to be operated from two PCs. This option provides connections for an additional 5 or 10 licensed PCs.

▪ **E-mail Notification Function**

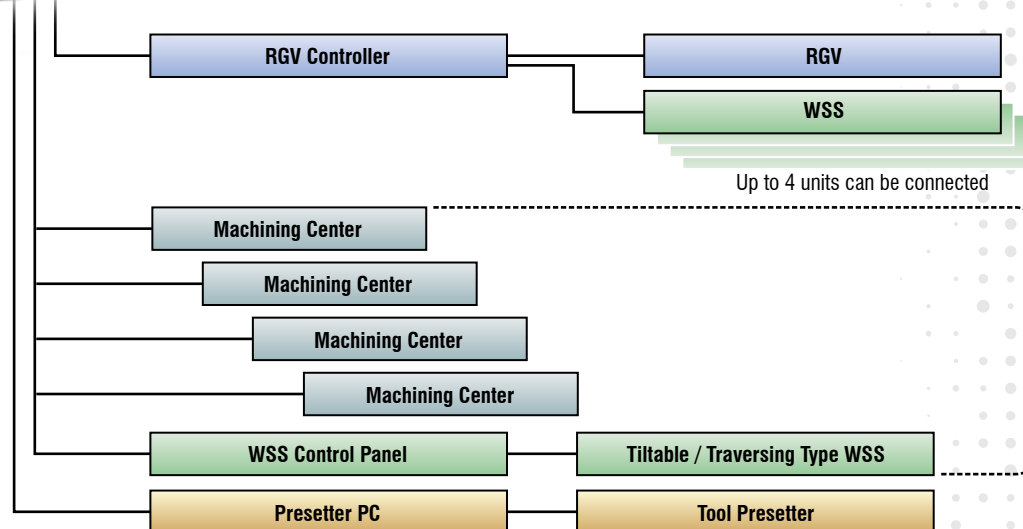
Alarm information for various units is notified by e-mail. (This function requires a Simple Mail Transfer Protocol (SMTP) server in the user's network environment.)

Conceptual Diagram of System Connections



PC-based system controller

- All units of the system are controlled via a network
- NC part programs, tools and all other data are centrally managed by the system controller
- Connections to CAD/CAM systems are easily made



Up to 4 units can be connected

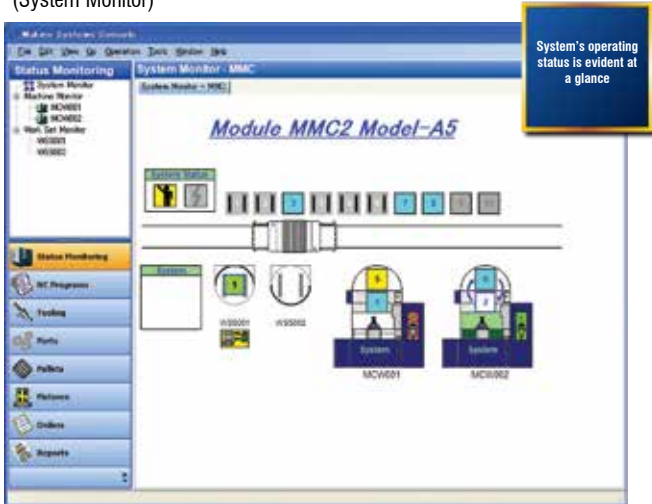
Up to 15 units can be connected

Easy to add more machines and to expand the system

MAS-A5 control software pursues optimum ease of operation to facilitate highly flexible use of Module MMC2 systems.

Entire System's Operating Status Is Displayed

(System Monitor)

