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Makino a81 PRE-INSTALLATION CHECKLIST – Rev 1/2009

Installation of your new Makino a81 can be smooth and rapid if preparations are made prior to the delivery of your machine. Any questions regarding machine installation should be directed to our service department for clarification. We hope this checklist will aid in a rapid installation of your new machine. **NOTE: The following must be completed prior to our service technician arriving at your facility to install the new machine.**

- Power Requirements for your machine: 240v/3ph/75**kVa 225 Amp (Main Circuit Breaker)
(machine comes dual-voltage) 460v/3ph/75kVa 125 Amp
NOTE: **100kVa (including options) See Makino Installation Manual (Air and Power Sources Information Attached) or contact our Service Department for complete information or questions. The machine comes with a 75kVa Transformer.
Proper voltage per machine specifications should be ready at machine site. **Do NOT power up the machine.**
- Customer should furnish and have available the proper supply and types of lubricants required for machine operation. **See enclosed Makino Installation Manual for specifics – any questions should be directed to our Service Department at the above locations.**

ITEM	CAPACITY	FLUID TYPE
Coolant	264 Gallons (may vary with type/size of tank ordered – check Manual for specifics)	Water Soluble, Synthetic

You will need to have Coolant on hand at the time of installation. Contact our Service Department with any questions.

- Air lines should be routed to the machine location and operational for proper air pressure.

Must have clean, dry air supply with less than 40% relative humidity in line. In-line water trap recommended. 72 psi @ 21.3 cfm; we recommend ¾" air line hose.
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- Machine location should be planned to allow enough room for access panels to be opened and serviced with ease. A minimum of 36" clearance is required around the machine for operator and maintenance access.
- Weight requirements should be checked to insure that the surface below the machine will have sufficient strength for support and stability. The machine must be set on a solid, sound and stable, steel bar-reinforced concrete slab poured directly on the grade. In general, the 6" concrete floor on industrial buildings is suitable for machine placement.
- **The Makino a81 can be moved with either a forklift or crane***. Upon arrival of your machine, uncrate and immediately check for visible damage. SEE ATTACHED FOR SHIPPING DIMENSIONS.**

*****NOTE: LIFTING EQUIPMENT, ROPES, SHACKLES, LIFTING BARS, LIFTING BEAMS, ETC. ARE OPTIONAL EQUIPMENT AND ARE NOT PROVIDED WITH THE MACHINE. ITEMS MUST BE PURCHASED PRIOR TO MACHINE DELIVERY. CHECK WITH YOUR RIGGER TO SEE IF THEY HAVE ANY OF THESE ITEMS.*****

- Remove as much preservative from the machine as possible without having to power up (tables – slides, pulleys, etc.). We recommend mineral spirits to clean. Apply oil when finished to prevent rust.

Approximate Machine Shipping Dimensions

(Note – they may vary slightly – we will provide you with a Bill of Lading copy with actual dimensions at time of shipment. Refer to your Makino Installation Manual for exact floor space/layout dimensions/requirements on the Chip Conveyor/Tank and any other optional peripherals purchased with your new machine.)

Makino a81, 60-Tool ATC Machine

SHIPPING WEIGHT	SHIPPING DIMENSIONS OF MACHINE
39,683# (machine)	210" L x 127" W x 146" H (machine CRATED)
2,314# (Chip Conveyor)	111" L x 70" W x 72" H (Chip Conveyor/Coolant Tank crated)
1,213# (Air Dryer)	48" L x 41" W x 92" H (Crated Box)
1,323# (Accessory)	61" L x 31" W x 18" H (Crated Box)
727# (transformer)	50" L x 35" W x 23 H (skidded – shipped separately from Makino in Ohio)
See Makino Installation Manual for Operational/Floor Space Requirements.	

Makino a81, 90-Tool ATC Machine

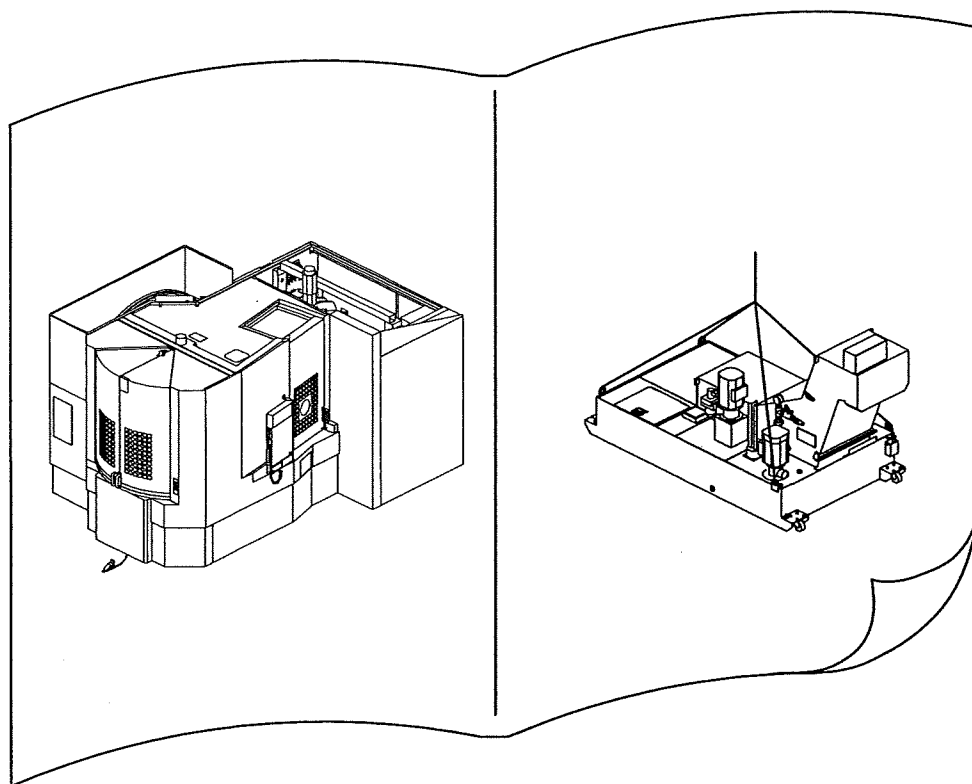
SHIPPING WEIGHT	SHIPPING DIMENSIONS OF MACHINE
39,683# (machine)	210" L x 127" W x 146" H (machine CRATED)
8,157# (90ATC)	111" L x 82" W x 135" H (Optional 90ATC Crated)
2,314# (Chip Conveyor)	111" L x 70" W x 72" H (Chip Conveyor/Coolant Tank crated)
1,213# (Air Dryer)	48" L x 41" W x 92" H (Crated Box)
1,323# (Accessory)	61" L x 31" W x 18" H (Crated Box)
727# (transformer)	50" L x 35" W x 23 H (skidded – shipped separately from Makino in Ohio)
See Makino Installation Manual for Operational/Floor Space Requirements.	

Makino a81, 137-Tool ATC Machine

SHIPPING WEIGHT	SHIPPING DIMENSIONS OF MACHINE
39,683# (machine)	210" L x 127" W x 146" H (machine CRATED)
9,039# (137ATC)	111" L x 80" W x 134" H (137ATC Crated)
2,314# (Chip Conveyor)	111" L x 70" W x 72" H (Chip Conveyor/Coolant Tank crated)
1,213# (Air Dryer)	48" L x 41" W x 92" H (Crated Box)
1,323# (Accessory)	61" L x 31" W x 18" H (Crated Box)
727# (transformer)	50" L x 35" W x 23 H (skidded – shipped separately from Makino in Ohio)
See Makino Installation Manual for Operational/Floor Space Requirements.	

PLEASE FORWARD THIS TO THE APPROPRIATE PERSON. THANK YOU.

Preparations for Installation and Installation



Preparations for Installation and Installation

1	Outline	1
1.1	Preface	1
1.2	Installation Flow	2
2	Preparations for Installation	4
2.1	Confirmation of Preparations for Installation	4
2.2	Preparation of Set-Up Area	5
2.2.1	Preparation for Set-Up Area: a81	6
2.2.2	Preparation for Set-Up Area: a82	14
2.3	Preparation of Transport Route	22
2.4	Set-Up Conditions	25
2.5	Recommended Foundation	26
2.6	Air and Power Sources	34
2.7	Preparation of Transportation/Installation Equipment	36
2.8	Required Manpower for Installation	37
2.9	Inspection Prior to Installation and Precaution During Installation	38
2.9.1	Inspection Prior to Installation	38
2.9.2	Handling of Heavy Components	38
2.9.3	Working at Elevated Locations	39
2.9.4	Working in Confined Spaces	39
2.9.5	Working in Group	39
2.9.6	Work Requiring Machine Operation	39
3	Main Machine Installation	40
3.1	Main Machine Lifting and Set-Up	40
3.1.1	Main Machine Lifting /Set-Up	42
3.1.2	Lifting Equipment Removal	44
3.2	Shipping Jig Removal/Motor Installation	46
3.2.1	Axis Shipping Jig Removal	46
3.2.2	Y-Axis Ball Screw Shipping Jig Removal and Y-Axis Motor Installation	48
3.2.3	Machine Rear Shipping Jig Removal	50
3.2.4	APC Safety Guard Shipping Jig Removal	51

3.2.5	Operator Door Shipping Jig Removal	52
3.2.6	Main Operation Panel Shipping Jig Removal	53
3.2.7	ATC Shutter Shipping Jig Removal	54
3.2.8	BTS (Optional) Stylus Shipping Jig Removal	55
3.2.9	Y-Axis Support Removal	56
3.3	Main Machine Leveling	58
3.4	Machine Fixing Tool Installation	60
4	Placing of Tool Magazine/Peripheral Devices	62
5	Tool Magazine Installation	66
5.1	Outline	66
5.2	Tool Magazine Installation (A40 and A60)	67
5.2.1	Tool Magazine Installation (A40)	67
5.2.2	Tool Magazine Installation (A60)	72
5.2.3	Tool Magazine Reference Position Return	78
5.3	Tool Magazine A97/A137 (Matrix) Installation	81
5.3.1	Outline: Tool Magazine Installation Flow	81
5.3.2	Tool Magazine Set-Up	82
5.3.3	Tool Magazine Piping and Wiring	88
5.3.4	Tool Magazine Reference Position Return	92
5.3.5	Tool Magazine Reference Position Adjustment	96
5.3.6	Tool Magazine Inclination/Position Adjustment	100
5.3.7	Fixing Tool Magazine Position	108
5.4	Tool Magazine A186 or Above (Matrix) Installation	111
5.4.1	Outline: Tool Magazine Installation Flow	111
5.4.2	Sub-Arm Installation	112
5.4.3	Sub-Arm Piping and Wiring	115
5.4.4	Sub-Arm Position Adjustment	118
5.4.5	Sub-Arm Oil Pan/Bracket Installation	122
5.4.6	Tool Magazine Set-Up	126
5.4.7	Tool Magazine Piping and Wiring	130
5.4.8	Tool Magazine Reference Position Return	132
5.4.9	Tool Magazine Position Adjustment	134
5.4.10	Retaining Bracket Installation	146

5.4.11	Cover/Oil Pan Installation	149
6	Peripheral Unit Installation	153
6.1	Spindle Cooling Oil Temperature Controller/Hydraulic Unit Installation	154
6.1.1	Spindle Cooling Oil Temperature Controller/Hydraulic Unit Set-Up	154
6.1.2	Spindle Cooling Oil Temperature Controller/Hydraulic Unit Piping and Wiring	158
6.2	Spindle Oil Temperature Controller/Hydraulic Unit Installation (20000min ⁻¹ Spindle Spec.)	160
6.2.1	Spindle Oil Temperature Controller/Hydraulic Unit Set-Up	160
6.2.2	Spindle Oil Temperature Controller/Hydraulic Unit Piping and Wiring	162
6.3	Coolant Tank Installation	166
6.3.1	Coolant Tank Set-Up (Common to All Coolant Tanks)	166
6.3.2	Coolant Tank Left Discharge 870L Spec. Piping and Wiring (a81)	170
6.3.3	Coolant Tank Rear Discharge 870L Spec. Piping and Wiring (a81)	172
6.3.4	Coolant Tank 1200L Piping and Wiring (a81/a82)	174
6.3.5	Coolant Tank Double Lift-Up Conveyor Spec. Piping and Wiring (a81/a82) ...	176
6.3.6	Cutting Fluid Temperature Controller (Option) Piping	178
6.4	Oil Supply to Peripheral Units	179
6.4.1	Recommended Lubricant/Cooling Oil/Hydraulic Oil	179
6.4.2	Spindle Cooling Oil Temperature Controller Oil Supply (Other than 20000min ⁻¹ Spindle Spec.)	180
6.4.3	Spindle Oil Temperature Controller Oil Supply (20000min ⁻¹ Spindle Spec.) ..	181
6.4.4	Hydraulic Unit Oil Supply	182
6.4.5	Oil Air Supply Unit Oil Supply (Other than 20000min ⁻¹ Spindle Spec.)	183
6.4.6	Coolant Tank Cutting Fluid Supply	184
7	Power and Air (Pneumatic) Source Connection	186
7.1	Power Source Connection	186
7.2	Air (Pneumatic) Supply Source Connection	186
8	Pre-Operation (Operation Preparations)	188
8.1	Initial Cleaning	188
8.2	Lighting Device Wiring Checks	189
8.2.1	Machining Chamber Lighting Device Wiring Check (Control Panel)	189

8.2.2	Tool Magazine A186 or Above Lighting Device Wiring Check (Lighting Device)	190
8.3	Turning Power ON/Checks When Power Is Turned ON	191
8.3.1	Turning Power ON	191
8.3.2	Checks When Power Is Turned ON	192
8.3.3	Hydraulic Piping Air Removal	194
8.4	Safety Device Function/Operation Checks	196
9	Axis Reference/2nd Reference Position Check	198
9.1	Y-Axis Reference Position Return	198
9.2	Axis Reference Position Checks	200
9.3	X/Y-Axis 2nd Reference (ATC) Position Check	202
9.4	Z-Axis 2nd Reference (APC) Position Check	204
10	Static Accuracy Confirmation	205
11	Operation Checks	207

1 Outline

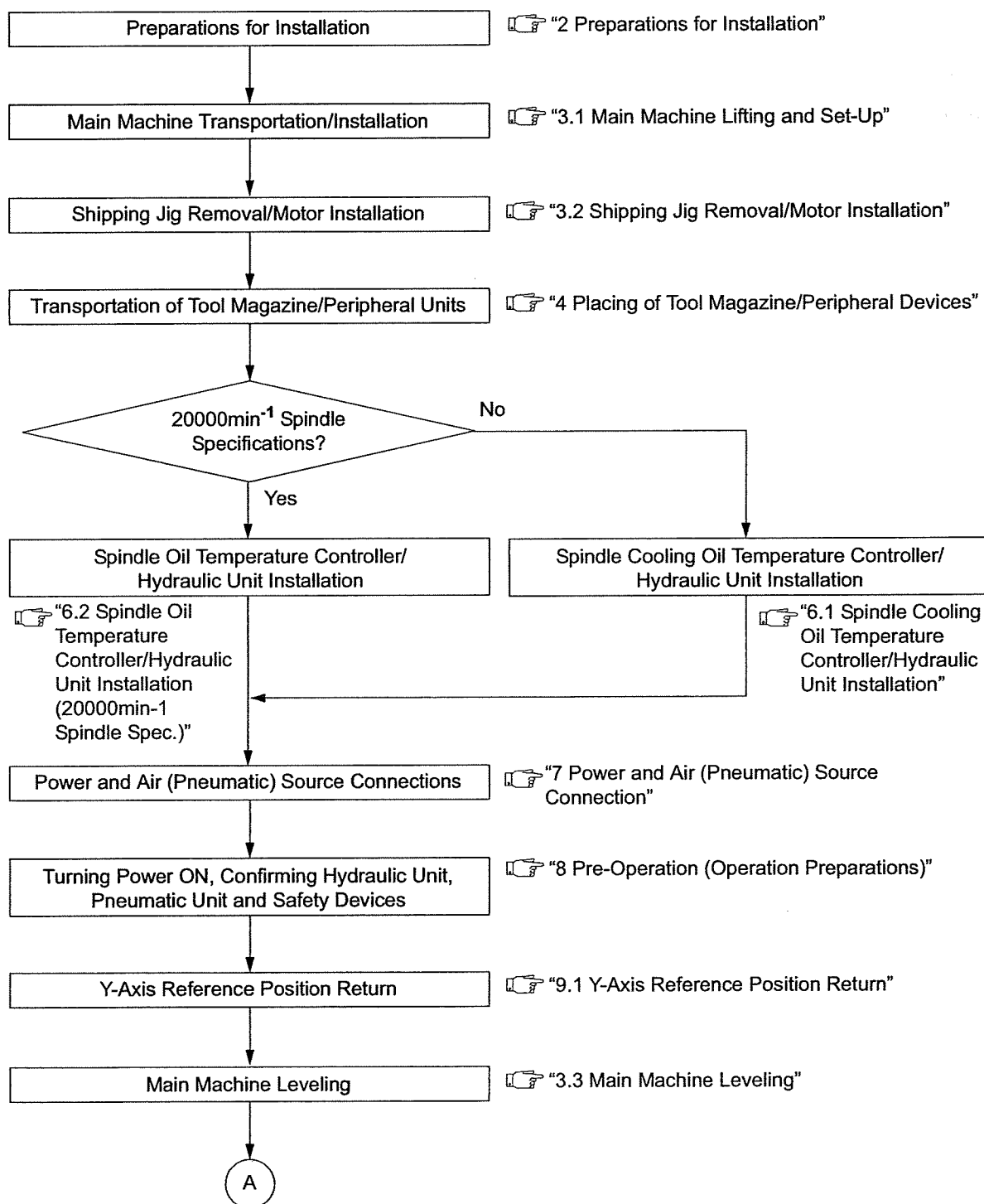
1.1 Preface

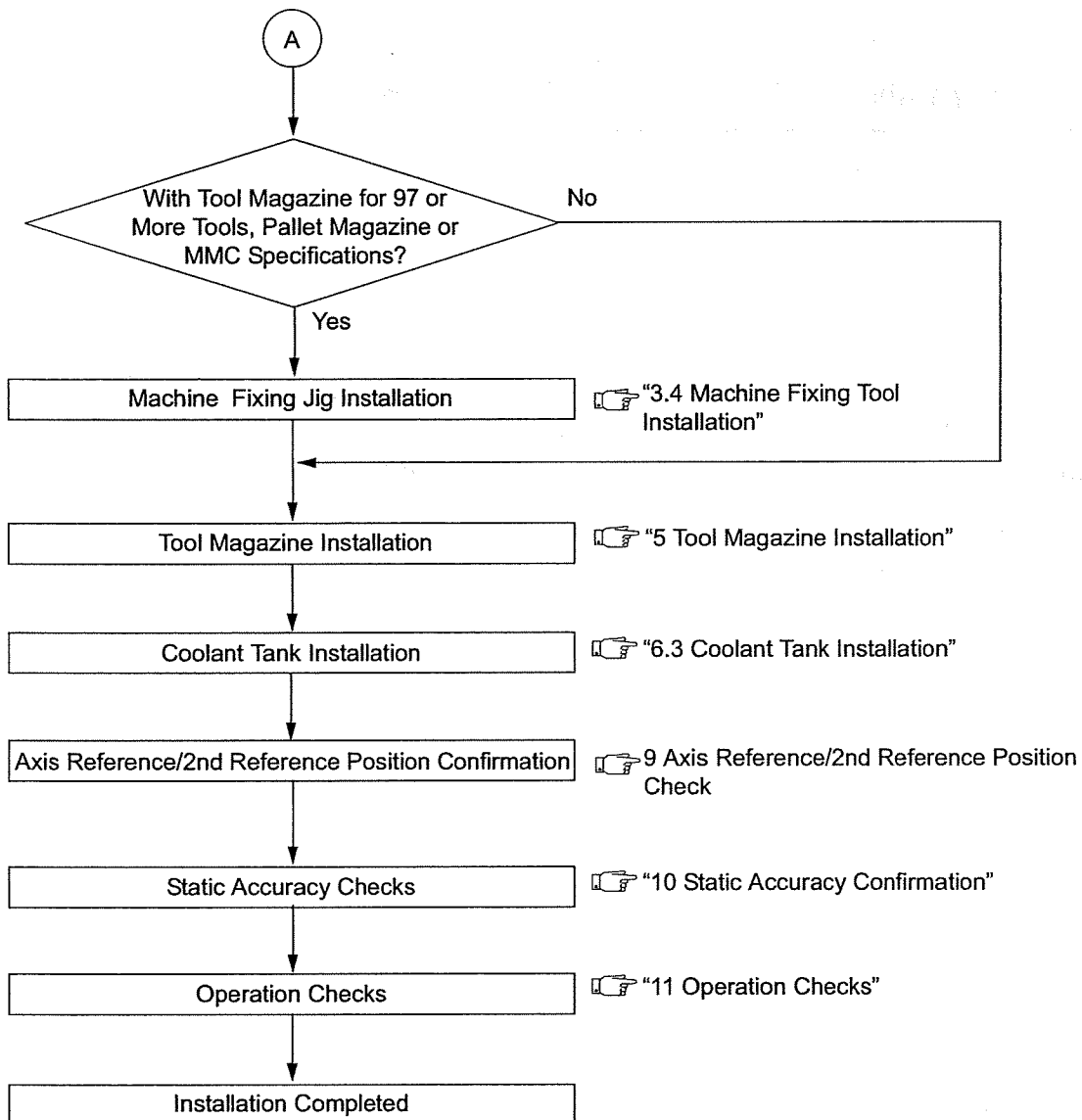
"Preparations for Installation and Installation" describes the necessary preparations and required conditions for installation, main machine and peripheral unit installation procedures, and confirmation/checks required after installation.

In the following section, the sequence of preparation for installation and actual installation work is shown in a flowchart. For details of each item, refer to the respective chapter and section.

To ensure safety of personnel and prevent damage to the machine, be sure to read this chapter and the previous "Safety" chapter carefully and understand it thoroughly prior to installation.

1.2 Installation Flow














2 Preparations for Installation

2.1 Confirmation of Preparations for Installation

Perform the following preparations to ensure all installation conditions are satisfied prior to machine installation. For details, refer to the respective section in this chapter.

- Preparation of Set-Up Area  "2.2 Preparation of Set-Up Area"
- Preparation of Transport Route  "2.3 Preparation of Transport Route"
- Confirmation of Set-Up Conditions  "2.4 Set-Up Conditions"
- Preparation of Foundation  "2.5 Recommended Foundation"
- Preparation of Electric Source  "2.6 Air and Power Sources"
- Preparation of Air Source  "2.6 Air and Power Sources"
- Preparation of Transportation Equipment  "2.7 Preparation of Transportation/ Installation Equipment"
- Preparation of Required Manpower for Installation  "2.8 Required Manpower for Installation"
- Safety Precautions and Other Confirmation  "2.9 Inspection Prior to Installation and Precaution During Installation"



Check List for Installation Preparation


 Table 2.1

Table 2.1 Check List for Installation Preparation

Check	Items
	Preparation of Set-Up Area
	Preparation of Transport Route
	Set-Up Conditions
	Preparation of Foundation
	Preparation of Electric Source
	Preparation of Air Source
	Preparation of Transportation Equipment
	Preparation of Air Dryer

2.2 Preparation of Set-Up Area

Refer to the figures in this section that show the general view and floor plan for respective machine specifications to confirm space requirements and prepare the required set-up area.

Note the following:

- When lifting the machine body using a crane, the total lifting height required is 4627mm.
- The maintenance area is the maintenance space required after installation.
- The maintenance area varies depending on the type of tool magazine and conveyor specifications:

a81 Tool Magazine A40/Left-Discharge Conveyor Spec.	Figure 2.1 and 2.2
a81 Tool Magazine A60/Left-Discharge Conveyor Spec.	Figure 2.3 and 2.4
a81 Tool Magazine A97/A137/Left-Discharge Conveyor Spec.	Figure 2.5 and 2.6
a81 Tool Magazine A186 or Above/Rear-Discharge Conveyor Spec.	Figure 2.7 and 2.8
a82 Tool Magazine A40/Left-Discharge Conveyor Spec.	Figure 2.9 and 2.10
a82 Tool Magazine A60/Left-Discharge Conveyor Spec.	Figure 2.11 and 2.12
a82 Tool Magazine A97/A137/Left-Discharge Conveyor Spec.	Figure 2.13 and 2.14
a82 Tool Magazine A186 or Above/Rear-Discharge Conveyor Spec.	Figure 2.15 and 2.16

NOTE:

A general view and floor plan for the 20000min⁻¹ spindle specifications and double lift-up conveyor specifications are not shown in this section.