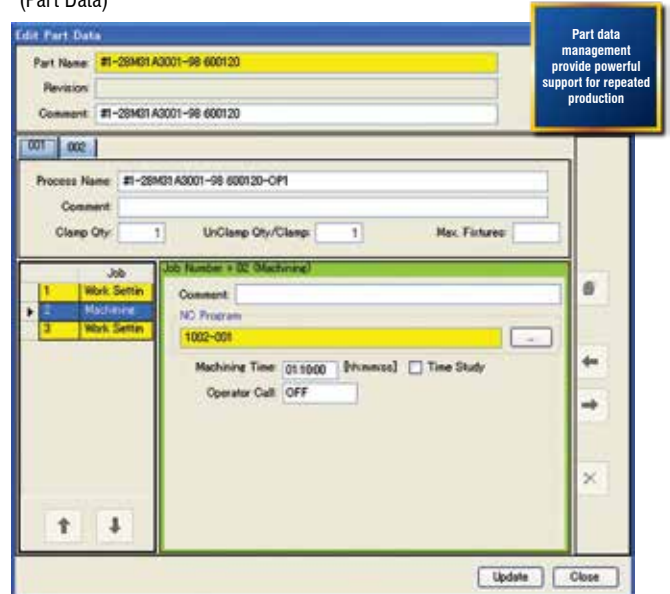


System's operating status is evident at a glance

All system units are centrally controlled from one PC. The menu screens are easy to understand and use, thanks to the Windows operating environment.

Workpiece Data Management

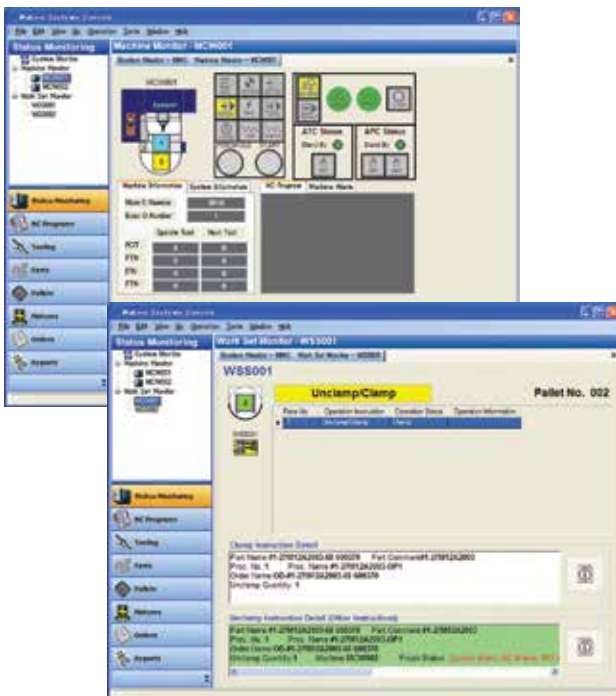
(Part Data)



Part data management provide powerful support for repeated production

Simply pre-register in the system the data of each process (machining program, specified machine, etc.) of the parts to be machined. The system will automatically generate the schedule between the machining processes, making it easy to produce the parts repeatedly.

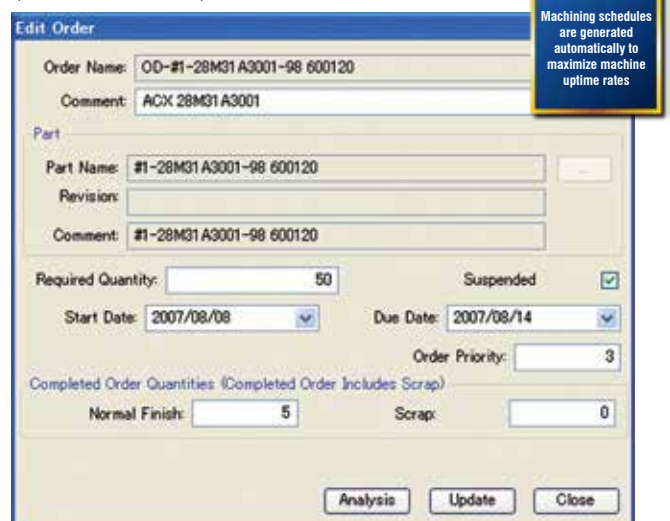
(Machine Monitor)



(WSS monitor screen)

Displays a machine's current status in real time. Work instructions for the WSS operator are also displayed in an easy-to-understand format.

(Production Order Data)

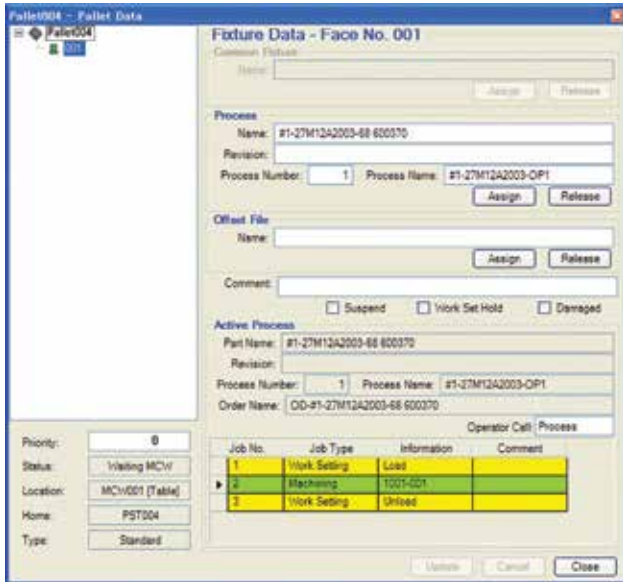


Machining schedules are generated automatically to maximize machine uptime rates

Simply input how many pieces of which parts are to be produced by what time. The dynamic scheduling function generates machining schedules automatically according to the operating status of each machine and the progress of production.

Pallet and Fixture Data Management

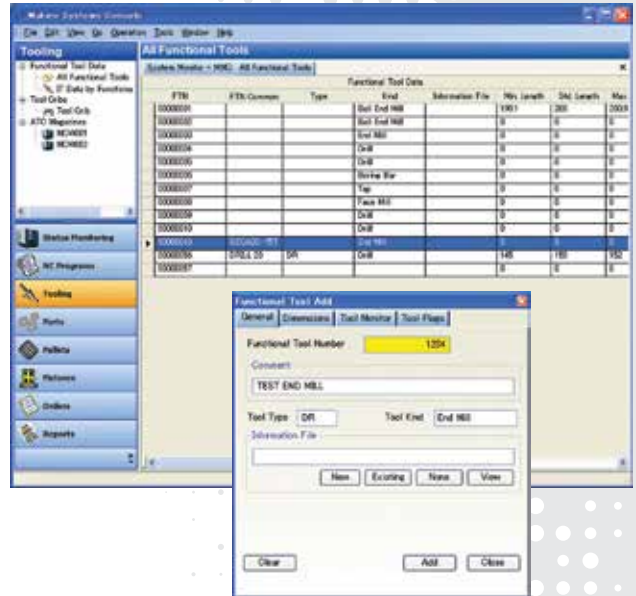
(Pallet Data)



The pallet data screen makes it easy to specify which workpieces should be fixtured on which pallets.

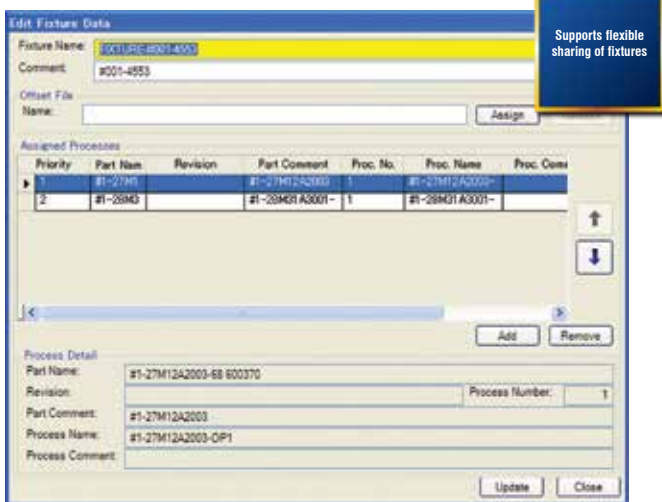
Functional Tool Data Management

(Functional Tool Data)



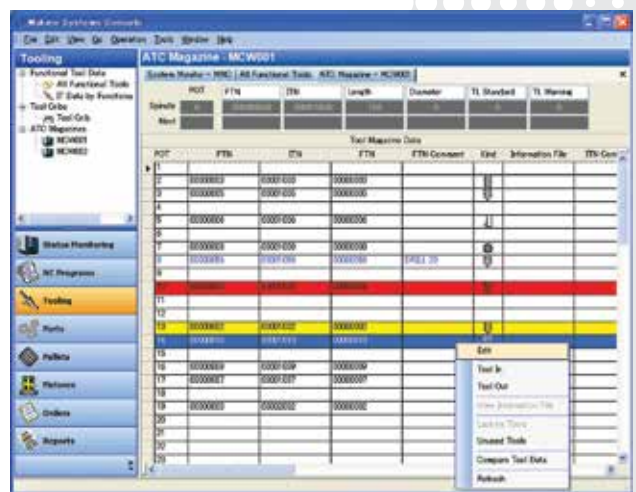
Tools are managed according to the data on each type of tool, thereby simplifying data input for multiple spare tools.