2.2.1 Preparation for Set-Up Area: a81

a81 General View: Tool Magazine A40, Left-Discharge Conveyor

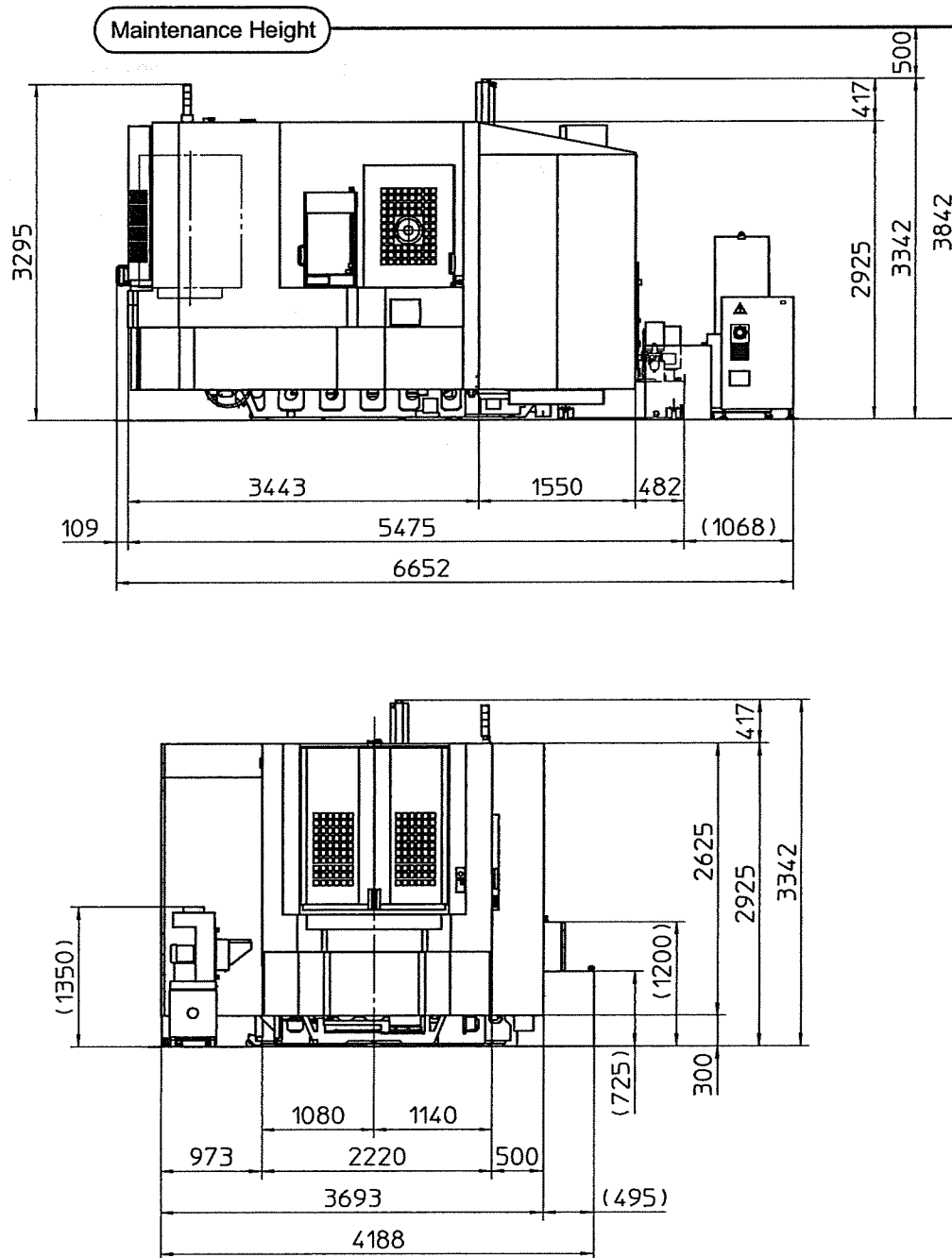
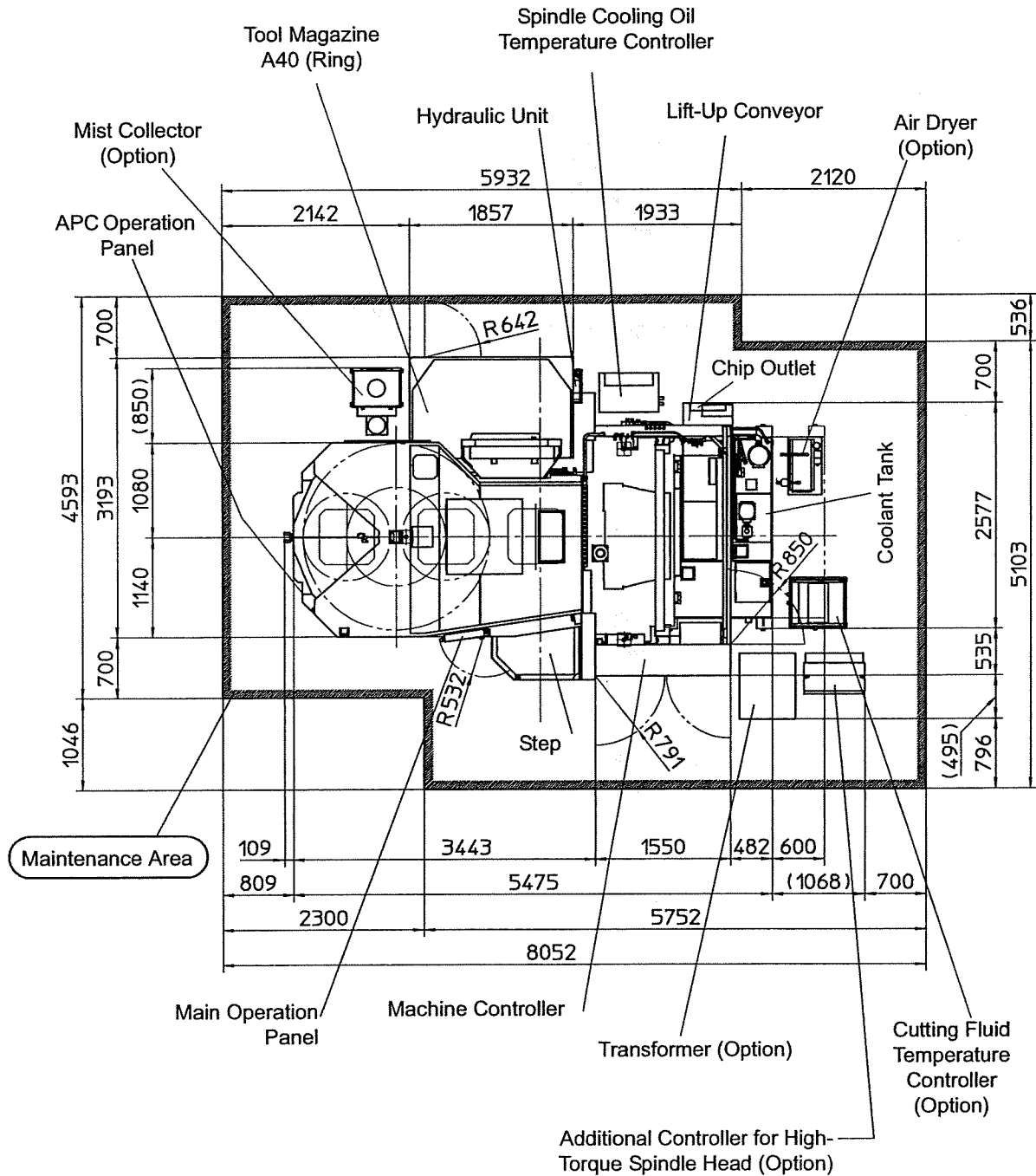


Figure 2.1 Front and Side View of Machine: a81
(Tool Magazine A40 and Left Discharge Lift-Up Conveyor Spec.)

a81 Floor Plan: Tool Magazine A40, Left-Discharge Conveyor



2 Preparations for Installation

Figure 2.2 Floor Plan (Top View of Machine): a81
(Tool Magazine A40 and Left Discharge Lift-Up Conveyor Spec.)

Preparations for Installation Preparation of Set-Up Area

a81 General View: Tool Magazine A60, Left-Discharge Conveyor

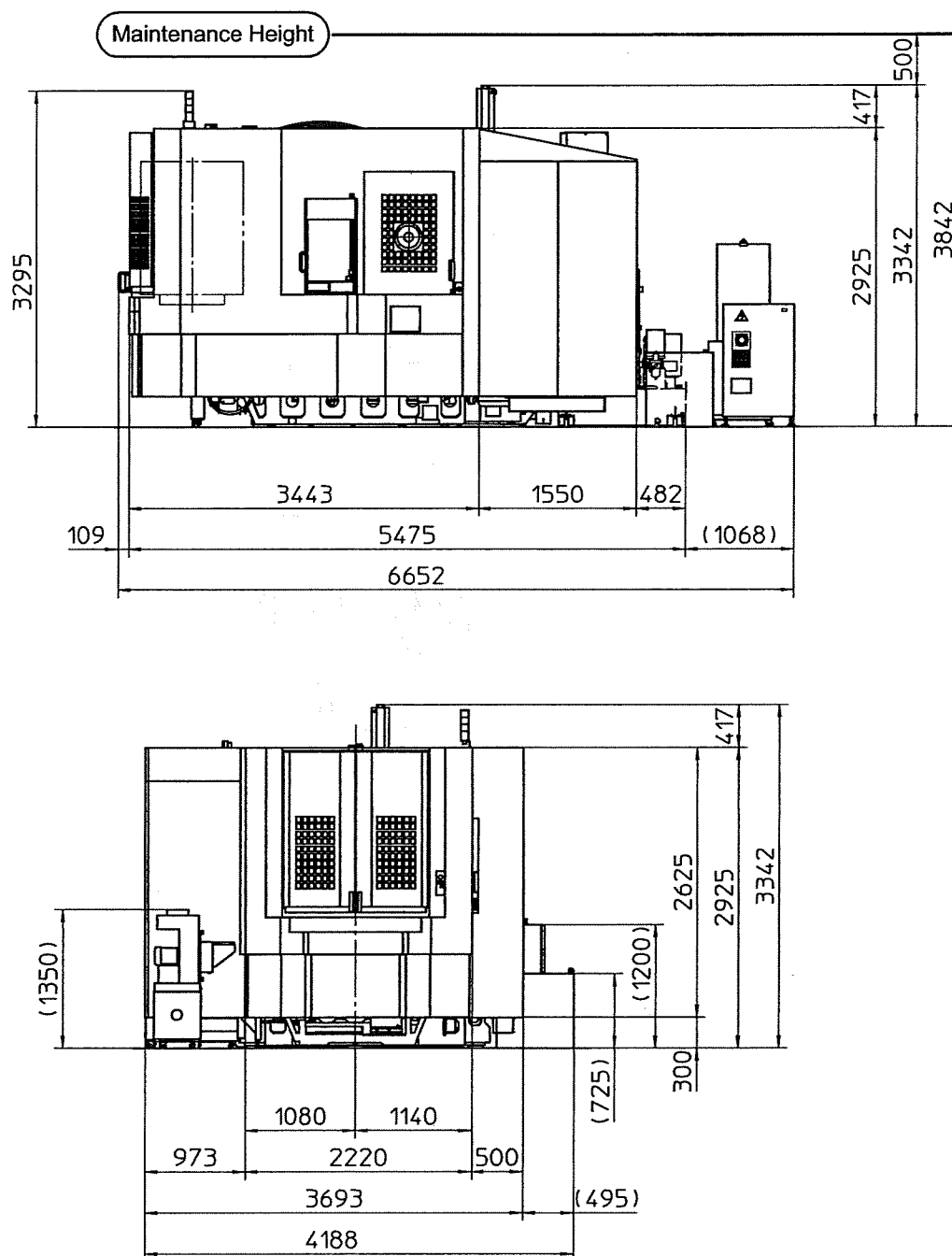
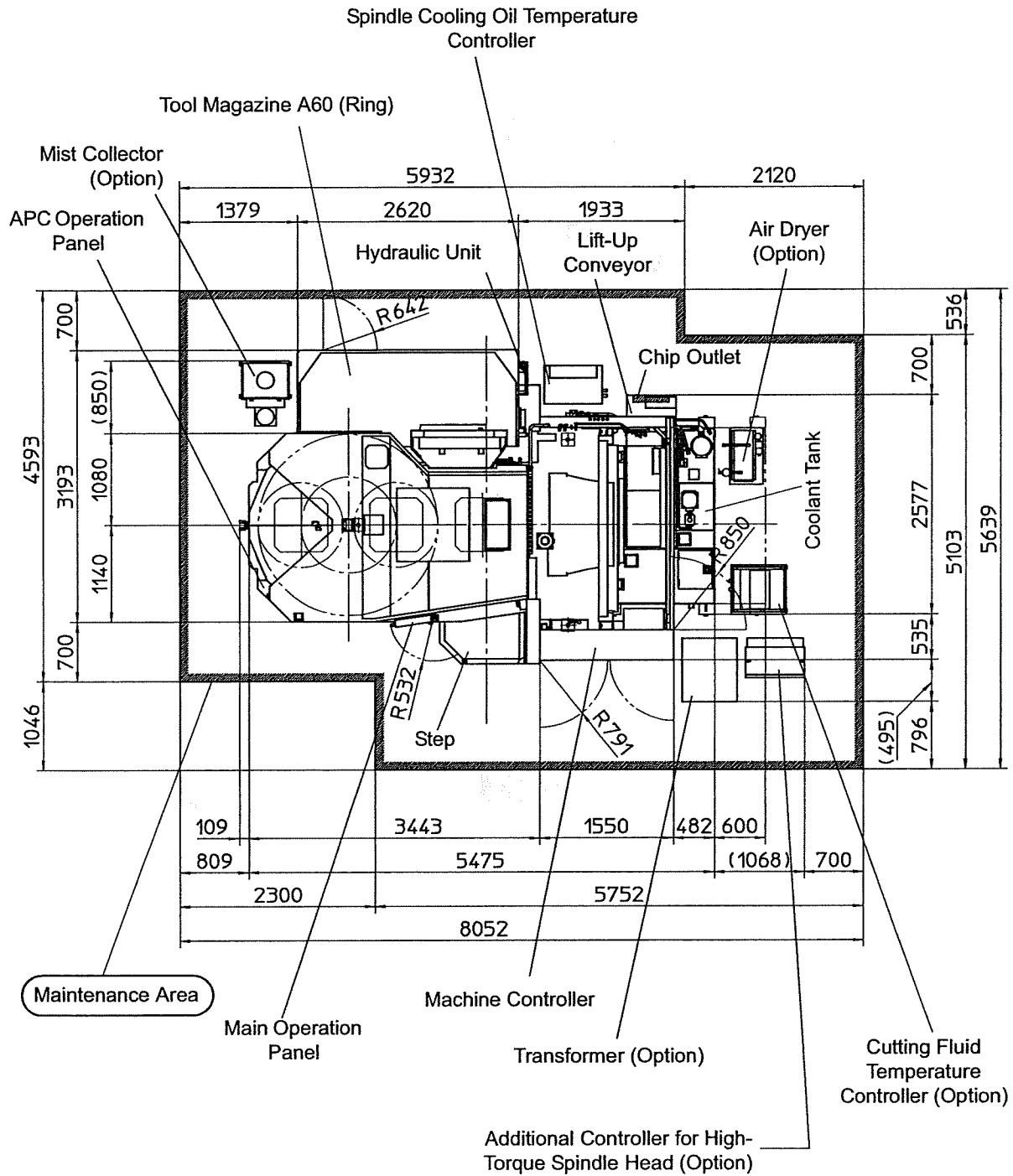


Figure 2.3 Front and Side View of Machine: a81
(Tool Magazine A60 and Left Discharge Lift-Up Conveyor Spec.)

a81 Floor Plan: Tool Magazine A60, Left-Discharge Conveyor



2 Preparations for Installation

Figure 2.4 Floor Plan (Top View of Machine): a81
(Tool Magazine A60 and Left Discharge Lift-Up Conveyor Spec.)

a81 General View: Tool Magazine A97/A137, Left-Discharge Conveyor

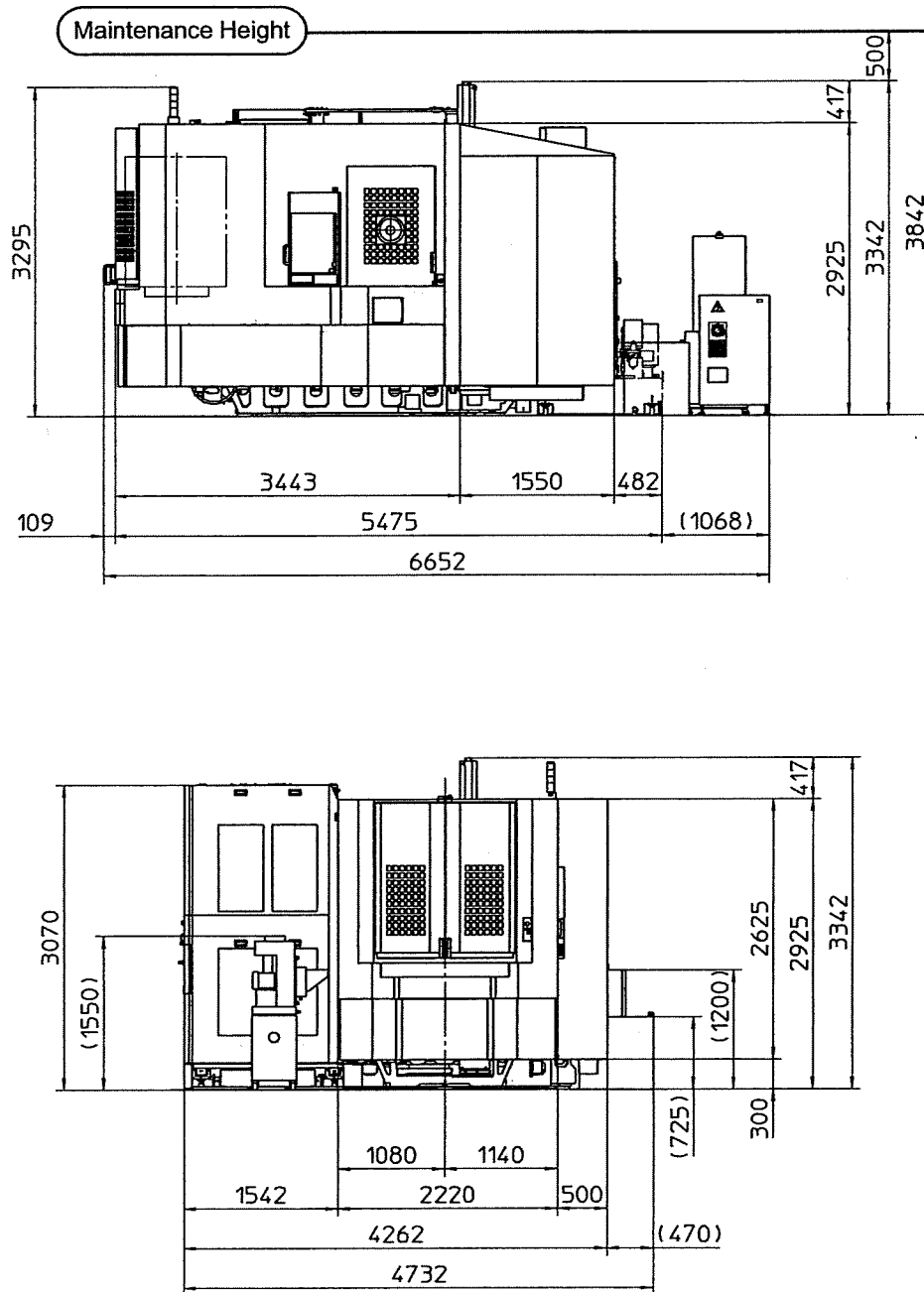
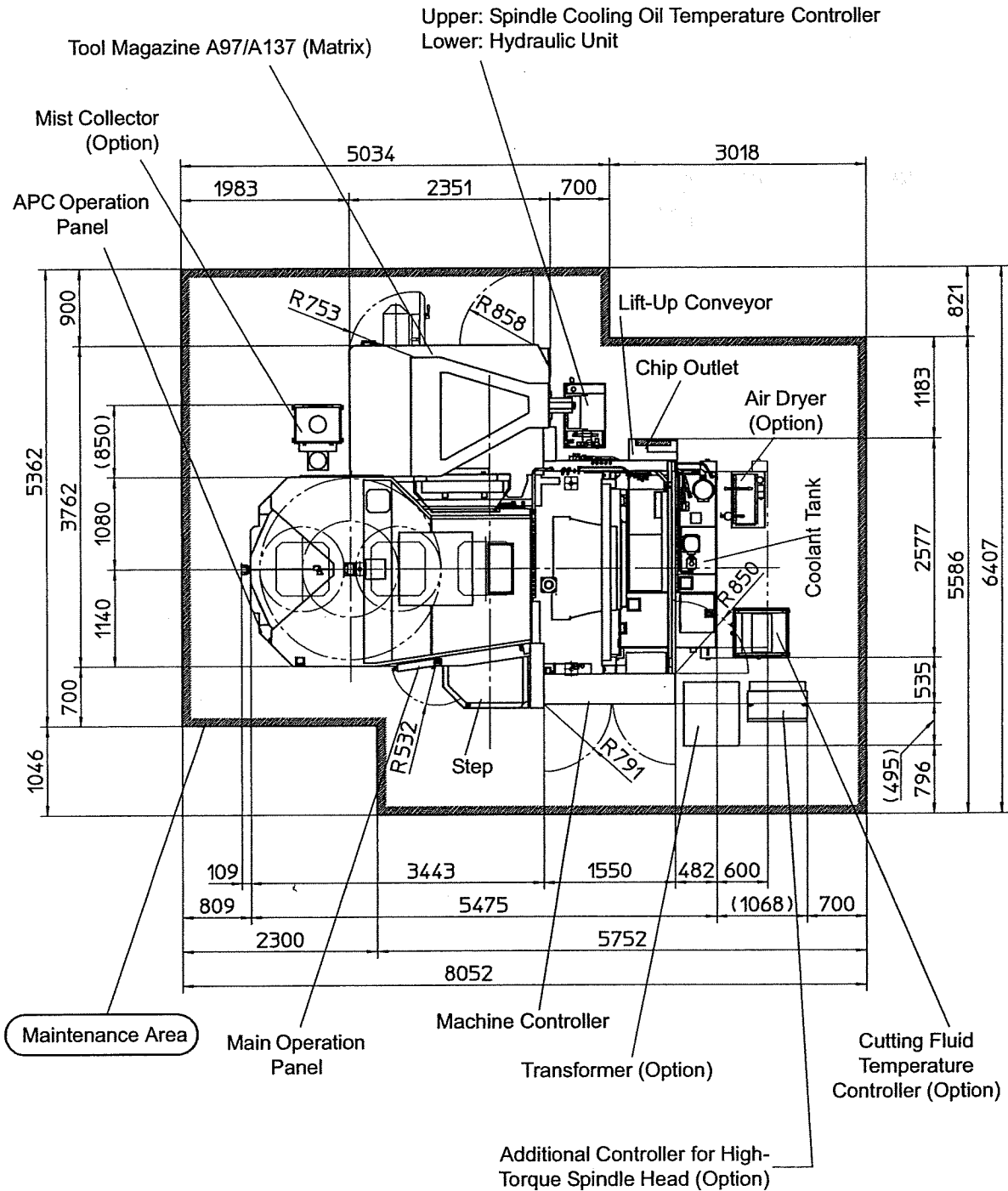


Figure 2.5 Front and Side View of Machine
(Tool Magazine A97A/A137 and Left Discharge Lift-Up Conveyor Spec.)

a81 Floor Plan: Tool Magazine A97/A137, Left-Discharge Conveyor



2 Preparations for Installation

Figure 2.6 Floor Plan (Top View of Machine): a81
(Tool Magazine A97/A137 and Left Discharge Lift-up Conveyor Spec.)