(Edit Fixture Data)



This function manages the data on common fixtures so that the fixtures can be shared between several different machining processes.

(ATC Magazine Tool Data)

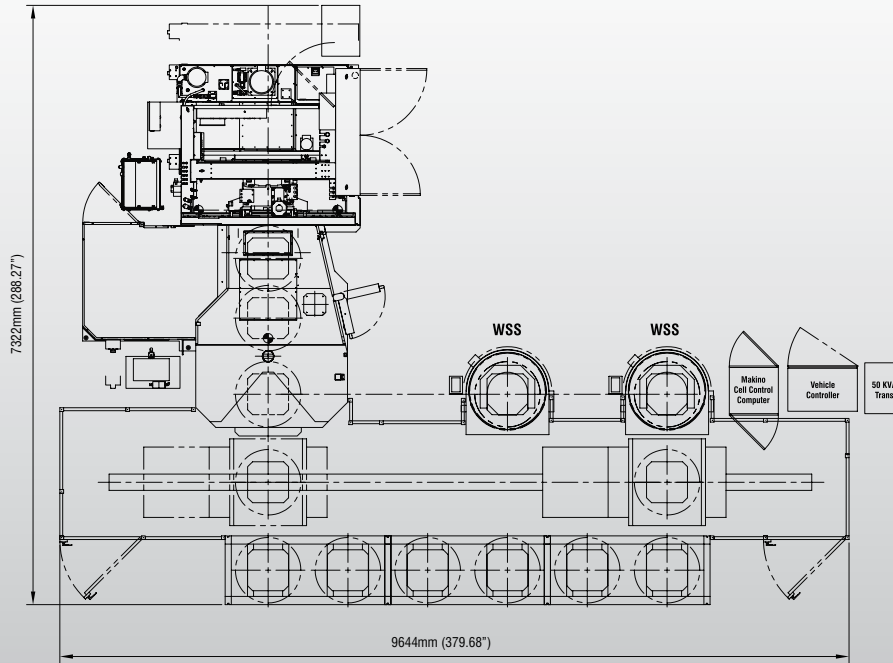


The current data for all tools in a machine's ATC magazine can be displayed on the screen and the data can be edited from the PC.

Easily Expanded to Match Capacity Requirements

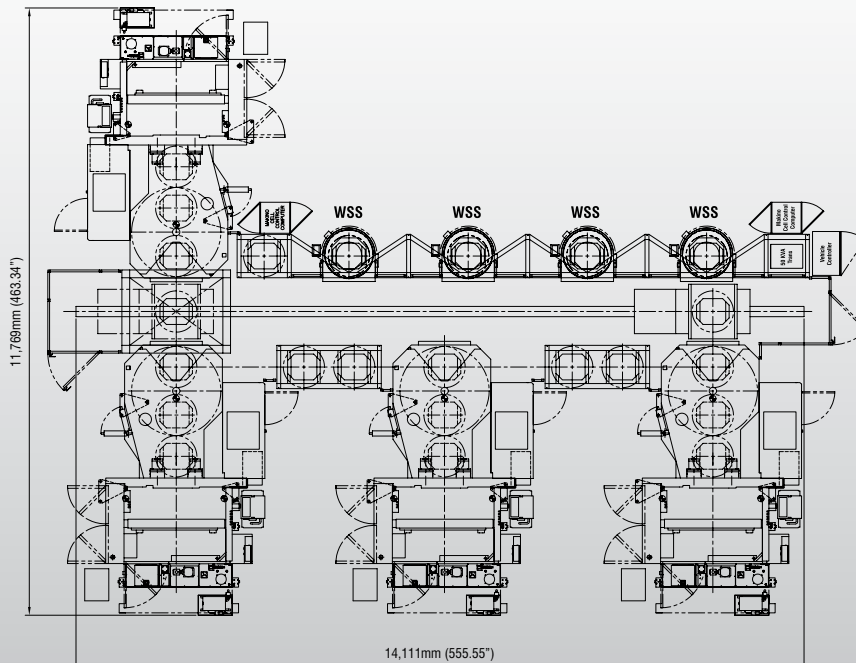
Example System 1: Initial Configuration:

(1) a61nx + (2) WSS + 6 piece pallet stocker (1 level)



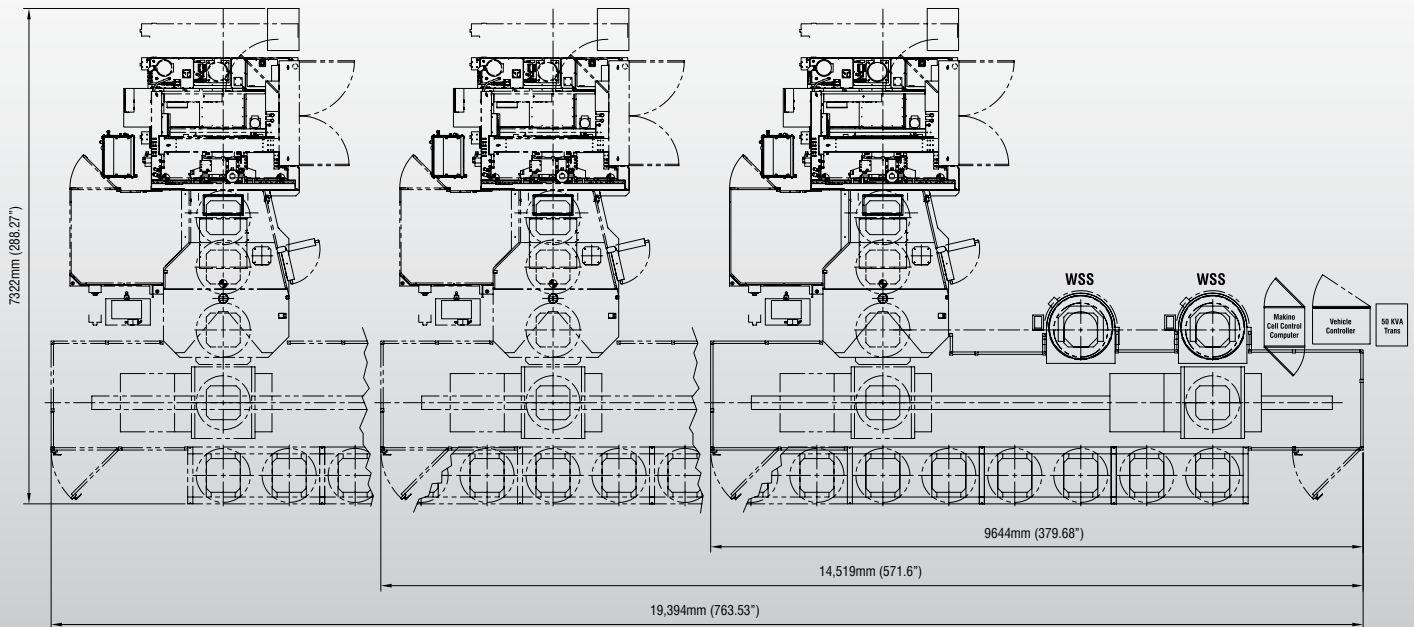
Example System 2: Initial Configuration

(4) a71 + (4) WSS + 10 piece pallet stocker (2 level)