a81 General View: Tool Magazine A186 or Above, Rear-Discharge Conveyor

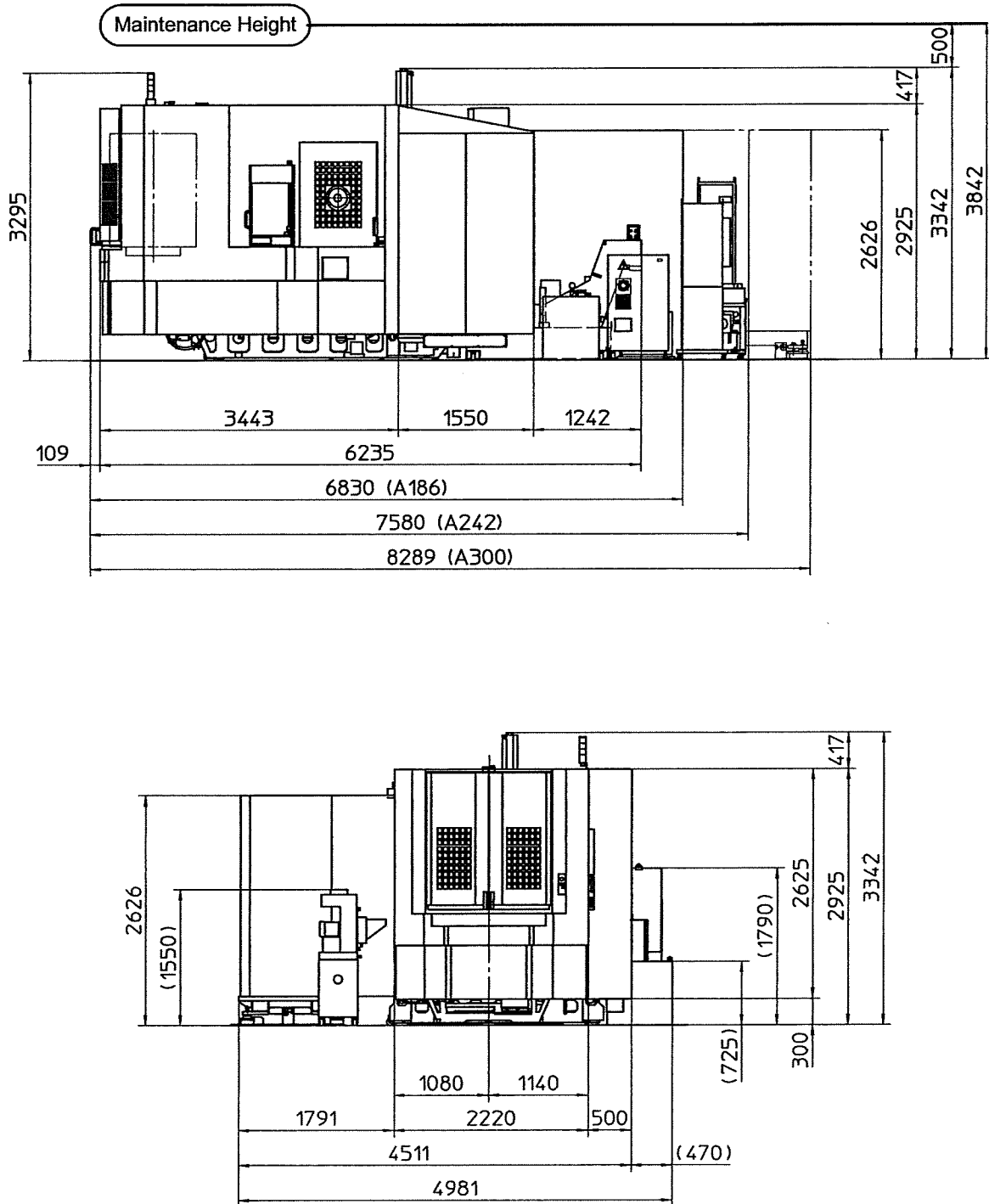
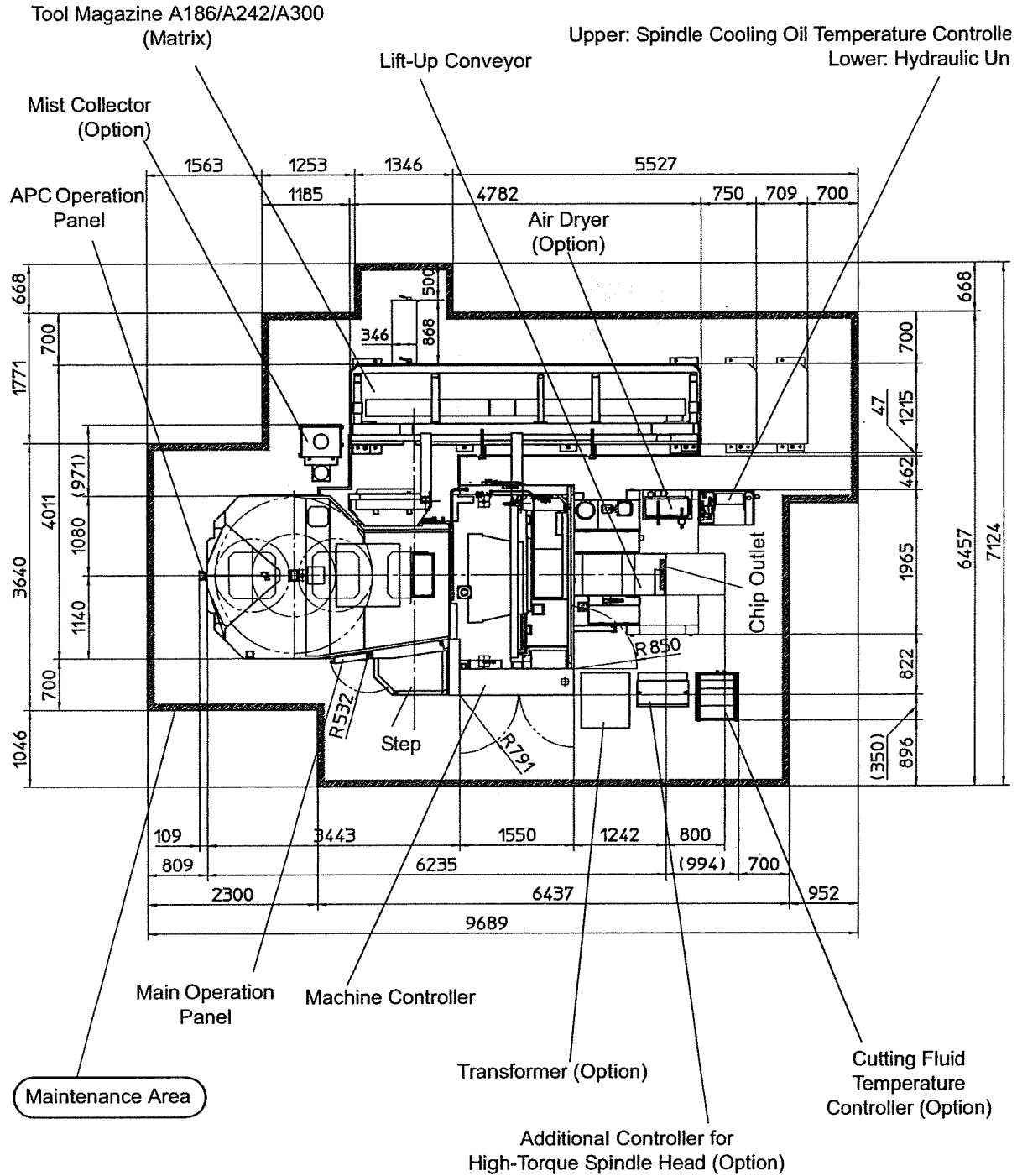


Figure 2.7 Front and Side View of Machine: a81
(Tool Magazine A186 or Above and Rear Discharge Lift-Up Conveyor)

a81 Floor Plan: Tool Magazine A186 or Above, Rear-Discharge



2 Preparations for Installation

Figure 2.8 Floor Plan (Top View of Machine): a81
(Tool Magazine A186 or Above and Rear Discharge Lift-Up Conveyor Spec.)

2.2.2 Preparation for Set-Up Area: a82

a82 General View: Tool Magazine A40, Left-Discharge Conveyor

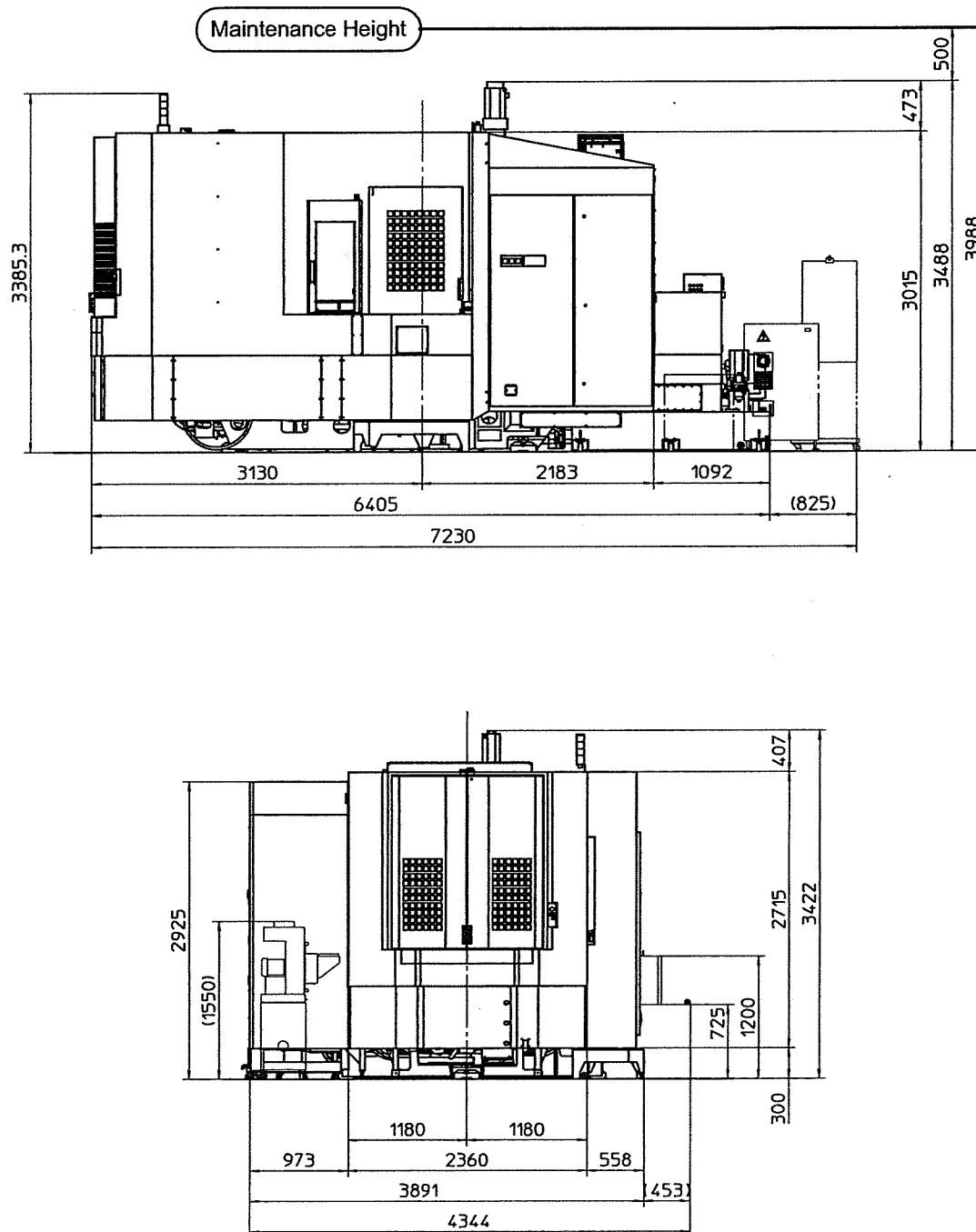


Figure 2.9 Front and Side View of Machine: a82
(Tool Magazine A40 and Left Discharge Lift-Up Conveyor Spec.)

a82 Floor Plan: Tool Magazine A40, Left-Discharge Conveyor

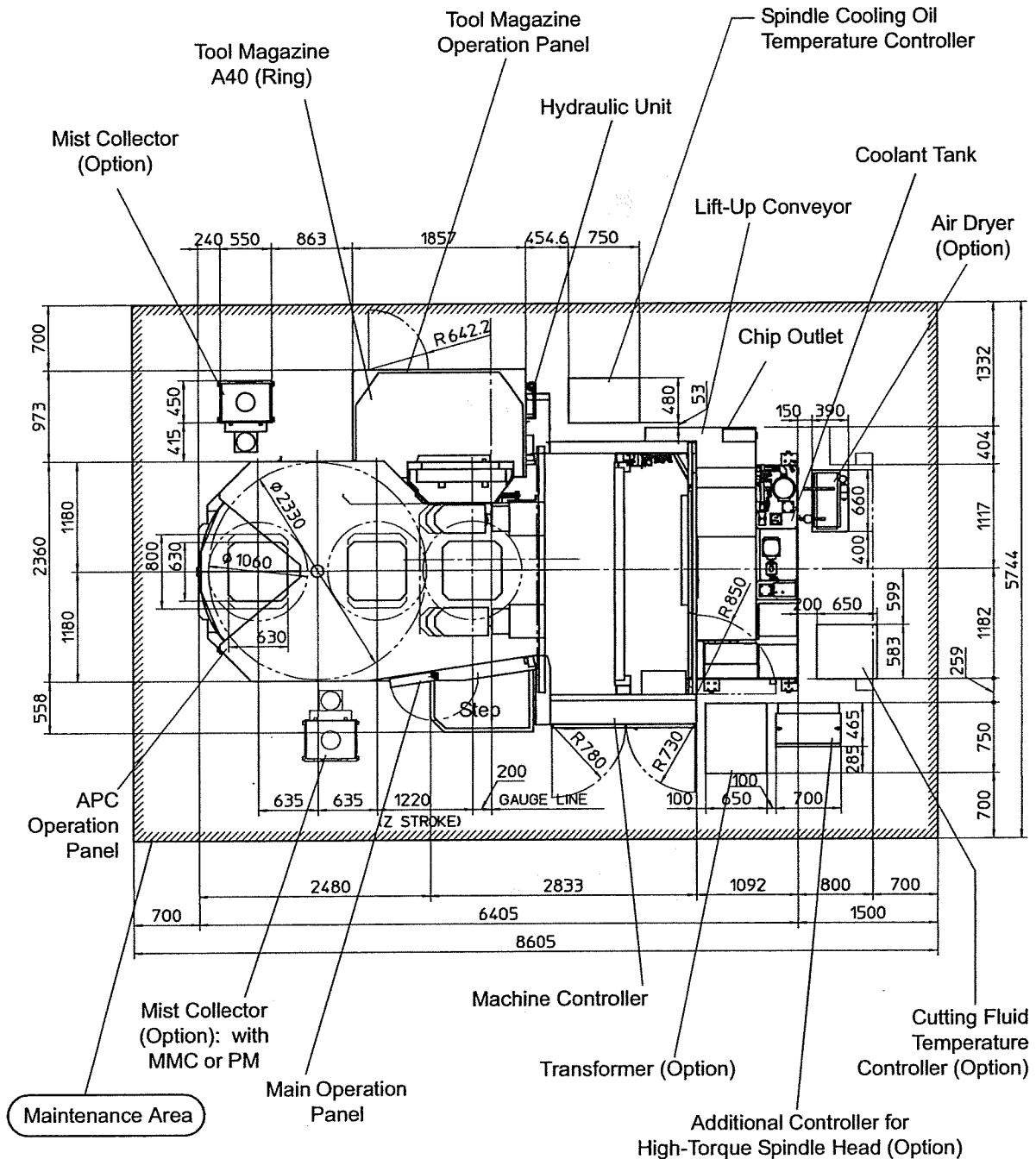


Figure 2.10 Floor Plan (Top View of Machine): a82
(Tool Magazine A40 and Left Discharge Lift-Up Conveyor Spec.)

a82 General View: Tool Magazine A60, Left-Discharge Conveyor

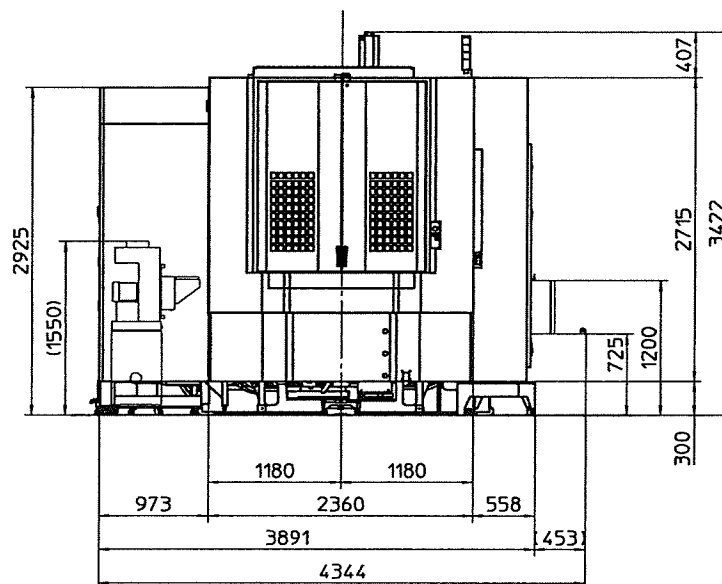
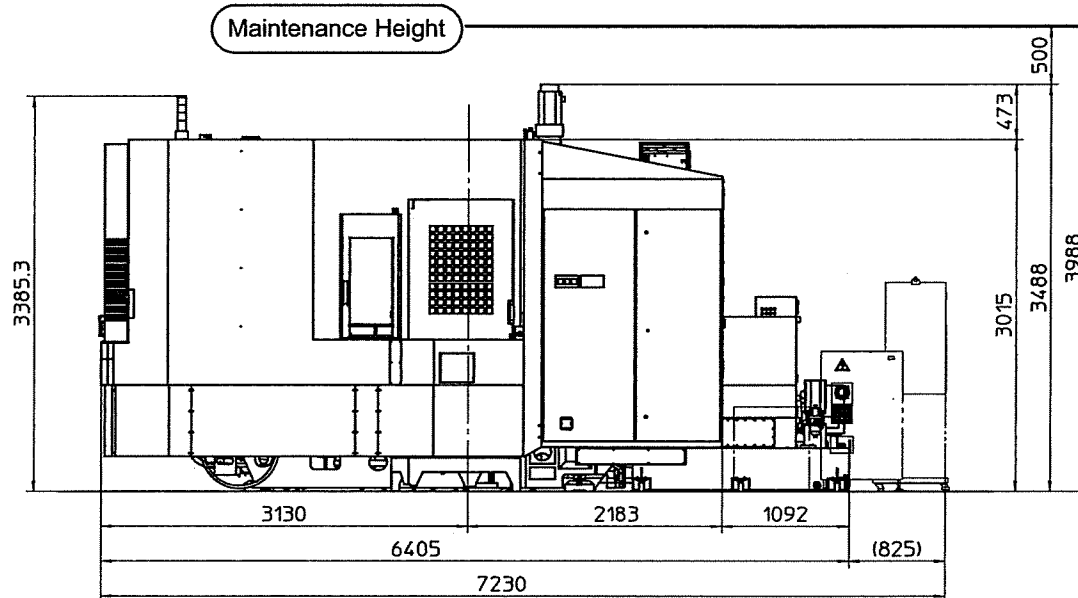
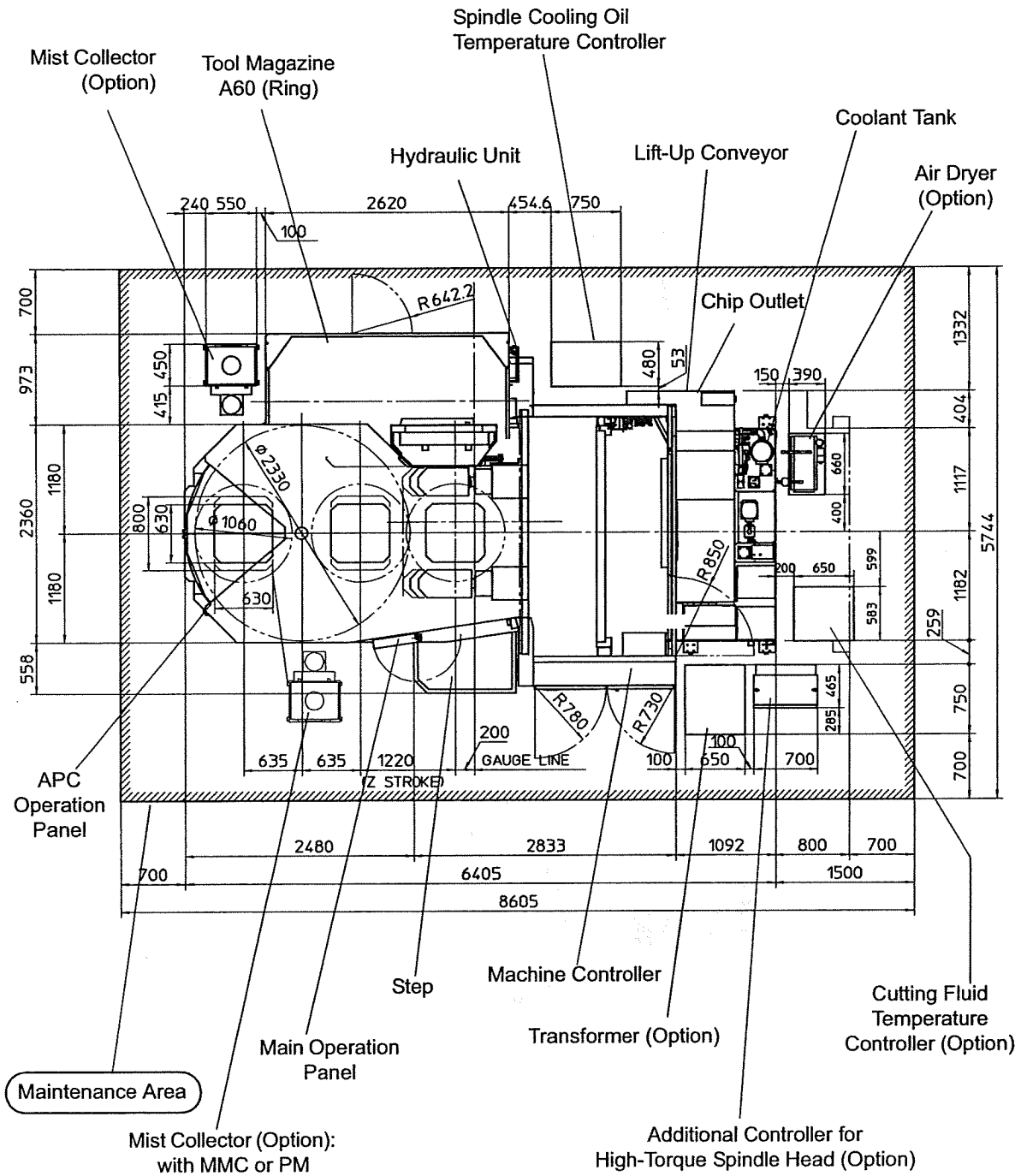


Figure 2.11 Front and Side View of Machine: a82
(Tool Magazine A60 and Left Discharge Lift-Up Conveyor Spec.)



Preparations for Installation

Preparation of Set-Up Area

a82 General View: Tool Magazine A97/A137, Left-Discharge Conveyor

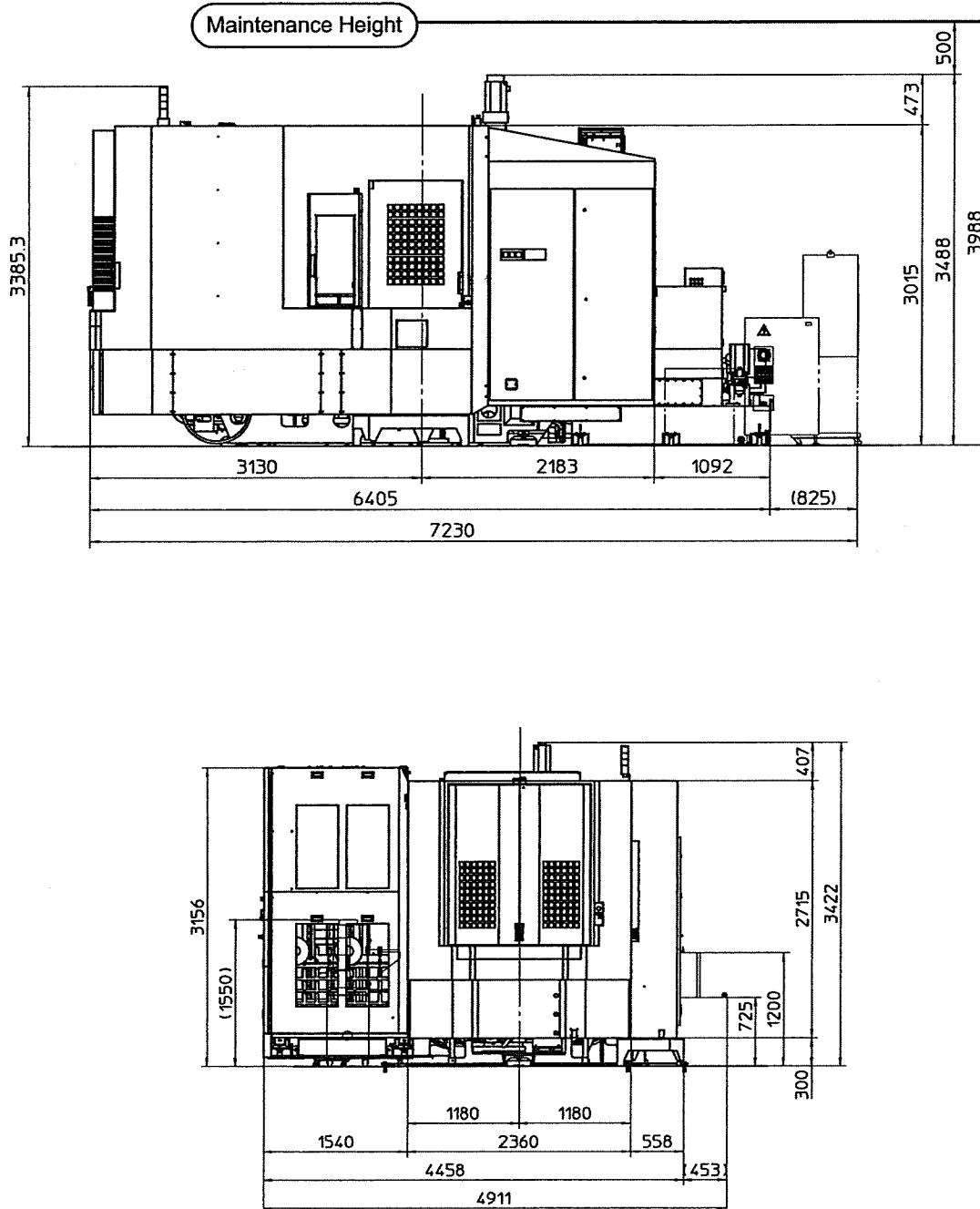
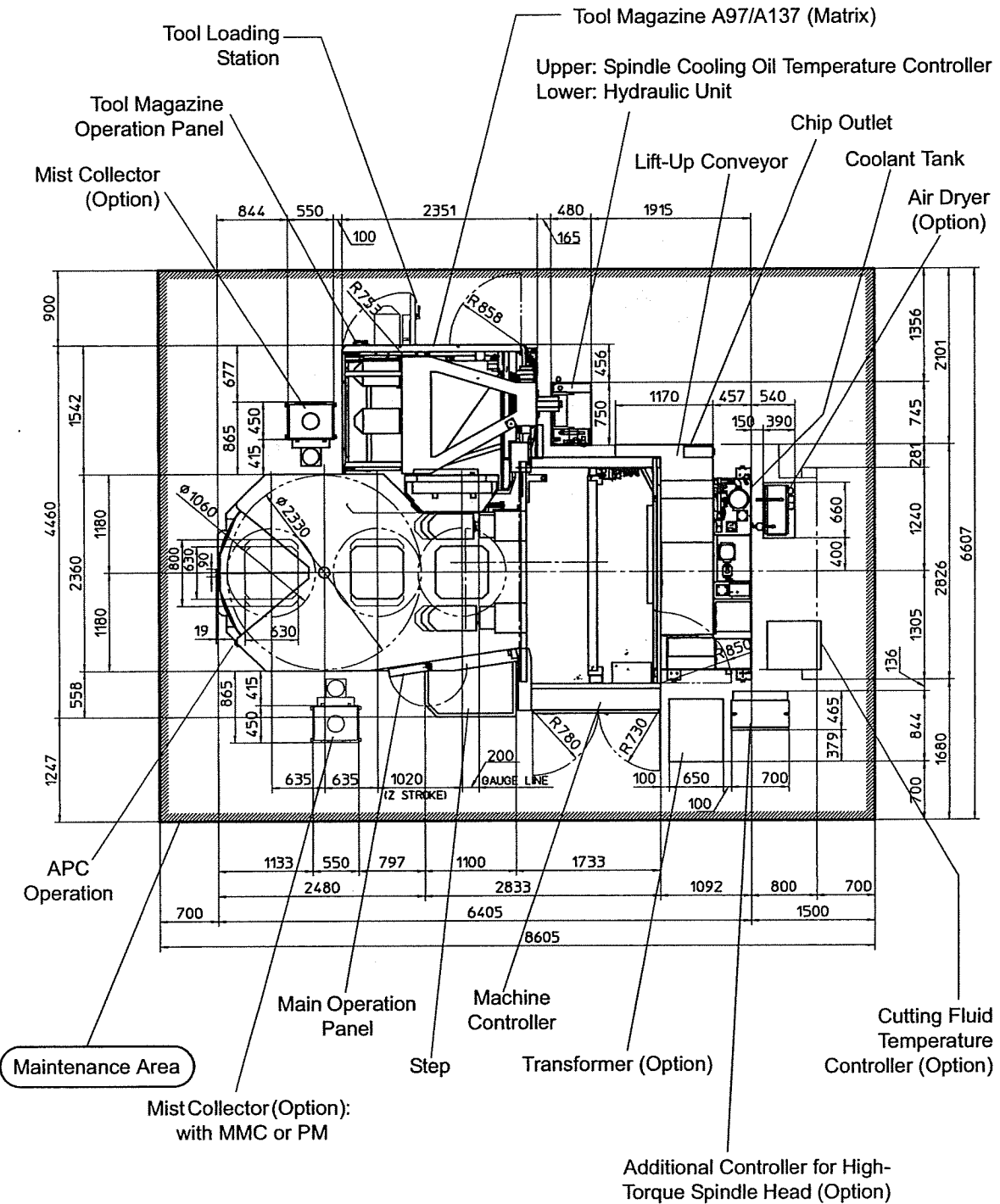


Figure 2.13 Front and Side View of Machine: a82
(Tool Magazine A97/A137 and Left Discharge Lift-Up Conveyor Spec.)

a82 Floor Plan: Tool Magazine A97/A137, Left-Discharge Conveyor



2 Preparations for Installation

Figure 2.14 Floor Plan (Top View of Machine): a82
(Tool Magazine A91/A137 and Left Discharge Lift-Up Conveyor Spec.)

a82 General View: Tool Magazine A186 or Above, Rear-Discharge Conveyor

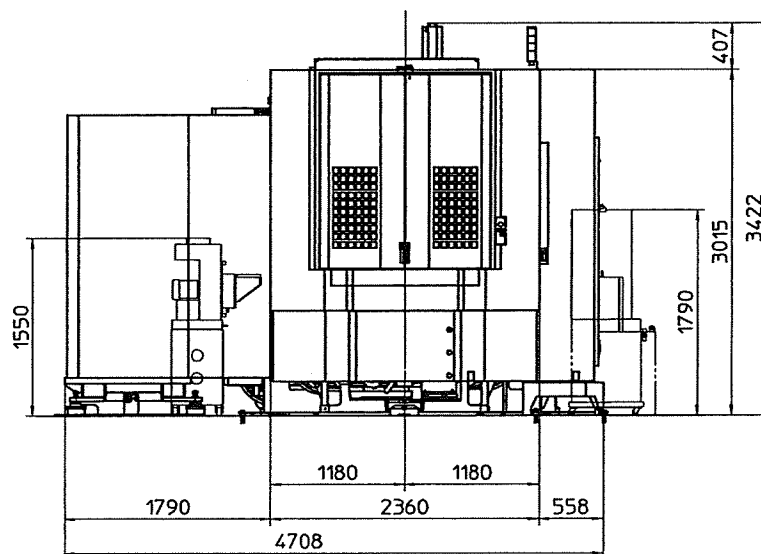
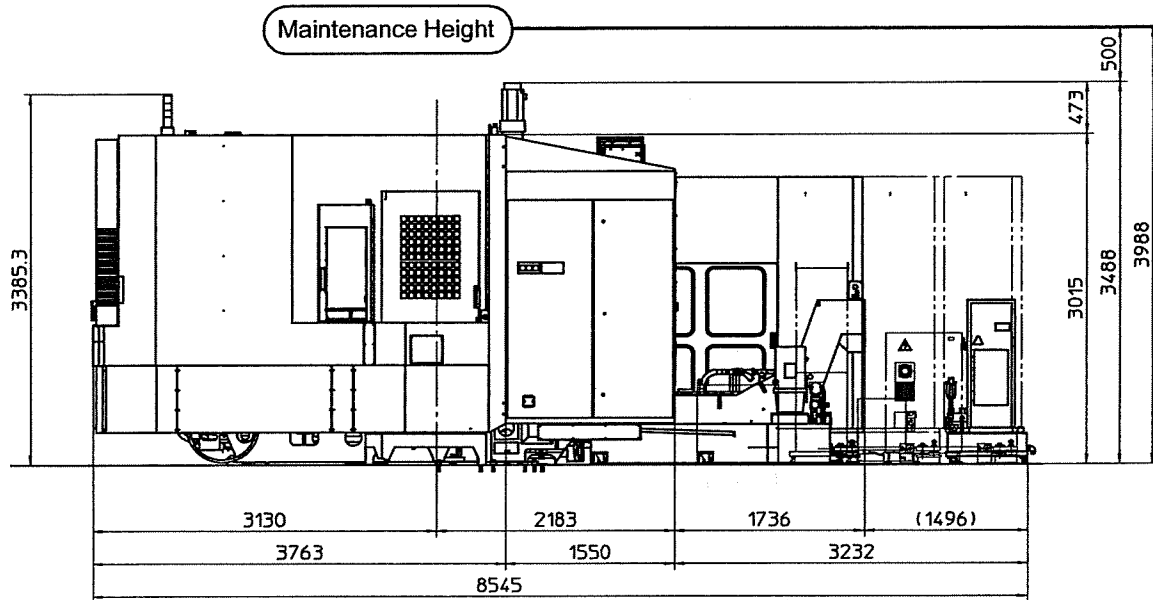


Figure 2.15 Front and Side View of Machine: a82
(Tool Magazine A186 or Above and Rear Discharge Lift-Up Conveyor Spec.)

a82 Floor Plan: Tool Magazine A186 or Above, Rear-Discharge



Figure 2.16 Floor Plan (Top View of Machine): a82
(Tool Magazine A186 or Above and Left Discharge Lift-Up Conveyor Spec.)







2.3 Preparation of Transport Route

Prepare the machine transport route, referring to the machine size shipment dimensions.

Tool Magazine A40/A60

The tool magazine is assembled onto the main machine prior to shipment.

Table 2.2 Machine Size Shipment Dimensions (a81/a82 with Tool Magazine A40/A60)

Item	Height	Height With Lifting Equipment	Width	Depth
a81 Main Machine (Tool Magazine A40)	3342mm ( NOTE 1)	4727mm ( NOTE 1)	3032mm	4993mm
a81 Main Machine (Tool Magazine A60)	3342mm ( NOTE 1)	4727mm ( NOTE 1)	3007mm	4993mm
a82 Main Machine (Tool Magazine A40/A60)	3422mm ( NOTE 1)	4807mm ( NOTE 1)	3255mm	5356mm





Tool Magazine A97 and Above

The tool magazine is not installed onto the main machine prior to shipment.

Table 2.3 Machine Size Shipment Dimensions (a81/a82 with Tool Magazine A97 or Above)

Item	Height	Height With Lifting Equipment	Width	Depth
a81 Main Machine	3342mm ( NOTE 1)	4727mm ( NOTE 1)	3020mm	4993mm
a82 Main Machine	3422mm ( NOTE 1)	4807mm ( NOTE 1)	3255mm	5356mm
Tool Magazine A97	3090mm	4080mm	1835mm	2462mm
Tool Magazine A137	3090mm	4080mm	1835mm	2462mm
Tool Magazine A186	2626mm	5310mm	1096mm	4782mm
Tool Magazine A242	2626mm	5310mm	1096mm	5532mm
Tool Magazine A300	2626mm	5310mm	1096mm	6241mm

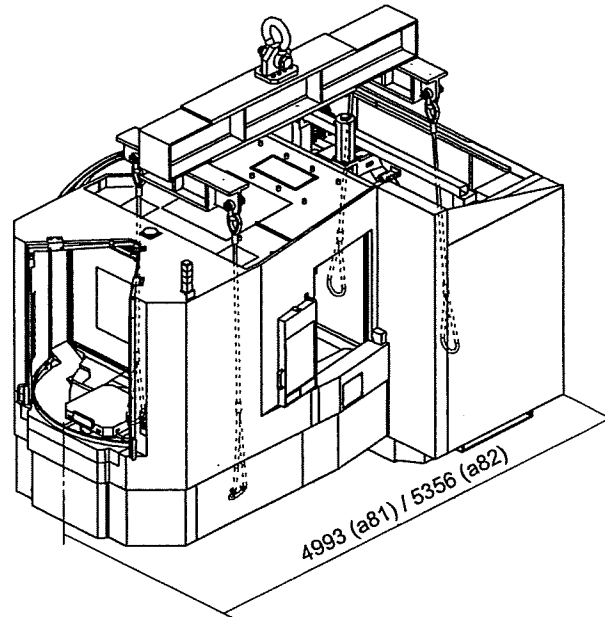
Lifting of Units

- Tool Magazine A97 and Above (Matrix)  Figure 2.18
- Spindle Cooling Oil Temperature Controller (For other than 20000min⁻¹ spindle spec.)  Figure 4.3
- Spindle Oil Temperature Controller (For 20000min⁻¹ spindle spec.)  Figure 4.3
- Coolant Tank  Figure 4.4

NOTES:

- 1 For the high-torque spindle and 20000min⁻¹ spindle specifications, the machine height is the above height plus 66mm.
- 2 When lifting the main machine using a crane, the necessary total height required to provide adequate lifting space is 500mm plus the height with the lifting equipment.

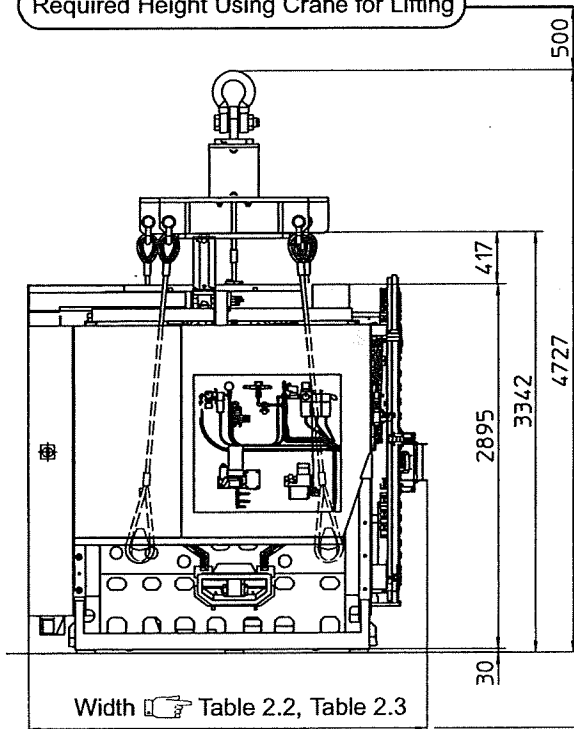
a81/a82



2 Preparations for Installation

a81

Required Height Using Crane for Lifting



a82

Required Height Using Crane for Lifting

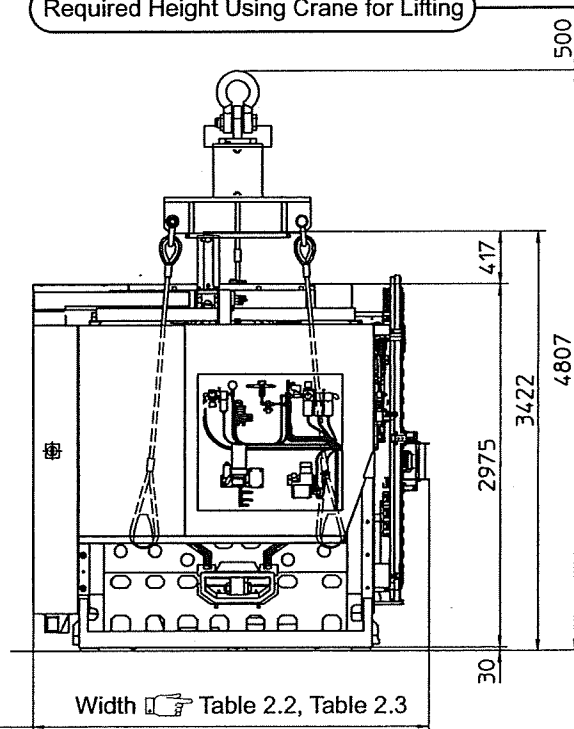
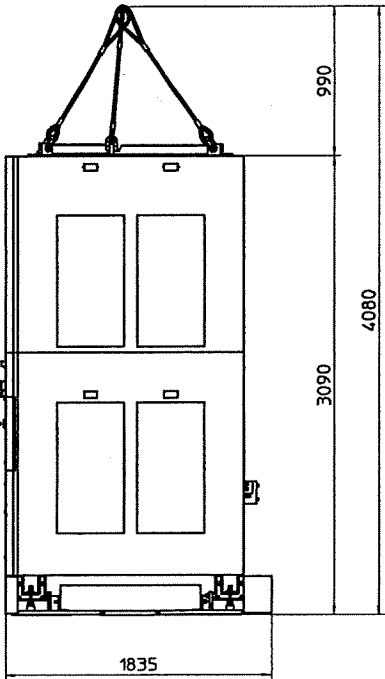
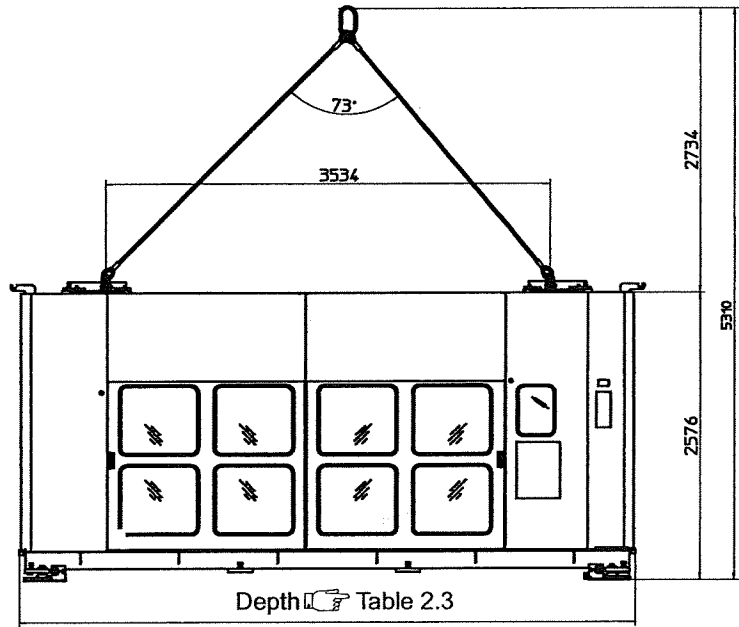


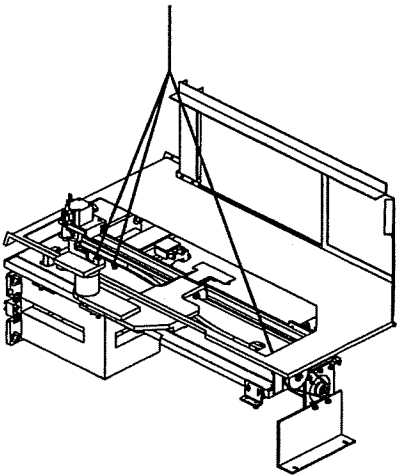
Figure 2.17 Main Machine Size When Being Transported (With 4-Point Lifting Equipment: a81/a82)



Tool Magazine A97/A137 (Matrix)



Tool Magazine A186/A242/A300 (Matrix)



Sub-Arm (Tool Magazine
A186 or Above)

Figure 2.18 Lifting of Tool Magazines (Matrix)

2.4 Set-Up Conditions

Confirm the following set-up location and environmental conditions prior to machine set-up.






Table 2.4 Set-Up Conditions

Set-Up Location and Environmental Conditions	
Ambient Temperature	10°C to 40°C (Optimum Temp: 20°C ± 1°C)
Relative Humidity	35% to 70% (No Condensation)
Temperature Fluctuation	Less than 1°C/30 minutes (Range which does not influence machining.)
Well-illuminated	
Free from direct sunlight	
Dust-free	
Available space for storing raw materials, finished workpiece and tools	
Available space for maintenance work	
Adequate space around machine to open doors completely	
Required electrical power sources	
A level foundation strong enough to support the weight of the machine	
Appropriate distance from factory air ducting/inlets (Air Flow)	

2.5 Recommended Foundation


Construct an appropriate foundation, by referring to Table 2.5 and Figure 2.19 ~ Figure 2.24.

Table 2.5 Recommended Foundation

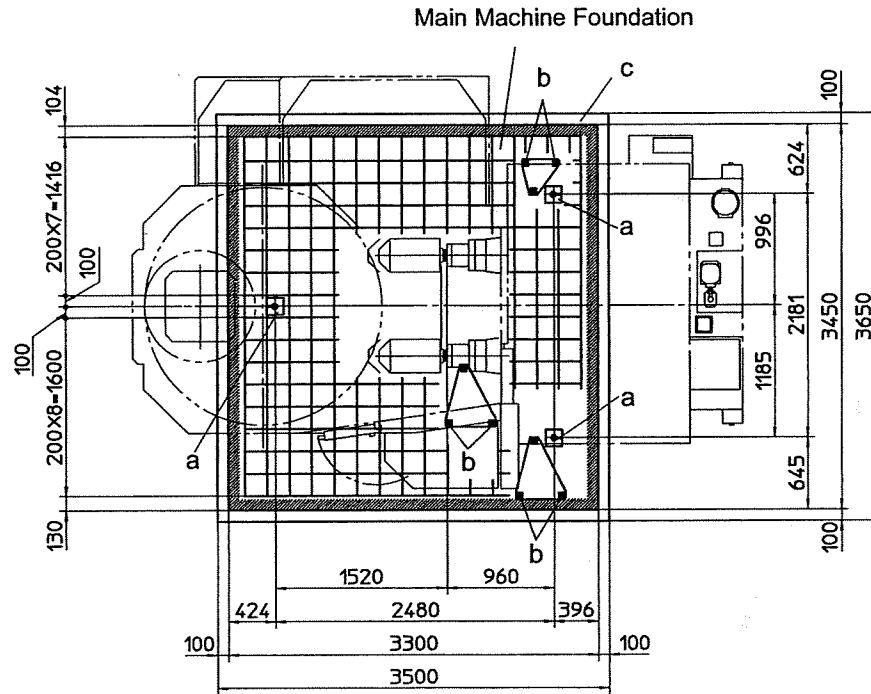
Symbol*	Item	Description
-	Ground Resistance	8 ton/m ² or above
-	Foundation Thickness	500mm
a	Main Machine Support Point	3 points
-	Machine Fixing Tool	3 points
b	Jet Anchor for Main machine	6 points (M16: Jet Anchor)
c	Insulated Foundation from Surrounding Vibration	Small crushed stone
d	Jet Anchor for Tool Magazine A97 and Above	4 points (M16: Jet Anchor)
-	Foundation Iron Bar	Vertical: $\phi 19\text{mm}$, Horizontal: $\phi 22\text{mm}$ ( NOTE 1)
-	Recommended Concrete	FC180 standard and above ( NOTE1)
-	Recommended Rubble	Medium or Large Size Crushed Stones
-	Leveling Concrete Thickness	50mm ( NOTE 1)
-	Concrete Weight for Tool Magazine (a81) (Weight based on the dimensions in Figure 2.19 ~Figure 2.21  NOTE 1)	Tool Magazine A40/A60: 16.3ton
		Tool Magazine A97/A137: 18ton
		Tool Magazine A186/A242: 21ton
		Tool Magazine A300: 22.7ton
-	Concrete Weight for Tool Magazine (a82) (Weight based on the dimensions in Figure 2.22 ~ Figure 2.24  NOTE1)	Tool Magazine A40/A60: 18.5ton
		Tool Magazine A97/A137: 18.5ton
		Tool Magazine A186: 21.4ton
		Tool Magazine A242: 22.1ton
		Tool Magazine A300: 22.8ton

* Indicates symbols used in Figure 2.19 ~ Figure 2.24.