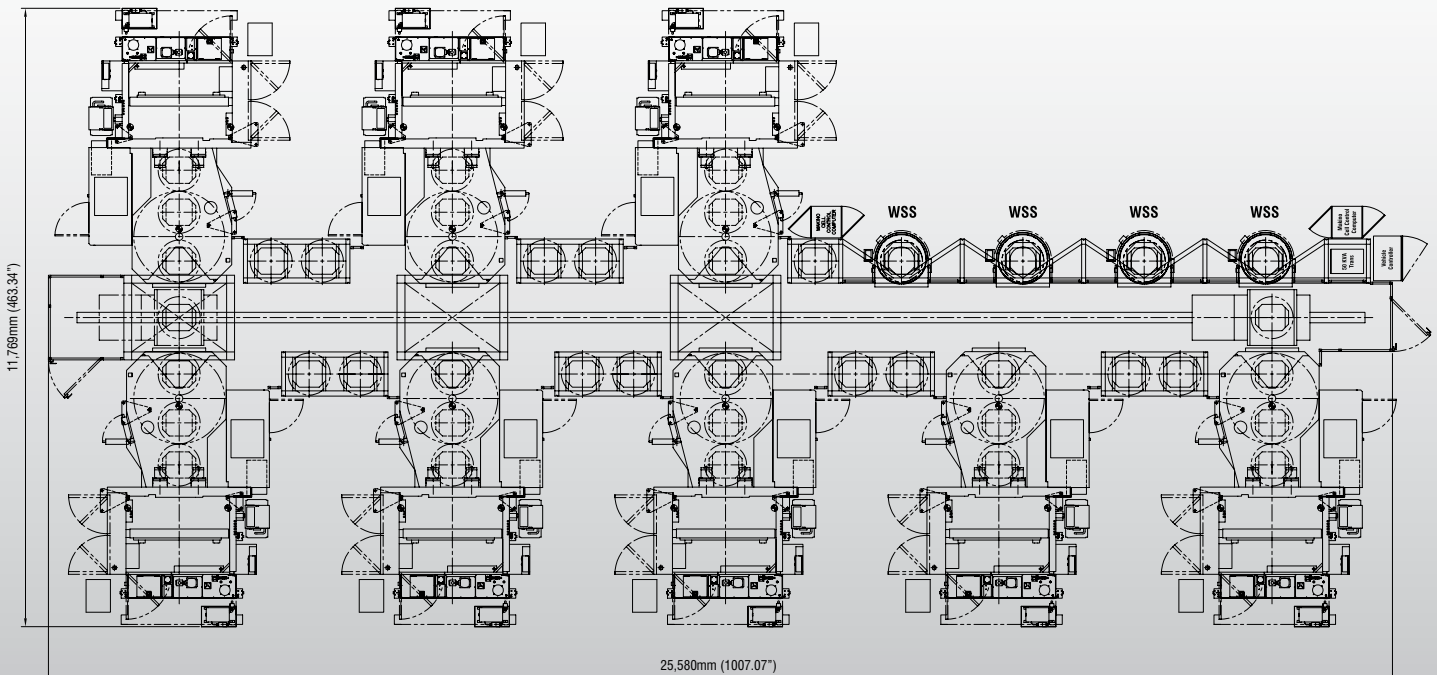
Example System 1: Expansion

(3) a61nx + (2) WSS + 14 piece pallet stocker (1 level)



Example System 2: Expansion

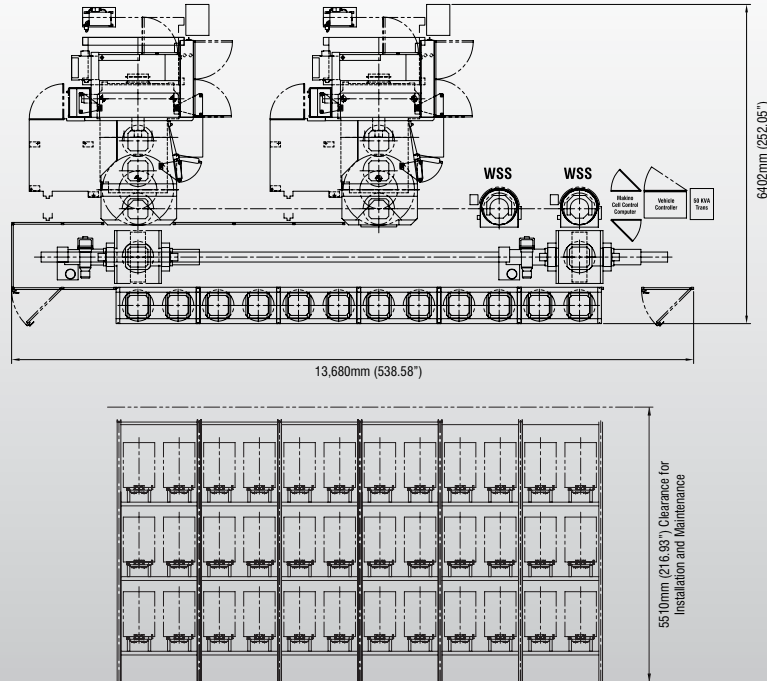
(8) a71 + (4) WSS + 13-piece pallet stocker (1 level)