NOTES:

- 1 These values are reference/recommended values.
- 2 It is necessary to use the machine fixing tools in order to secure the main machine to the floor when installing the options (matrix magazine, pallet magazine or MMC).  "3.4 Machine Fixing Tool Installation"
- 3 Dimensions indicated in this foundation drawing are minimum requirements given for good solid installation foundation. The foundation drawings on following pages show only recommended values.
- 4 As this machine operates at high-speeds, vibration generated by machine operations may affect the surrounding area depending upon the foundation and ground conditions. Consult a professional civil engineer to determine the final foundation dimension requirements as they vary according to the actual ground conditions and possible influence on the surrounding area.

a81: Tool Magazine A40/A60 and Left-Discharge Conveyor



a: Main Machine Support Point
b: Jet Anchor for Machine
c: Isolated Foundation

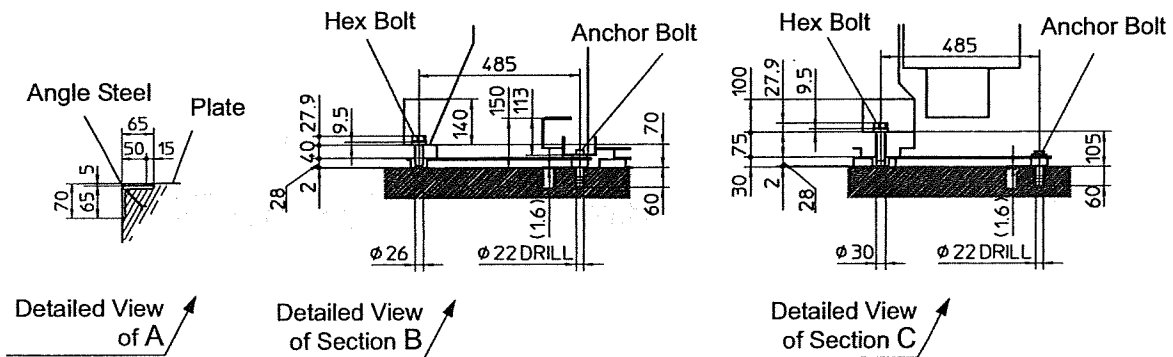
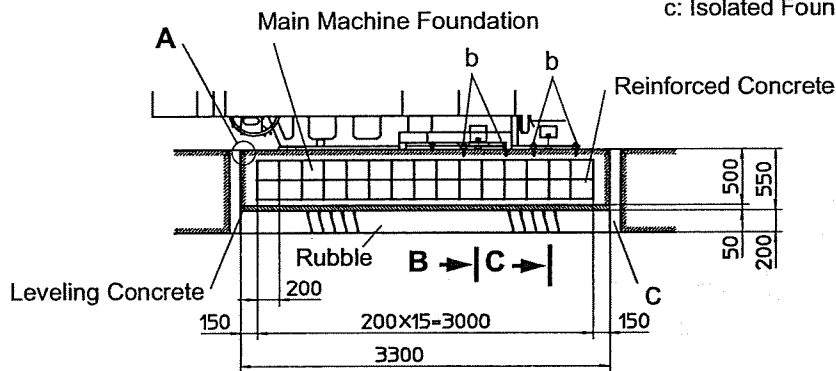


Figure 2.19 a81 Foundation Drawing (Tool Magazine A40/A60 and Left Discharge Conveyor Spec.)

Preparations for Installation Recommended Foundation

a81: Tool Magazine A97/A137 and Left-Discharge Conveyor

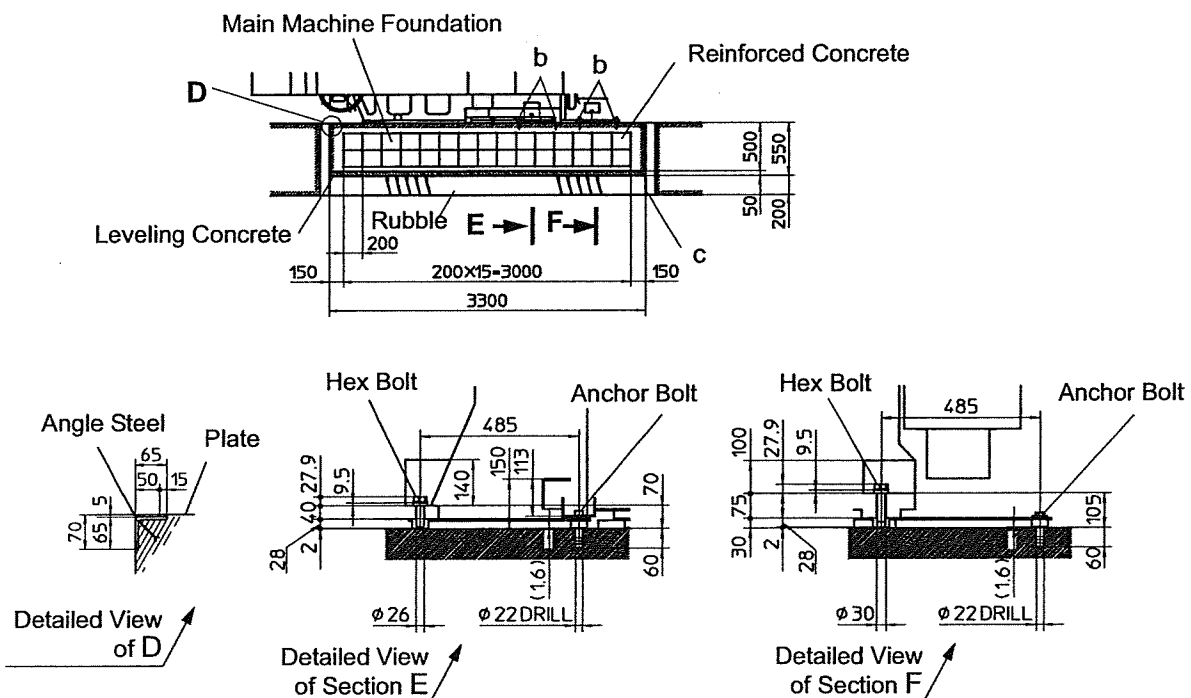
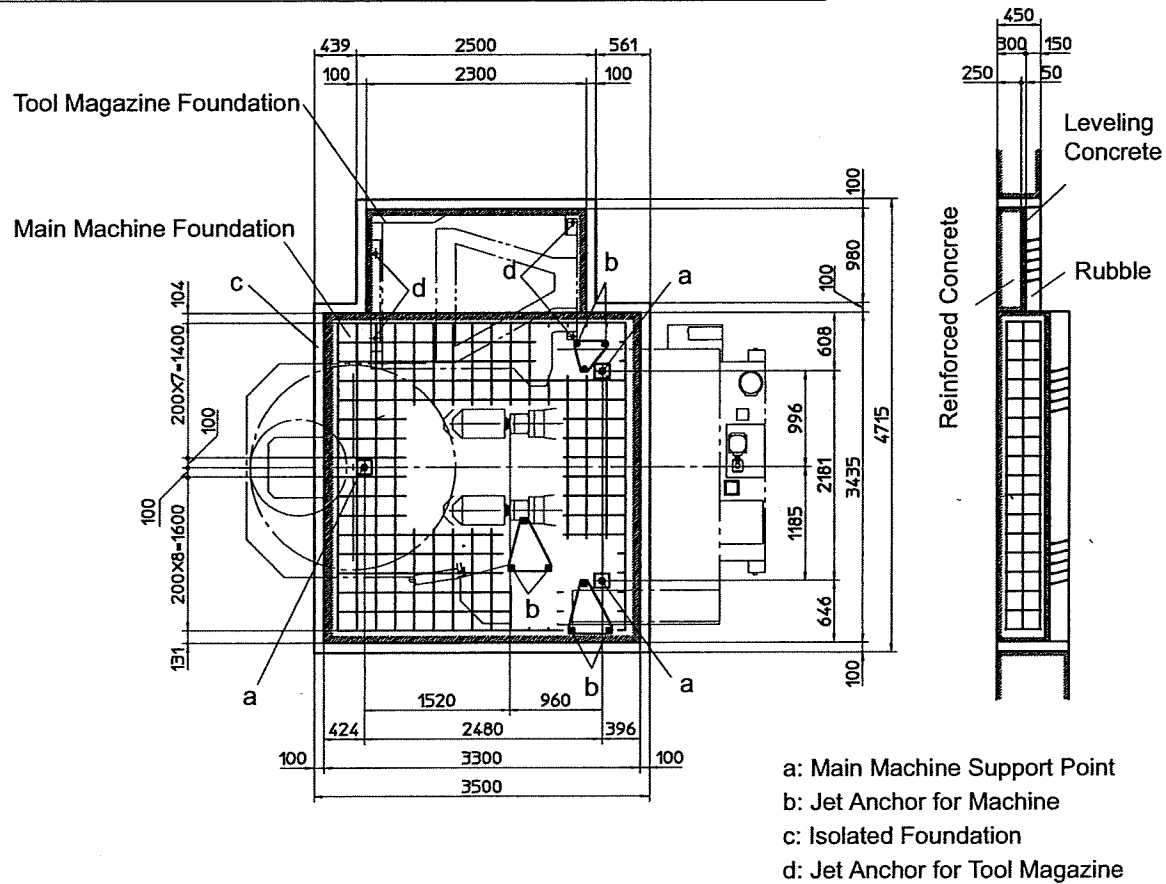
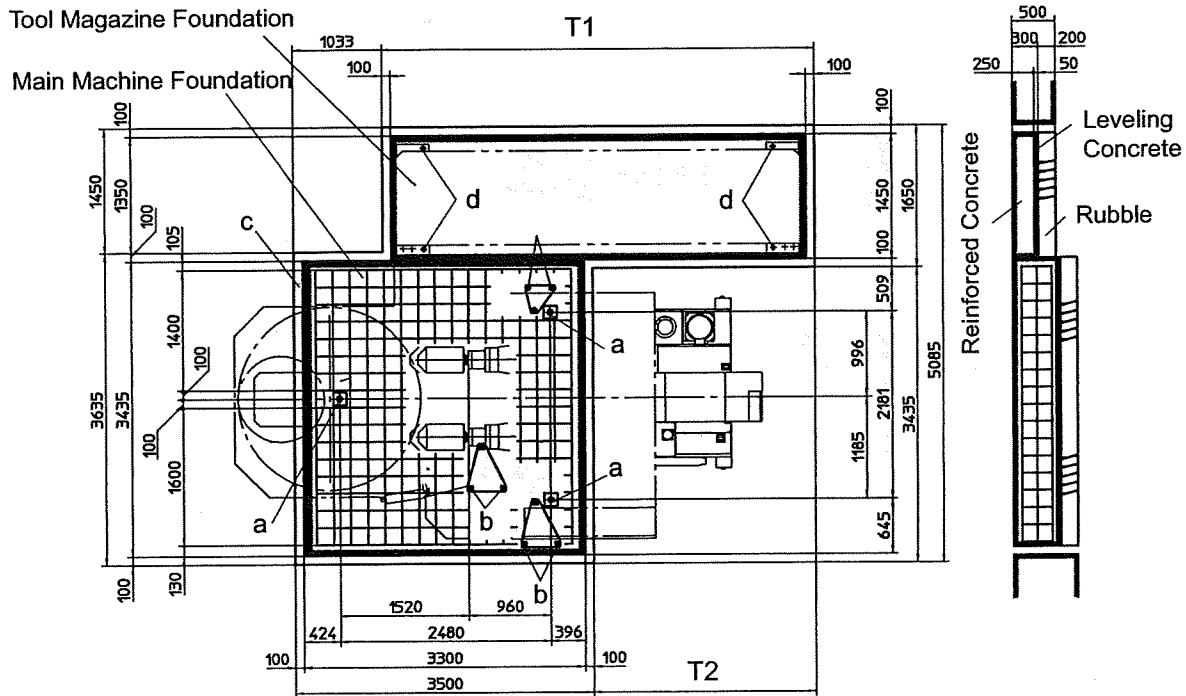


Figure 2.20 a81 Foundation Drawing (Tool Magazine A97/A137 and Left Discharge Conveyor Spec.)

a81: Tool Magazine A186 or Above and Rear Discharge Conveyor



Tool Magazine Foundation (unit: mm)

	T1	T2
A186	5060	2593
A242	5810	3333
A300	6520	3943

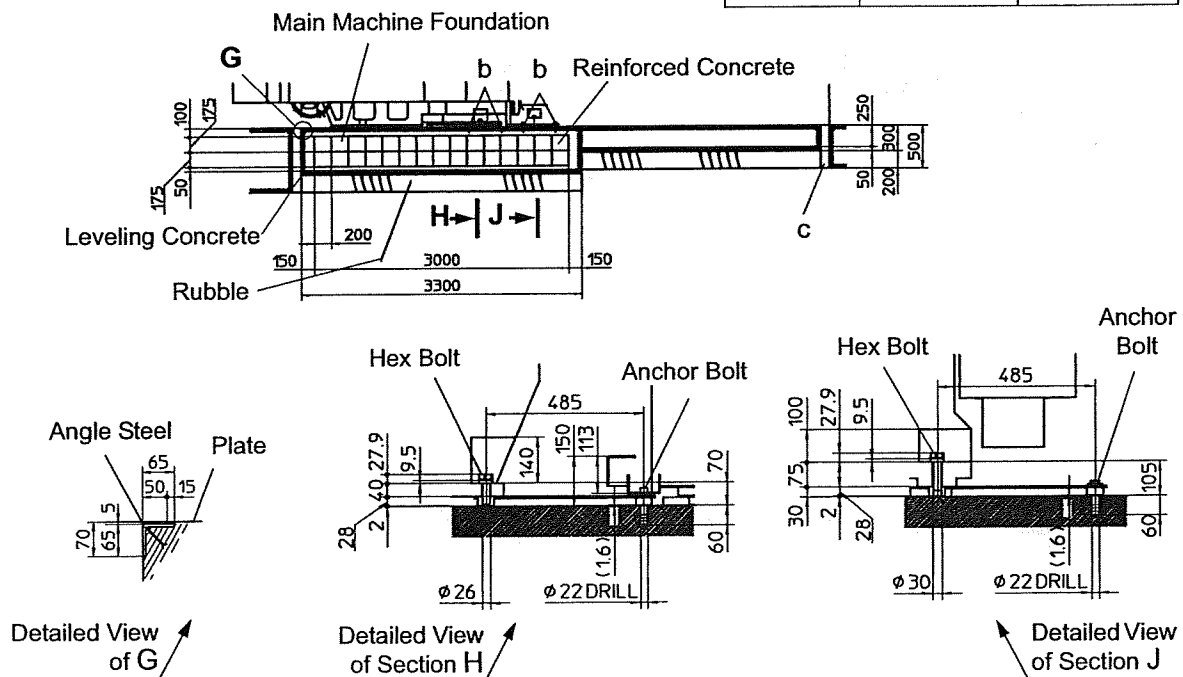


Figure 2.21 a81 Foundation Drawing
(Tool Magazine A186/A242/A300 and Rear Discharge Conveyor Spec.)

Preparations for Installation Recommended Foundation

a82: Tool Magazine A40/A60 and Left-Discharge Conveyor

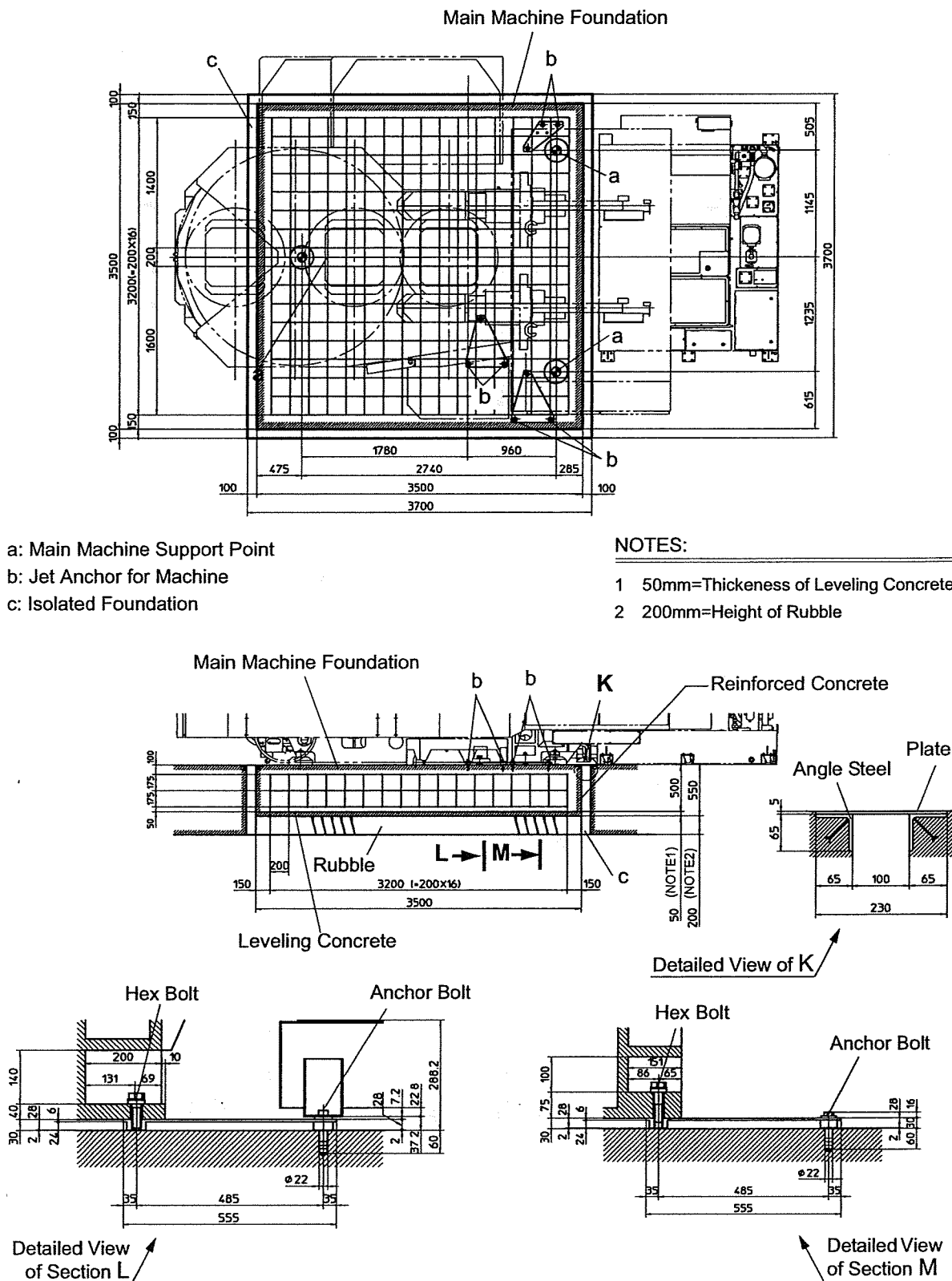
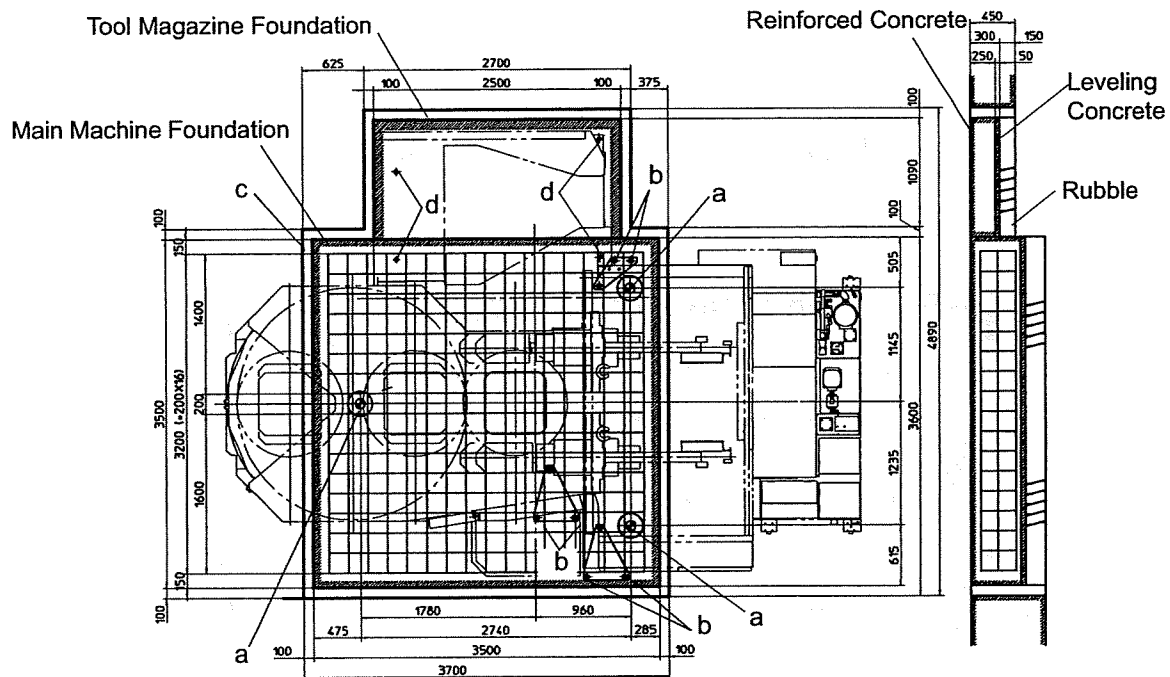


Figure 2.22 a82 Foundation Drawing (Tool Magazine A40/A60 and Left Discharge Conveyor Spec.)

a82: Tool Magazine A97/A137 and Left-Discharge Conveyor



NOTES:

- 1 50mm=Thickness of Leveling Concrete
- 2 200mm=Height of Rubble

- a: Main Machine Support Point
b: Jet Anchor for Machine
c: Isolated Foundation
d: Jet Anchor for Tool Magazine

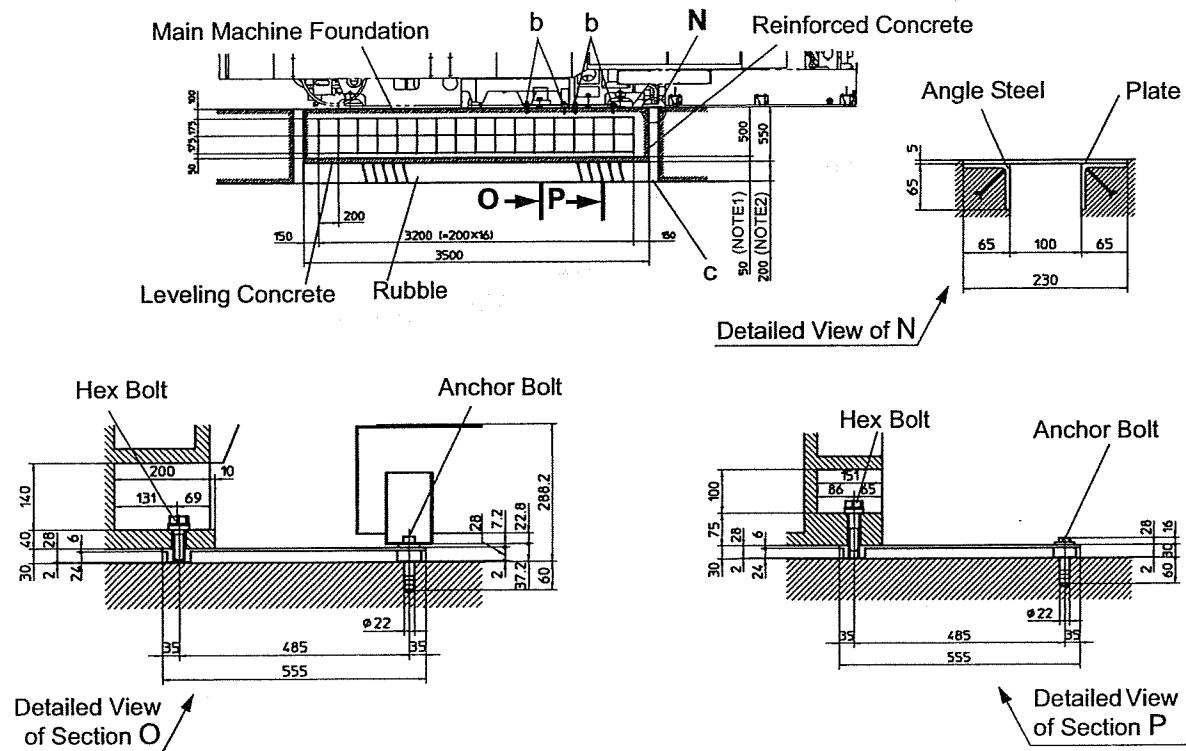


Figure 2.23 a82 Foundation Drawing (Tool Magazine A97/A137 and Left Discharge Conveyor Spec.)

Preparations for Installation Recommended Foundation

a82: Tool Magazine A186 or Above and Left Discharge Conveyor

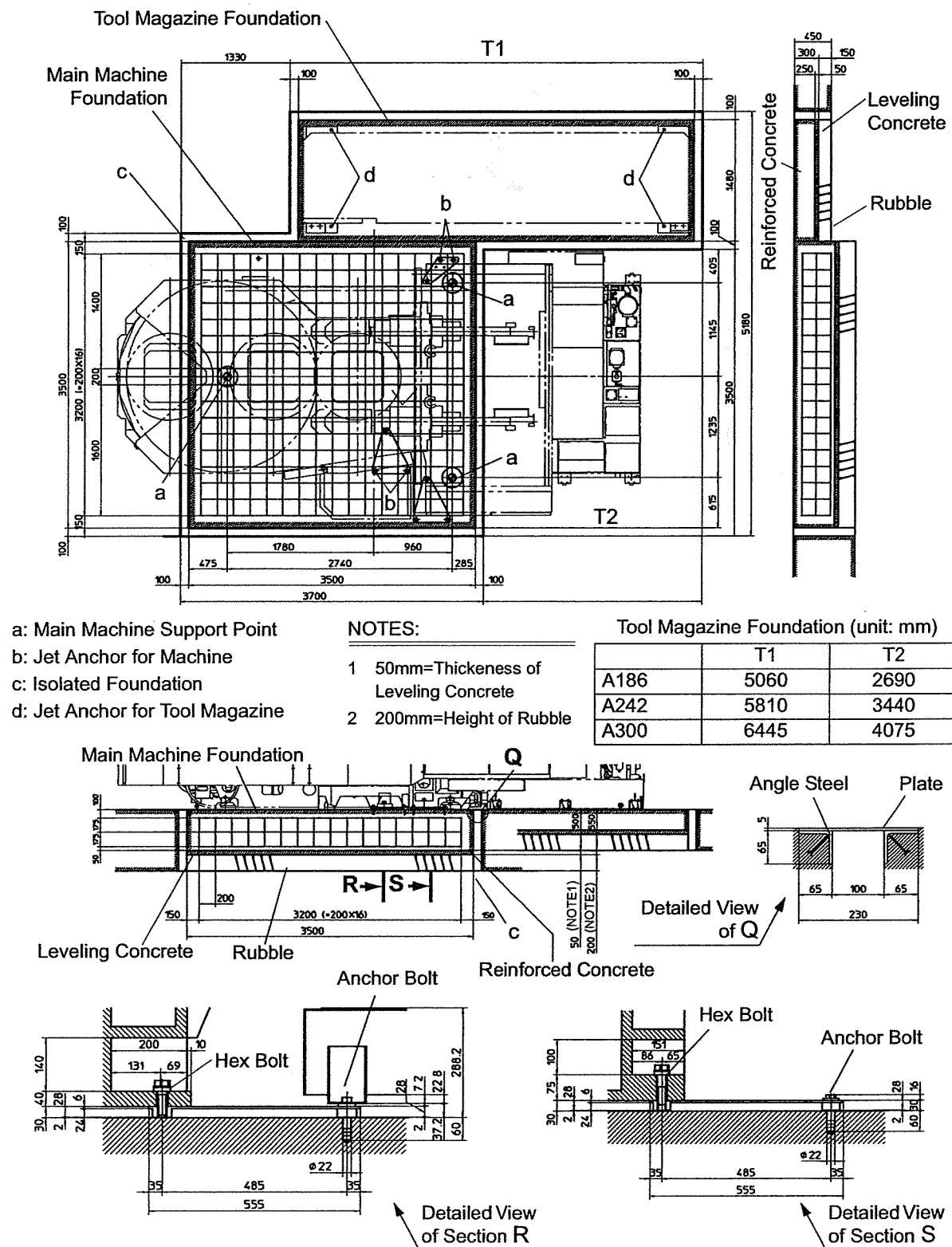


Figure 2.24 a82 Foundation Drawing
(Tool Magazine A186/A242/A300 and Left Discharge Conveyor Spec.)

Preparations for Installation

Air and Power Sources

2.6 Air and Power Sources

Table 2.6 Required Air and Power Sources

Item	Description																		
Electrical Source	AC200/220V ± 10% 50/60Hz ± 2%																		
Maximum Power Consumption	78kVA (a81 standard)	80kVA (a82 standard)																	
	Approx. 100kVA (a81: including options)	Approx. 100kVA (a82: including options)																	
Total Power Requirement	The actual power requirements are shown below:																		
	78 x 0.6 = 46.8kVA (a81 standard) 100 x 0.6 = 60kVA (a81: including options)	80 x 0.6 = 48kVA (a82 standard) 100 x 0.6 = 60kVA (a82: including options)																	
Circuit Breaker	225A																		
Power Cable	60mm ² or more (600V insulated cables specified by JIS C3307) or 38mm ² or more (600V-flame-retardant poly-flex insulated cables made by HITACHI cable SP39-10021J)																		
Ground	Ground resistance 100 Ω																		
Ground Cable	30mm ² or more cross section (600V insulated cables specified by JIS C3307)																		
Air Source	<ul style="list-style-type: none">• 0.5MPa to 0.8MPa• 410L/min: ANR (Standard Condition)• Dew point temperature: -20°C or less <p>NOTE:</p> <p>Clean air (free from solvent and iron rust) is required.</p> <p>Equivalent to the grade ISO2.5.2 specified by ISO8573-1 (equivalent to JIS B 8392-1)</p> <ul style="list-style-type: none">• Max. particles number/1m³: Below 10 (diameter: 0.001 < x ≤ 0.005mm)• Max. particles number/1m³: Below 1000 (diameter: 0.0005 < x ≤ 0.001mm)• Max. particles number/1m³: Below 100000 (diameter: 0.0001 < x ≤ 0.0005mm)• Dew point at max. pressure: Below 7°C (Absolute Pressure: 0.8MPa)• Max. oil concentration: 0.1mg/m³ or less <p>NOTE:</p> <p>The machine requires the above air quality. The air filters are installed as a standard feature. However, when maintenance of the filters is neglected, filter pollution and damage to the filter may occur in a short period of time. Periodic maintenance must be performed to maintain an optimum air supply.</p> <table><tr><th colspan="4">Required Air Flow (L/min: ANR)</th></tr><tr><th></th><th>Standard</th><th>Using Through Spindle Air Frequently</th><th>With Air Blow</th></tr><tr><td>Standard Spec. (without scale)</td><td>410</td><td>600</td><td>660</td></tr><tr><td>With Scale</td><td>460</td><td>690</td><td>750</td></tr></table>			Required Air Flow (L/min: ANR)					Standard	Using Through Spindle Air Frequently	With Air Blow	Standard Spec. (without scale)	410	600	660	With Scale	460	690	750
Required Air Flow (L/min: ANR)																			
	Standard	Using Through Spindle Air Frequently	With Air Blow																
Standard Spec. (without scale)	410	600	660																
With Scale	460	690	750																
Air Dryer	Must be ordered except when prepared by customer																		
Air Filter	5µm + 0.3µm + water remover																		

NOTE:

The air quality varies according to the factory circumstances. Use a particle counter to confirm that the air quality values satisfy the required values.

The air quality specified by ISO 8573-1 (equivalent to JIS B 8329-1) is recommended.

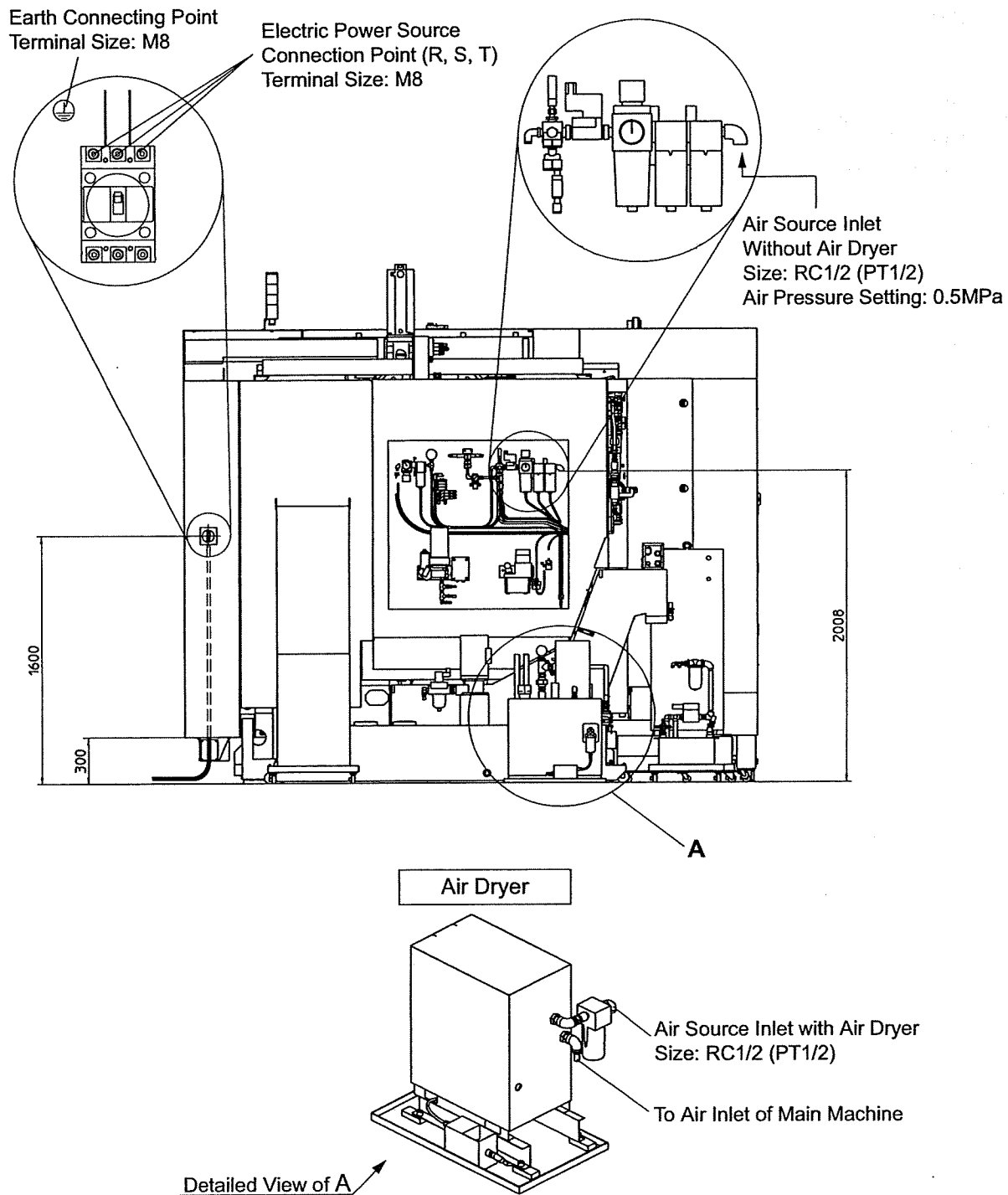


Figure 2.25 Power Source Connection Point and Air Source Inlet (With Air Dryer)

Preparations for Installation

Preparation of Transportation/Installation Equipment

2.7 Preparation of Transportation/Installation Equipment

Prepare equipment such as the crane, fork lift truck, skates, capable of supporting the size and withstanding the weight of the machine prior to machine transportation.

If the required transportation equipment cannot be prepared, contact Makino service representatives for further assistance.

Table 2.7 Required Equipment

Prepare:
Transfer Equipment: Crane, Forklift, Lifting Equipment
Tools: Tools supplied standard with the machine
Measurement Tools: Precision Level, Indicator

Table 2.8 Machine Weight

Model: Item	Weight
a81 Main Machine (Without Tool Magazine)	15570kg
a81 Main Machine (Tool Magazine A40)	16000kg
a81 Main Machine (Tool Magazine A60)	16300kg
a82 Main Machine (Without Tool Magazine)	20600kg
a82 Main Machine (Tool Magazine A40)	21000kg
a82 Main Machine (Tool Magazine A60)	21300kg
Tool Magazine A97	3200kg
Tool Magazine A137	3200kg
Tool Magazine A186	3900kg
Tool Magazine A242	4000kg
Tool Magazine A300	4500kg
Spindle Cooling Oil Temperature Controller (For Other than 20000min ⁻¹ Spindle Spec.)	200kg
Spindle Lubricant Temperature Controller (For 20000min ⁻¹ Spindle Spec.)	580kg
Hydraulic Unit (For Other than 20000min ⁻¹ Spindle Spec.)	60kg
Hydraulic Unit (For 20000min ⁻¹ Spindle Spec.)	200kg
Coolant Tank Left Discharge (Through Spindle 1.5MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller: Standard Spec.)	510kg
Coolant Tank Left Discharge (Through Spindle 3.0MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller)	560kg
Coolant Tank Left Discharge (Through Spindle 7.0MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller)	577kg
Coolant Tank Rear Discharge (Through Spindle 1.5MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller: Standard Spec.)	610kg
Coolant Tank Rear Discharge (Through Spindle 3.0MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller)	660kg
Coolant Tank Rear Discharge (Through Spindle 7.0MPa/Without Workpiece Cleaning Gun and Cutting Fluid Temperature Controller)	677kg
* Add 13kg to coolant tank weight listed above when installing a workpiece cleaning gun or cutting fluid temperature controller.	

2.8 Required Manpower for Installation

The following table shows the minimum required manpower, time and the number of days for installation of the a81/a82 machine.

Prepare/reserve manpower necessary for installation by referring to the table below.

This work schedule may change for different installation environments and machine options.

Table 2.9 Work Schedule

Work Item	Required Manpower	Required Time (hrs/person)	Required Day (day/person)
Main Machine Installation	1	22	3
Tool Magazine A97 and A137	2	8	1
Tool Magazine A186/A242/A300	2	8	1
Spindle Cooling Oil Temperature Controller and Hydraulic Unit (For Other than 20000min ⁻¹ Spindle Spec.)	1	1	1
Spindle Oil Temperature Controller and Hydraulic Unit (For 20000min ⁻¹ Spindle Spec.)	1	1	1
Coolant Tank Installation	1	4	1
Operation Checks After Installation	1	4	1

Preparations for Installation

Inspection Prior to Installation and Precaution During Installation

2.9 Inspection Prior to Installation and Precaution During Installation

The previous "Safety" chapter describes safety precautions for machine operation, maintenance and inspection in general. This section specifically describes safety precautions for installation as well as what needs to be checked prior to installation. Read and understand this section and the "Safety" chapter thoroughly and observe the safety precautions to ensure safety.

2.9.1 Inspection Prior to Installation

Confirm the following points prior to installation work:

- Inspect for any machine damage.
- Check all attachments and accessory units with the shipping and packing check list.

2.9.2 Handling of Heavy Components

A Unassisted Lifting

Avoid lifting of heavy machine components by one person alone. Lift them with the help of two or more persons according to the circumstances. Use mechanical equipment such as a crane, electrical forklift stacker, pallet trolley, or cart chain block depending on the requirements.

B Lifting with a Crane

The breakage of rope during the lifting of heavy components can result in the balance of heavy components being lost, and them falling. The falling of heavy components may cause irreparable damage to the components and may result in serious injury or death. When using a crane for lifting:

- Forklift must always be operated by qualified personnel only.
- Safety helmets and shoes must be worn at all times.
- All hook and linking tasks required for crane lifting must be performed by only qualified personnel.
- Use the crane within the range of its rated capacity.
- Use specialized tools where prescribed.
- Confirm the weight of the component to be lifted. Then, considering the presumed position of the center of gravity, attach wires guaranteed to carry the weight of the component and lift slowly, keeping the weight as stable as possible.
- Clearly indicate off-limit zones and keep all unauthorized personnel from entering these areas.

C Forklift Lifting

When using a forklift to carry heavy components there is a danger of the load falling from the forks or overturning the forklift.

When lifting by forklift:

- Safety helmets and shoes must be worn at all times.
- Forklift must always be operated by qualified personnel only.

- Use the forklift within the range of its rated capacity.
- Widen the forks as much as possible to allow the weight to be raised to be stable at as convenient a height as possible.
- Do not attempt to balance an un-balanced load with extra personnel riding on the opposite side of the forklift.
- When lifting a component by forklift, avoid its prohibited area.

2.9.3 Working at Elevated Locations

Falling from high places can result in serious injury.

When performing tasks at elevated locations:

- Safety helmets and shoes must be worn at all times.
- Use stable steps or a stepladder. Do not stand on a pail, or cans or boxes stacked one on top of the other.
- Extreme care should be taken to avoid slipping on oily surfaces, etc. and ensure stable working positions when performing tasks using both hands freely.
- Use a safety rope when performing tasks on the splashguard.

2.9.4 Working in Confined Spaces

When working in low or confined spaces, take care to avoid striking your head, shoulders or arms, or catching clothing on protruding machine parts. Proper work attire, safety helmet and shoes must be worn at all times.

2.9.5 Working in Group

When working in combination, lack of communication when turning ON the main power or operating the machine may result in death due to accidents such as electric shock, falling, or being caught between moving parts. Before operating the machine:

- Confirm the location and tasks being performed by other personnel and give a clearly audible warning when starting to operate the machine.
- Display clearly work description warnings and signs in front of the crane operation panel, the main power switch and the main operation panel etc. so that the content of work can be understood.

2.9.6 Work Requiring Machine Operation



- Some installation procedures can only be preformed by moving the machine. Ensure adequate precautions are taken at all times.
- Stop the machine, turn the control and main power supplies OFF, and perform “Lockout/ Tagout” before performing inspections and maintenance except for some inspections that must be performed with power ON.

3 Main Machine Installation

3.1 Main Machine Lifting and Set-Up

Confirm the following points prior to installation work:

- Inspect for any machine damage.
- Check all attachments and accessory units with the shipping and packing check list.



- Keep the machine level.
- Lift no higher than necessary.
- Prevent impact with nearby objects.
- Do not remove the axis shipping jig.
- All procedures are to be performed in pairs, and clear communication maintained at all times, to ensure operator safety.

The main machine is normally lifted and transported using 4-point lifting. Three-point lifting is possible if the center trough/internal conveyor is removed from the main machine.

Parts To Be Prepared (Lifting/Transportation)

Name	Part No.	Q'ty
Front Rope (Operator Door Side)	29M74C2001	1
Front Rope (Tool Magazine Side)	29M74C2002	1
Rear Rope	29M74A2004=1	2
Beam (1)	29M74A2005=3	1
Beam (2)	20M74A201=1	1
Beam (3)	29M74B2001	1
Shackle (SB40)	Z259B6400000	☞ Table 3.1
Hook (Base/Shackle)	J2M322A111C/BB65	1

Parts To Be Prepared (Installation)

	Name	Part No.	Q'ty
a81 (supplied with machine)	Plate	28M30A2003	3
	Flat Point Set Screw	Z272A1112020	3
	Leveling Bolt	13M30B424	3
	Protective Metal	13M30B703=1	3
a82 (supplied with machine)	Leveling Base	19M30A104=1	3
	Protective Metal/Lock Pad	Z281I0800087	3
	Flat Point Set Screw	Z272A1110014	3 × 2
	Leveling Bolt	34M030A2003	3

Table 3.1 Number of Shackles Required for Different Machine Specifications

Model	Tool Magazine	Shackle Position/Number	
a81	A40/A60	Machine Front: 1 on each side	Machine Rear: 1 on each side
	A97 and Above	Machine Front: 2 on each side (4 in total)	Machine Rear: 1 on each side
a82	A40/A60	Machine Front: 1 on each side	Machine Rear: 3 on each side (6 in total)
	A97 and Above	Machine Front: 1 on each side	Machine Rear: 1 on each side

* The number of shackles required varies depending upon the machine specifications.

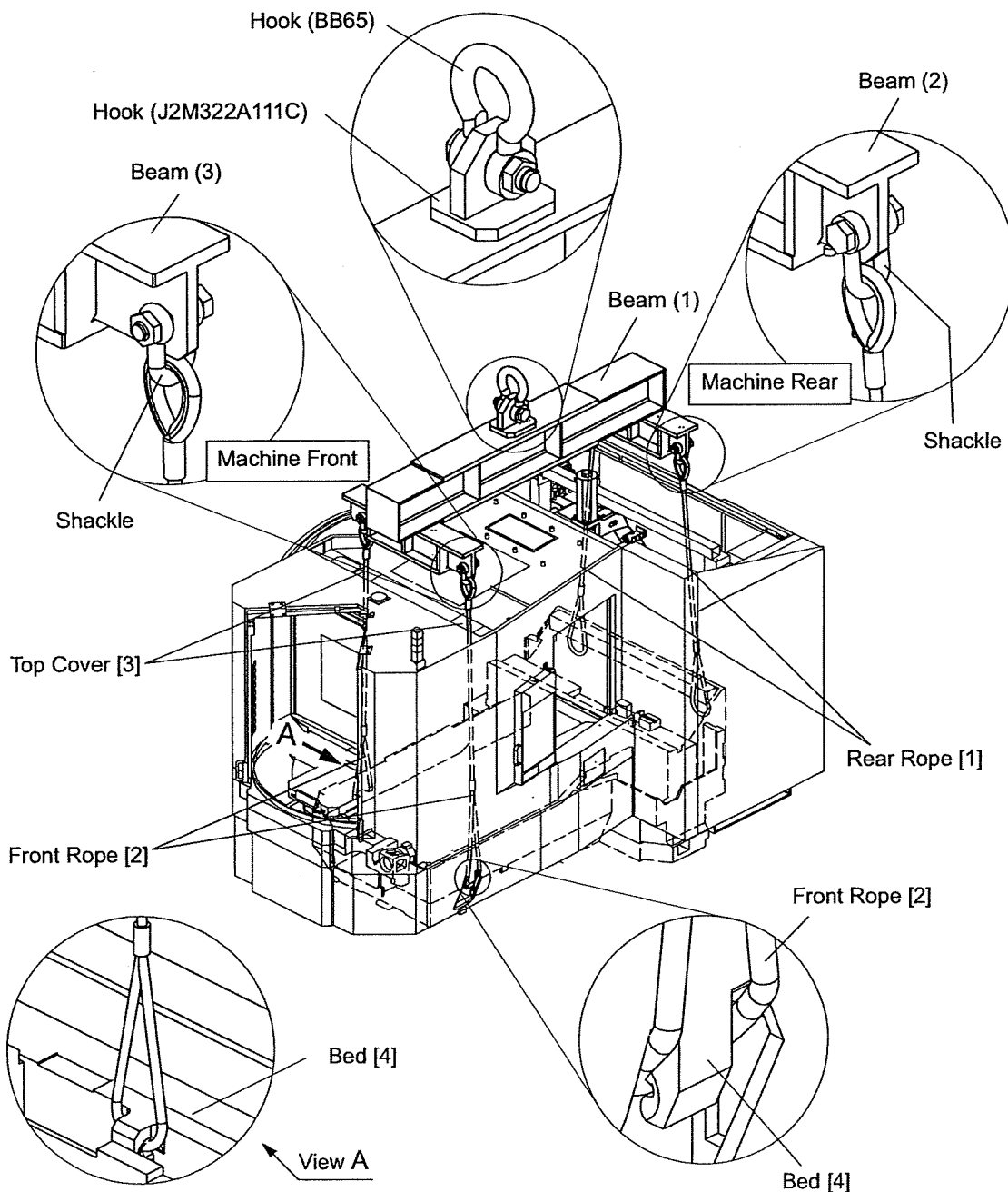


Figure 3.1 Lifting Main Machine (Using 4-Point Lifting Equipment: a81/a82)

3.1.1 Main Machine Lifting /Set-Up

Main Machine Transportation and Installation Procedure

☞ (Figure 3.1 ~ Figure 3.3)

- 1) Lift the assembled lifting equipment using a crane, and move it near the main machine.
- 2) Insert the two front ropes [2] from the two top covers [3] into the main machine.
- 3) Insert the two front ropes into the two covers on machining chamber to mount the ropes to the beds [4] (at two positions).
- 4) Mount the two rear ropes [1] to the machine bed at rear side.
- 5) Place each of the three leveling plates [5]/leveling bolt (a81) or leveling bases [6]/leveling bolt (a82) on each of the three machine support points [7]/[8] on the foundation.
- 6) Lift the machine carefully using a crane and place it on the foundation shown in Figure 3.3.
- 7) Confirm the height between the floor and the main machine is 30mm (☞ Figure 2.17).

This completes the main machine transportation/lifting and set-up procedure.