Examples of System Configurations

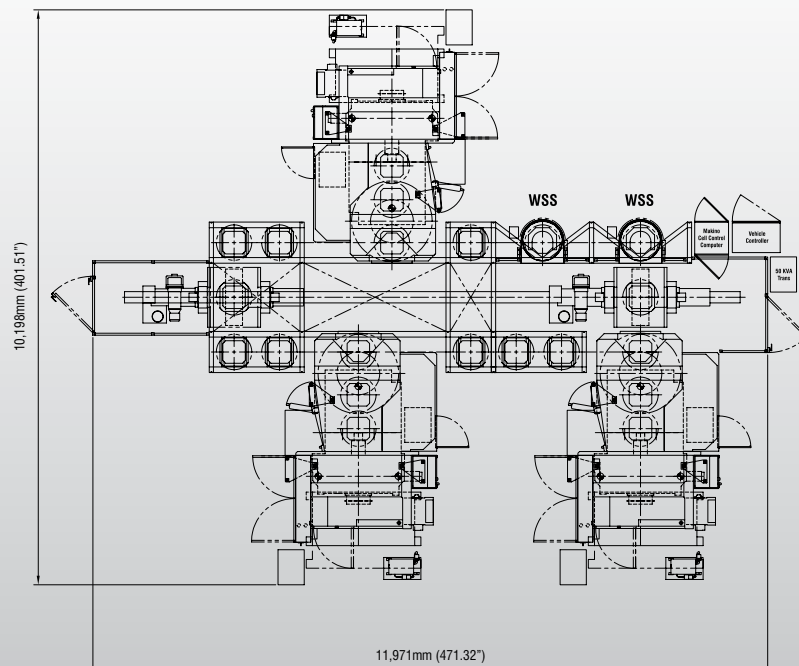
Example of System Configuration: 1

(2) a51nx + (2) WSS + 36 piece pallet stocker (3 level)