Next, remove the lifting equipment. ☞ “3.1.2 Lifting Equipment Removal”

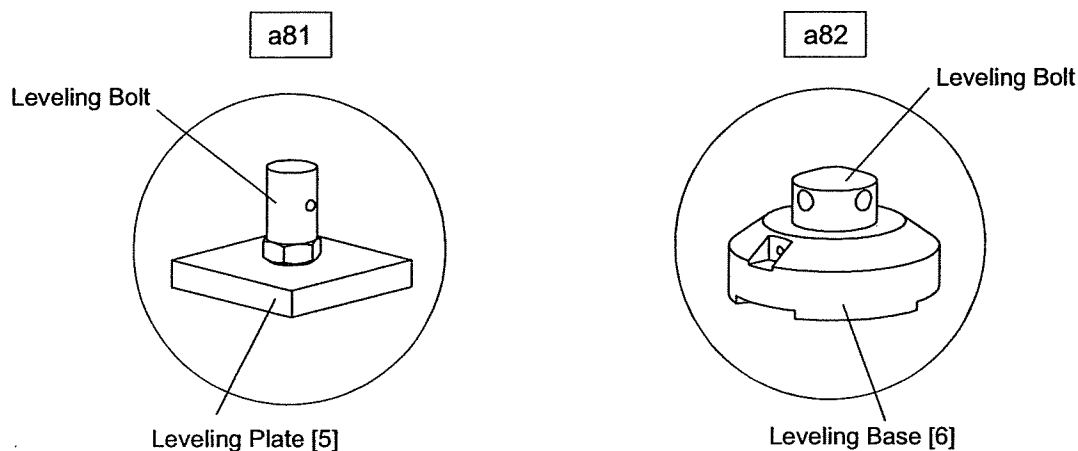


Figure 3.2 Leveling Plate (a81)/Leveling Base (a82)

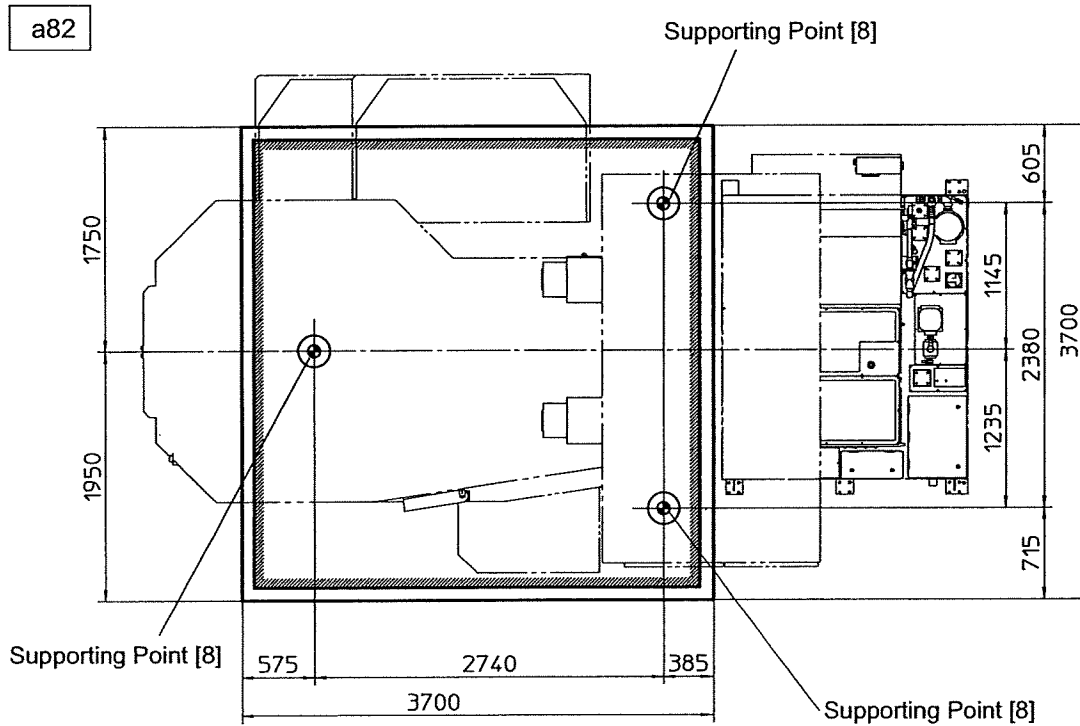
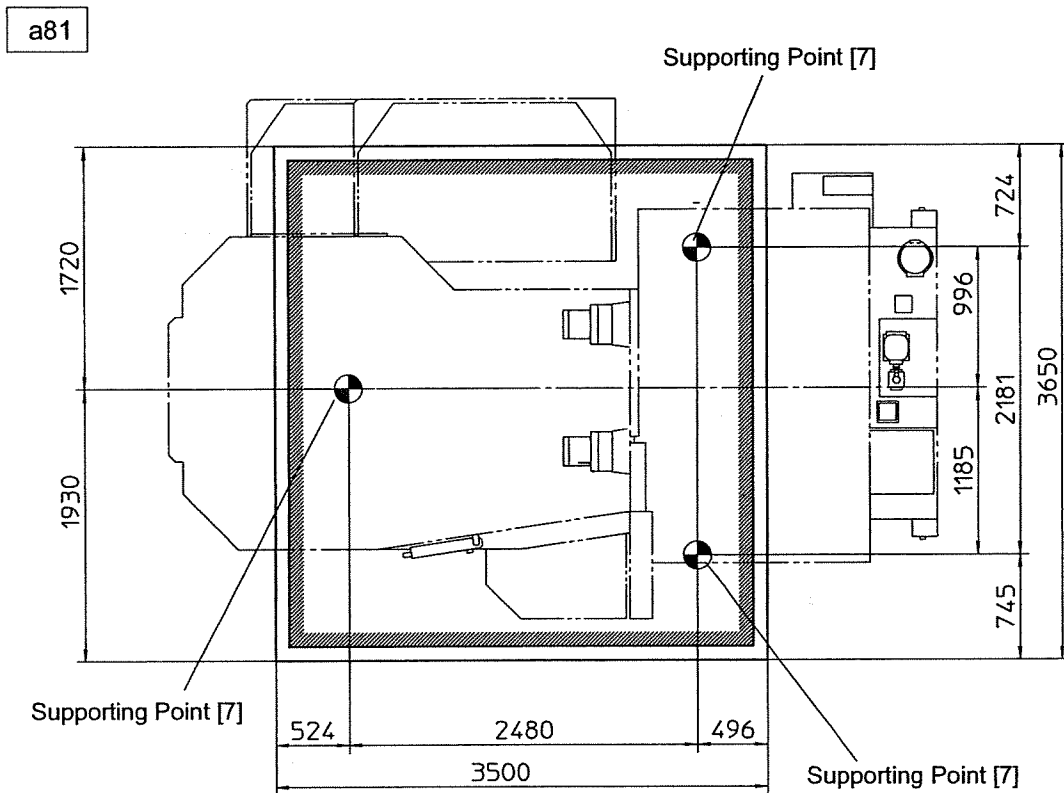


Figure 3.3 Main Machine Installation (a81/a82)

3.1.2 Lifting Equipment Removal

Lifting Equipment Removal Procedure

(☞ Figure 3.1 and Figure 3.4)

- 1) When the main machine is placed on the foundation as specified, reverse the mounting lifting equipment and main machine installation procedure in steps 1 ~ 4 to remove the lifting equipment.
- 2) Lift the assembled lifting equipment using a crane to put it outside of the main machine.
 - Ensure to prevent the front rope from hitting the window on the ceiling of machining chamber.
 - Ensure to prevent the rear rope from hitting the parts inside of the column room.
- 3) Mount the two gaskets [11] and two center trough covers [10].
 - Apply silicon to the gasket to avoid coolant leakage.
- 4) Install the two APC arm covers [12] on the machining chamber side.
- 5) Replace the two top covers [9].

This completes the lifting equipment removal procedure.

Next, remove the shipping jigs. ☞ "3.2 Shipping Jig Removal/Motor Installation"

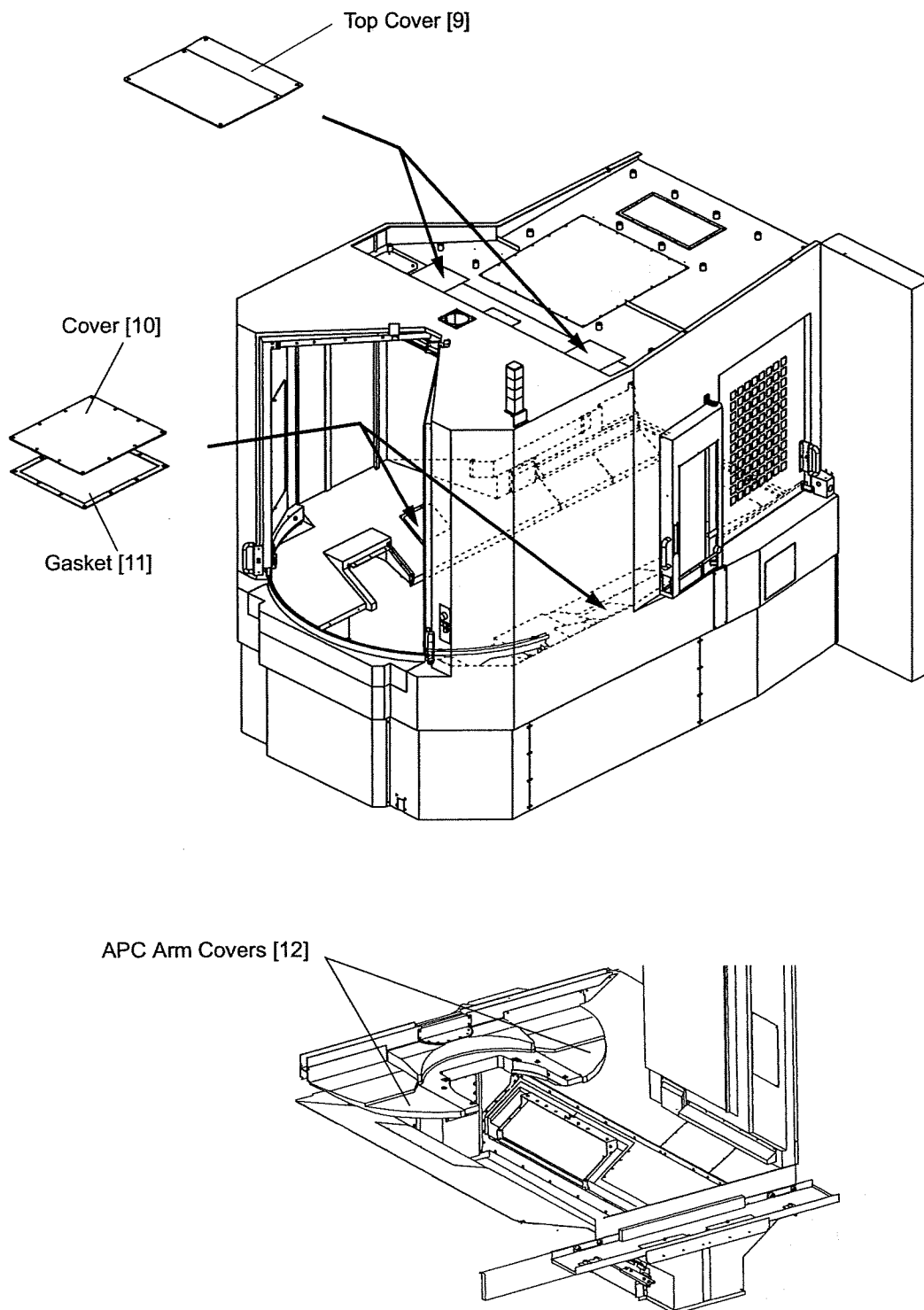


Figure 3.4 Lifting Equipment Removal (a81/a82)

3.2 Shipping Jig Removal/Motor Installation

3.2.1 Axis Shipping Jig Removal



– Exercise extreme caution as entry into the machine area is necessary in order to perform the procedures in this section.

X, Y and Z-Axis Shipping Jig Removal Procedure

- 1) Remove the six socket head cap screws [2] to remove the X-axis shipping jig [1].
- 2) Remove the four socket head cap screws [4] to remove the Y-axis shipping jig [3].
- 3) Remove the Z-axis shipping jig. The removal procedure differs for a81 and a82.
 - a81: Remove the two socket head cap screws [7] on the APC base [12] side, then remove the two socket head cap screws [9] on the table side to remove the Z-axis shipping jig [8]. After removing the Z-axis shipping jig, install the gasket [11] and cover [10] on the APC base [12].
 - a82: Remove the four socket head cap screws [6] to remove the Z-axis shipping jig [5].

This completes the X, Y and Z-axis shipping jig removal procedure.

Next, remove the Y-axis ball screw fixing jig and instal the Y-axis motor.

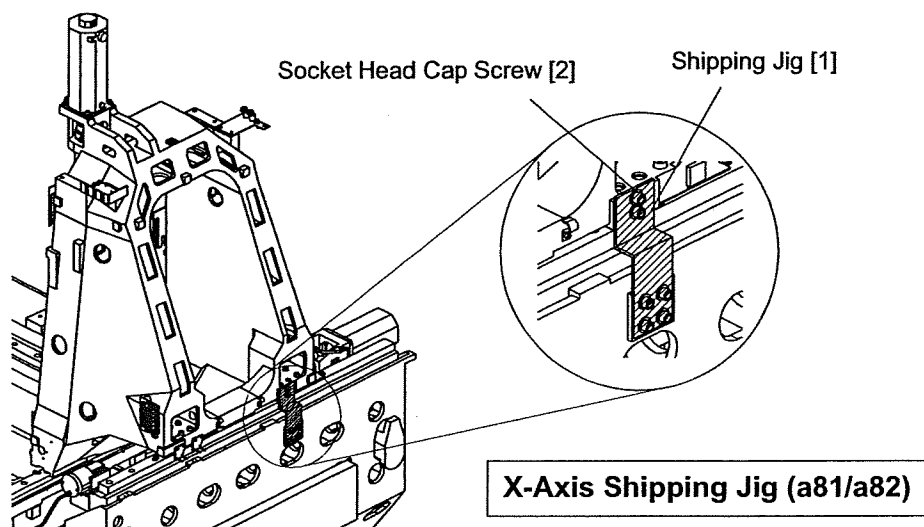


Figure 3.5 X-Axis Shipping Jig Removal

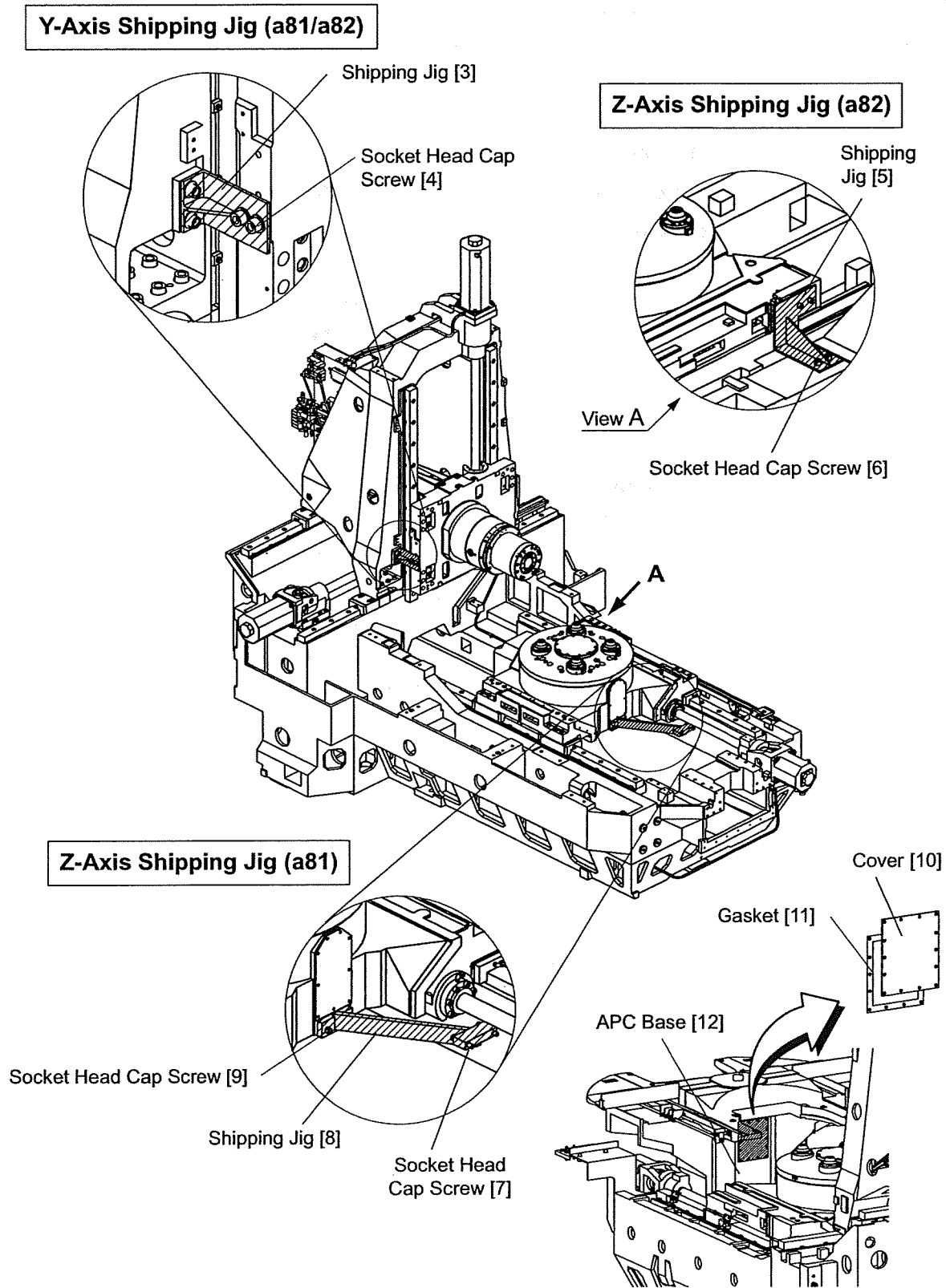


Figure 3.6 Y/Z-Axis Shipping Jig Removal

3.2.2 Y-Axis Ball Screw Shipping Jig Removal and Y-Axis Motor Installation


The Y-axis motor is not generally removed prior to shipment. When the necessary space cannot be obtained in the factory, the Y-axis motor is removed prior to shipment.


When the Y-axis motor is removed for shipment, remove the Y-axis shipping jig (ball screw fixing jig) and install the motor using the following procedure.

Y-Axis Shipping Jig Removal and Motor Installation Procedure

- 1) Remove the two socket head cap screws [1] to remove the Y-axis shipping jig [2].
 - Do not misplace the socket head cap screws [1]. The socket head cap screws are used when fixing the motor.
- 2) Install the Y-axis motor [3].
 - The motor is installed with the coupling [7] assembled onto the motor shaft.
 - Confirm that the distance between the motor upper end and coupling lower end is 49mm.
 - a) Install the motor into the motor bracket [6].
 - Confirm the position for the clamping bolts [11] and [12] of the motor coupling from the motor bracket window and install the motor so that the four bracket holes and four socket head cap screw [4] holes are aligned.
 - b) Support the motor using lifting equipment and confirm that the motor installation surface is free from dust and other foreign matter.
 - c) Tighten the four socket head cap screws [4] with the four safety washers [5] using a torque wrench to uniformly secure the motor.
 - Tightening Torque: 58.8N·m
 - d) Tighten the clamping bolt [12] attached to the coupling on the ball screw side using a torque wrench.
 - Tightening Torque: 30N·m
 - e) Connect the motor cables (power cable [9], signal cable [8], Y-axis motor brake cable [10]).

This completes the Y-axis shipping jig removal and motor installation procedure.

A "Reference Position Return Request" alarm is triggered when the power is turned ON after the main machine installation. Perform reference position return.  "9.1 Y-Axis Reference Position Return"

Perform reference position return for each axis (X-, Y- and Z-axes) and confirm the reference position.  "9.2 Axis Reference Position Checks"

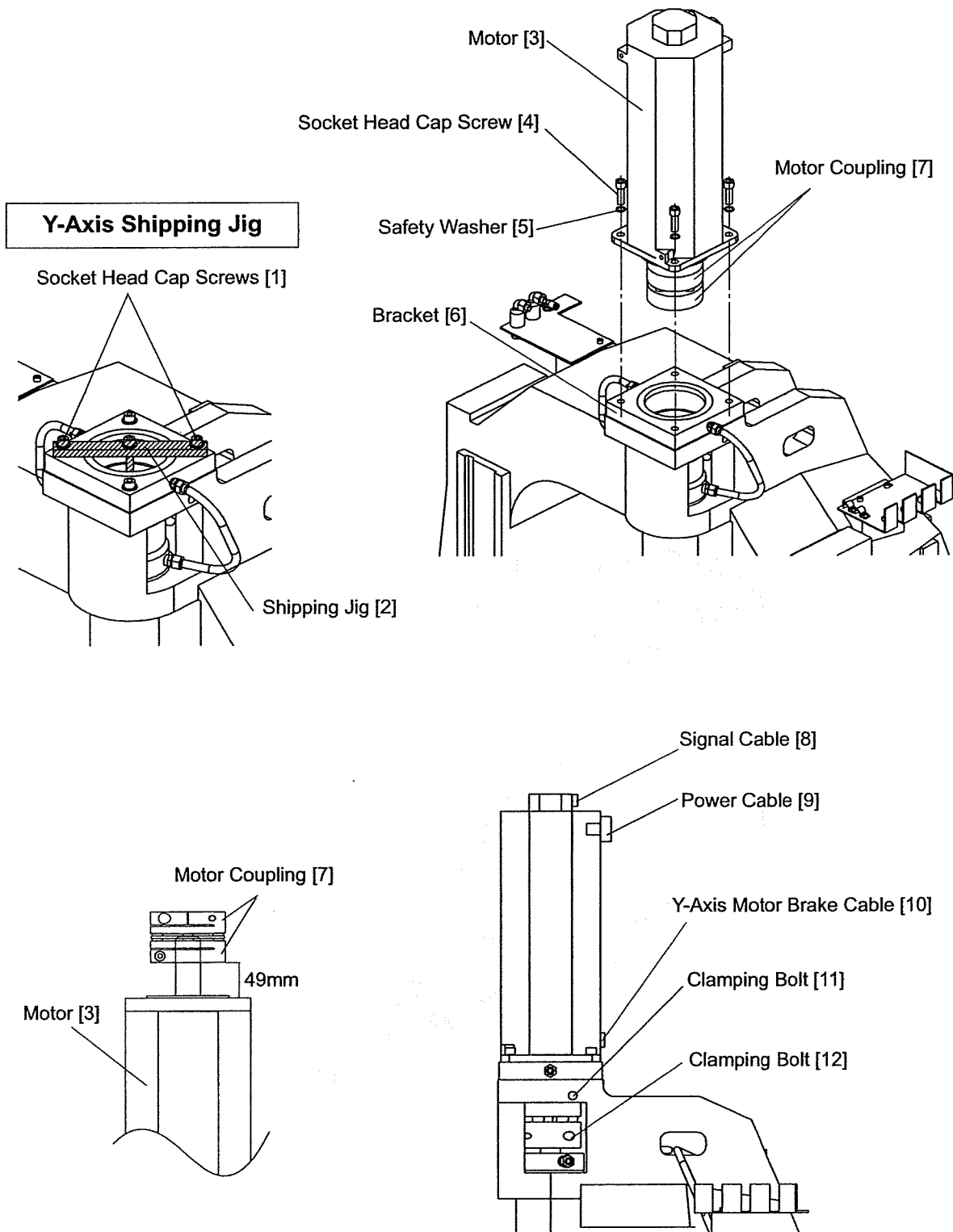


Figure 3.7 Y-Axis Shipping Jig Removal and Y-Axis Motor Installation

3.2.3 Machine Rear Shipping Jig Removal

Machine Rear Shipping Jig Removal Procedure

- 1) Remove the nine socket head cap screws.
- 2) Remove the shipping jig.

This completes the machine rear side shipping jig removal procedure.

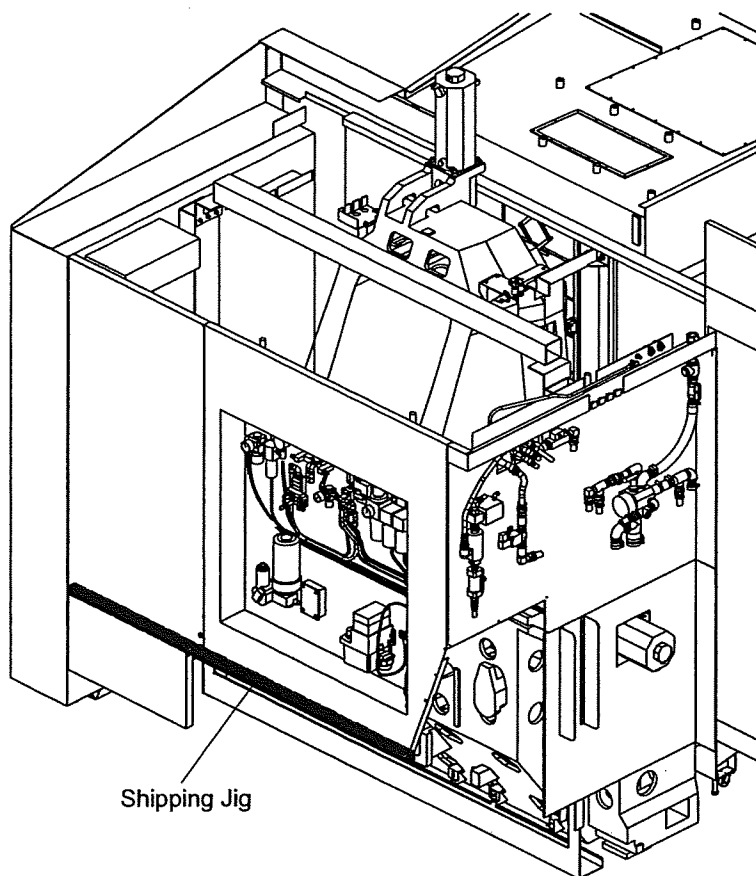


Figure 3.8 Machine Rear Shipping Jig Removal

3.2.4 APC Safety Guard Shipping Jig Removal

APC Safety Guard Door Shipping Jig Removal Procedure

- 1) Remove the four socket head cap screws [1] to remove the shipping jig [2].
- 2) Remove the four socket head cap screws [4] to remove the shipping jig [3].

This completes the APC safety guard door shipping jig removal procedure.