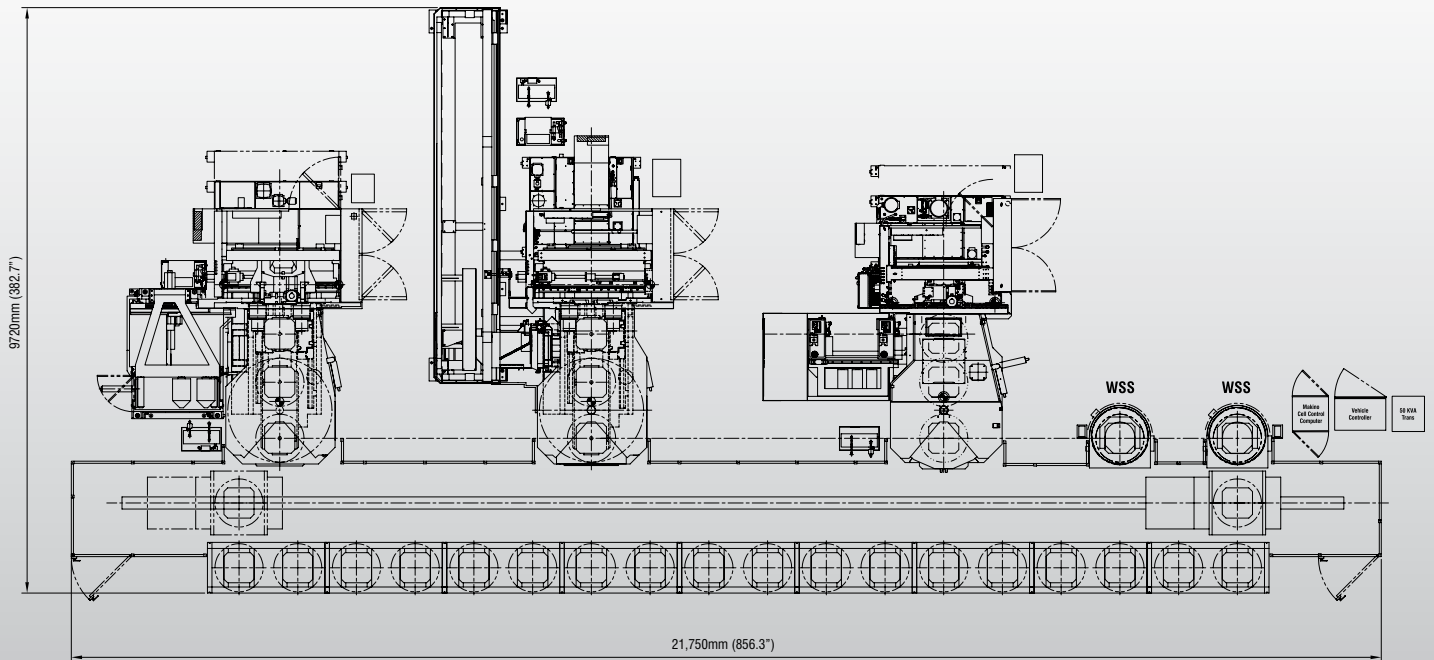
Example of System Configuration: 2

(3) a51nx + (2) WSS + 8 piece pallet stocker (1 level)



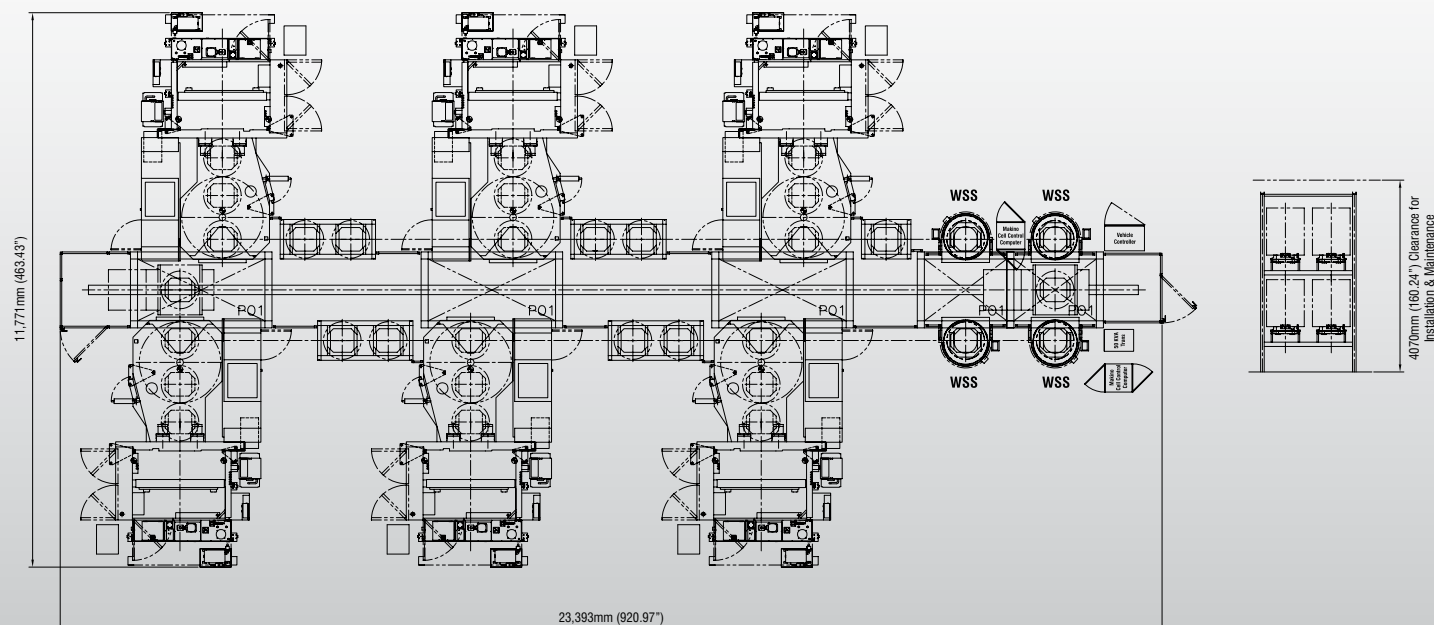
Example of System Configuration: 3

(2) a71 + (1) a61nx + (2) WSS + 12 piece pallet stocker (1 level)



Example of System Configuration: 4

(6) a71 + (4) WSS + 18 piece pallet stocker (2 level)







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