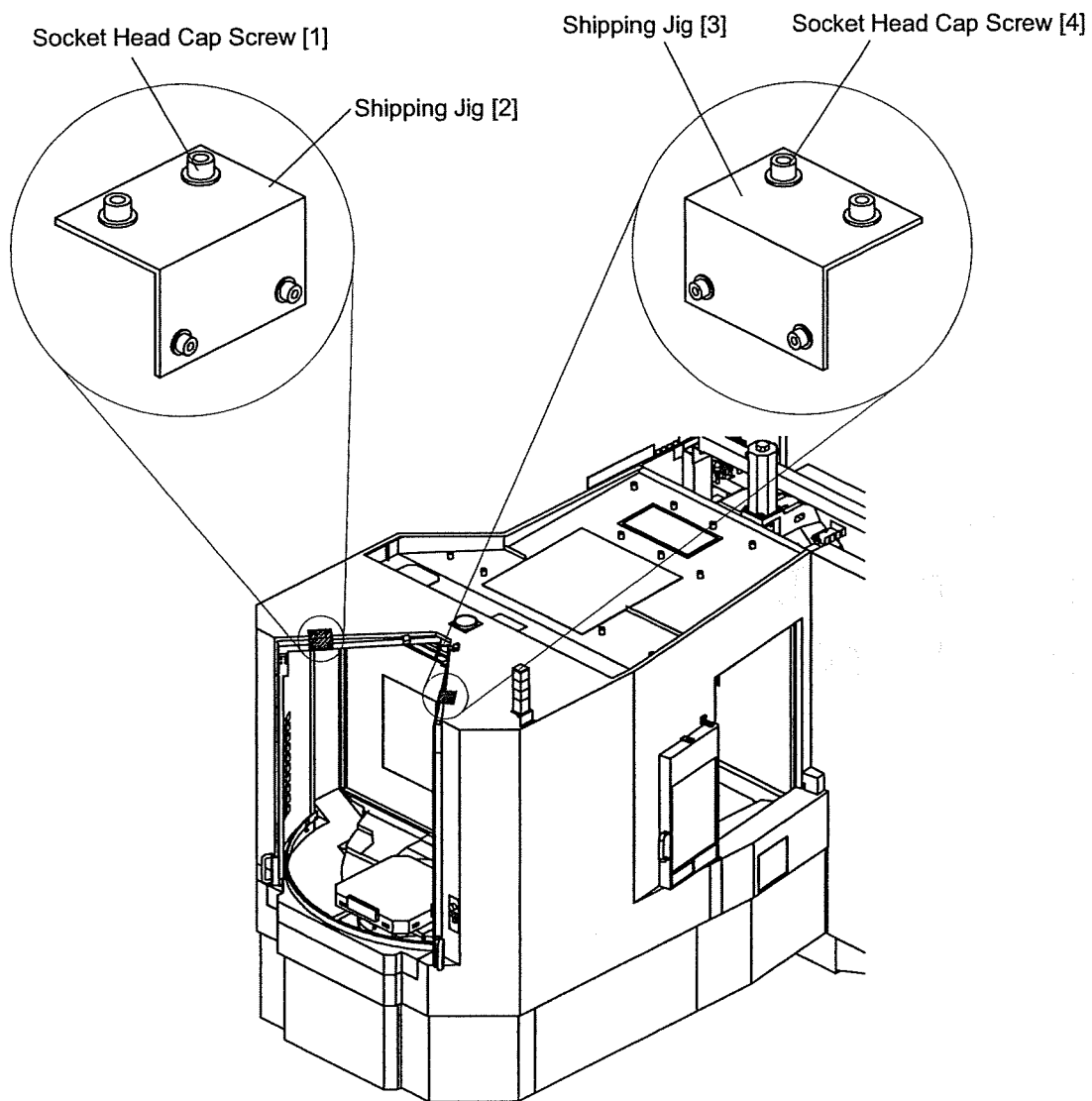


Figure 3.9 APC Safety Guard Shipping Jig Removal

3.2.5 Operator Door Shipping Jig Removal

Operator Door Shipping Jig Removal Procedure

- 1) Remove the six socket head cap screws [2] [3].
- 2) Remove the shipping jig [1].
- 3) Remove the six socket head cap screws [5] [6].
- 4) Remove the shipping jig [4].

This completes the operator door shipping jig removal procedure.

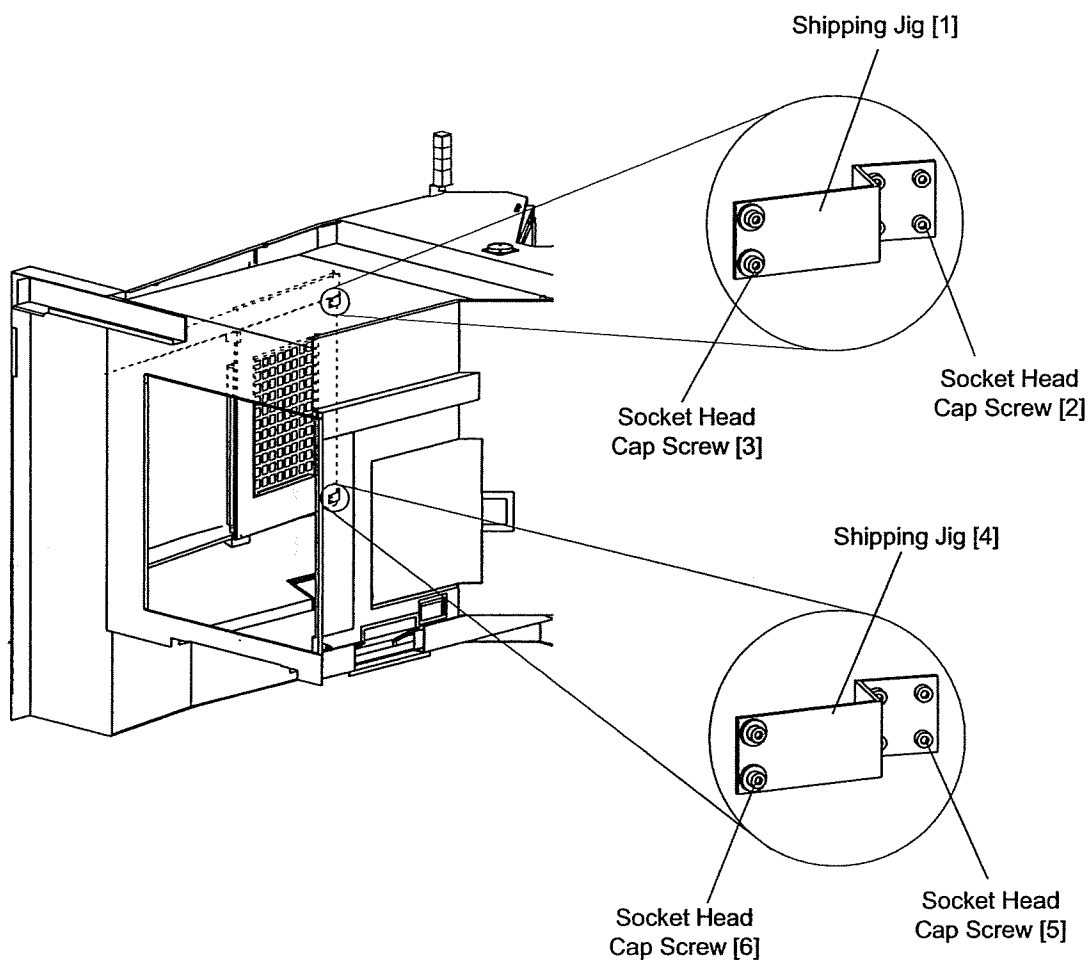


Figure 3.10 Operator Door Shipping Jig Removal

3.2.6 Main Operation Panel Shipping Jig Removal

Main Operation Panel Shipping Jig Removal Procedure

- 1) Remove the socket head cap screw [2].
- 2) Move the Main operation panel to remove the four socket head cap screws [3].
- 3) Remove the shipping jig [1].

This completes the Main Operation panel shipping jig removal procedure.

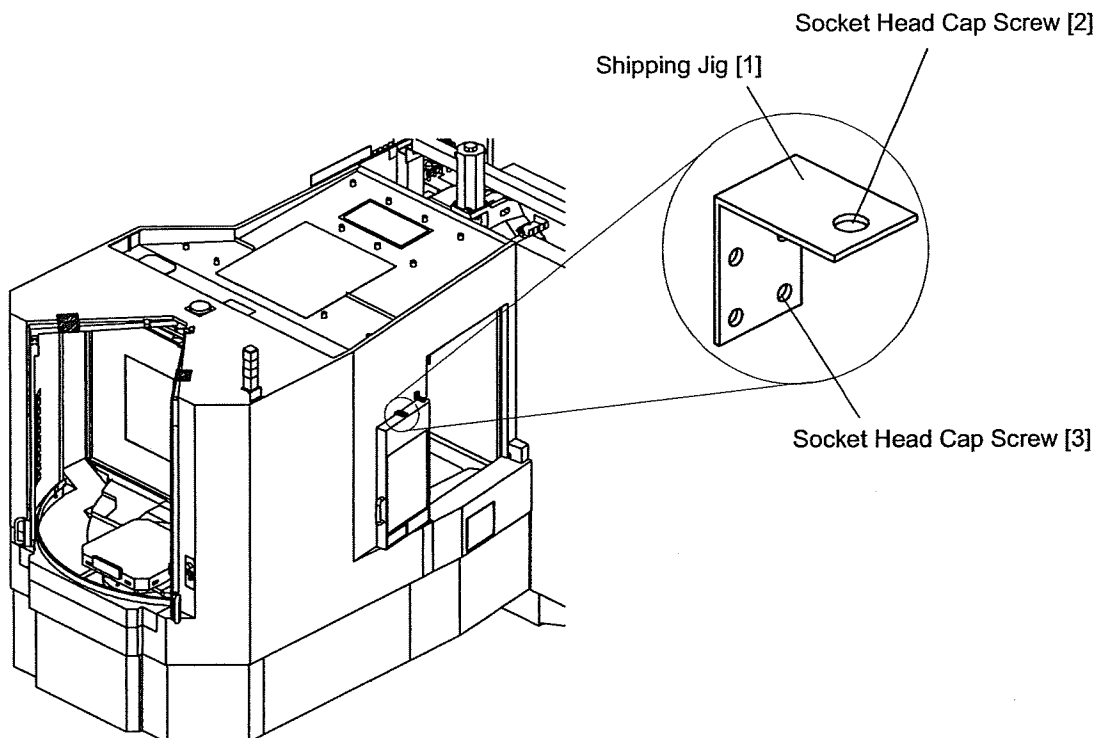


Figure 3.11 Main Operation Panel Shipping Jig Removal

3.2.7 ATC Shutter Shipping Jig Removal

ATC Shutter Shipping Jig Removal Procedure

- 4) Remove the truss head cap screw [2].
- 5) Remove the shipping jig [1].
- 6) Replace the truss head cap screw [2].
- 7) Remove the truss head cap screw [3].
- 8) Remove the shipping jig [4].
- 9) Replace the truss head cap screw [3].

This completes the ATC shutter shipping jig removal procedure.

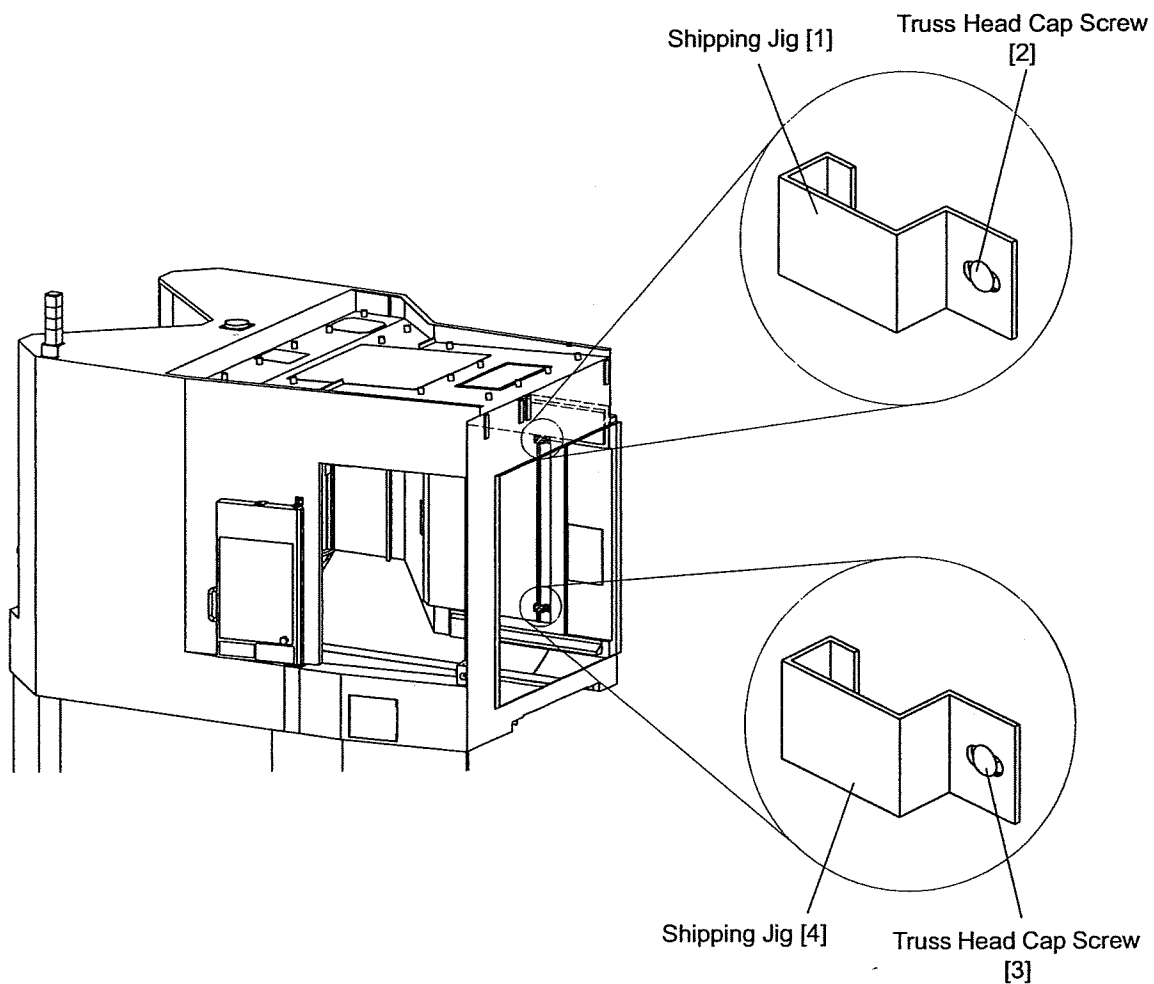


Figure 3.12 ATC Shutter Shipping Jig Removal

3.2.8 BTS (Optional) Stylus Shipping Jig Removal

BTS Stylus Shipping Jig Removal Procedure

- 1) Remove the cable tie [3] securing the BTS stylus [1] to the shipping jig [2].
- 2) Remove the socket head cap screw [4] to remove the shipping jig [2] mounting on the ATC unit frame.

This completes the BTS stylus shipping jig removal procedure.

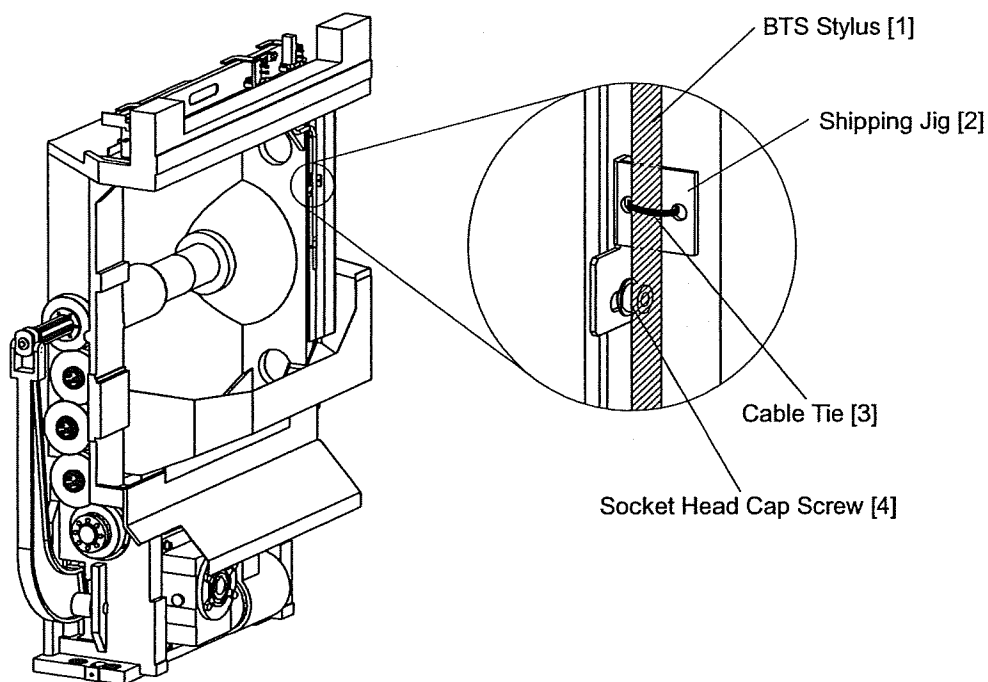



Figure 3.13 BTS Stylus Shipping Jig Removal


3.2.9 Y-Axis Support Removal



- Exercise extreme caution as entry into the machine is necessary in order to perform the following procedure.
- Perform this procedure when the machine axes can be moved.

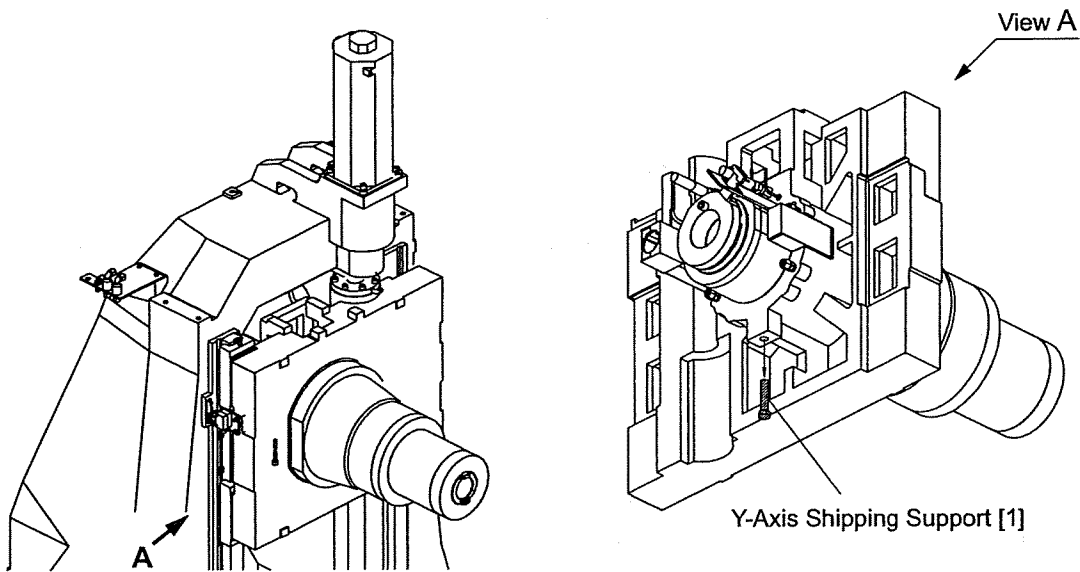
Y-Axis Shipping Support Removal Procedure

This procedure must be performed with the power ON. Perform the following procedure when operation preparations for the power to be turned ON have been completed and axis feed becomes possible  "8.3 Turning Power ON/Checks When Power Is Turned ON"

- 1) Turn ON the power supply.
 - Continue with the procedure even though NC alarm No.300 (Y-axis reference position return request) is triggered when the power is turned ON.  "9.1 Y-Axis Reference Position Return"
- 2) Using the manual pulse generator in the Handle mode, move the Y-axis gradually in the plus (+) direction and stop near the reference position (plus stroke end).
 - Ensure the Y-axis is moved in the plus (+) direction. If the Y-axis is moved in the minus (-) direction, a servo alarm is triggered and the machine enters the Emergency stop condition.
- 3) Remove the Y-axis shipping support [1]/[2].
 - Other than High-Torque Spindle Spec.: Remove the Y-axis shipping support (hex bolt) [1] in the spindle head base.
 - High-Torque Spindle Spec.: Remove the Y-axis shipping support [2] on the column.

This completes the Y-axis shipping support removal procedure.

Spindle (Standard/High-Acceleration/20000min⁻¹ Spec.)



Spindle (High-Torque Spec.)

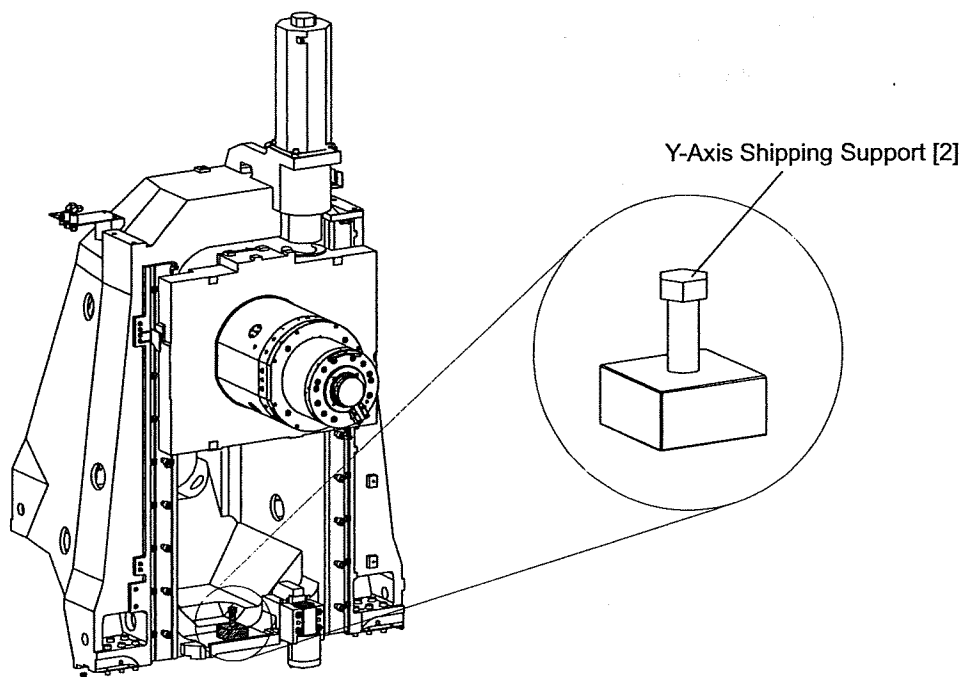


Figure 3.14 Y-Axis Support Removal

3.3 Main Machine Leveling

**WARNING**

- Exercise extreme caution as entry into the machine is necessary in order to perform the following procedure.
- Perform this procedure when the machine axes can be moved.

This procedure must be performed with the power ON. Perform the following procedure when operation preparation is completed for the power to be turned ON and axis feed becomes possible.

Leveling must be performed before installing the tool magazine and coolant tank.

Parts To Be Prepared (Leveling)

	Name	Part No.	Q'ty
	Precision Level	-	2
	Pallet	-	1
	Hex Socket Screw Key	-	1
a81 (Supplied with machine)	Leveling Plate	28M30A2003	3
	Flat Point Set Screw	Z272A1112020	3
	Leveling Bolt	13M30B424	3
	Protective Metal	13M30B703=1	3
a82 (Supplied with machine)	Leveling Base	19M30A104=1	3
	Protective Metal/Lock Pad	Z281I0800087	3
	Flat Point Set Screw	Z272A1110014	2×3
	Leveling Bolt	34M030A2003	3

Main Machine Leveling Procedure

- 1) Turn ON the power supply.
- 2) Open the operator door and turn OFF the power.
- 3) Mount the pallet on the table in the machining chamber and had it clamped.
- 4) Turn ON the power and move the axes to the following positions in the manual mode:
 - X-Axis: Reference Position
 - Y-Axis: Center of stroke (a81: -400, a82:-410)
 - Z-Axis: Center of stroke (a81/a82: -510)
- 5) Turn OFF the power with the operator door closed.
- 6) Place the two precision levels [1] on the machining chamber side pallet [2] as shown in the figure to confirm the level of the machine. When the precision level is less than 20μm, the machine level is correct.
- 7) If the level is not correct, adjust the leveling bolt [3]/[6].

- a81

a) Rotate the three leveling bolts [3] using a spanner to adjust the level of the main machine.

b) Mount and tighten the three protective metals [5] and the three flat point set screws [4] to secure the main machine position.


- a82


a) Insert the iron bar [10] into the leveling bolts [6] and rotate the three leveling bolts [6] to adjust the level of the main machine.

b) Remove the iron bar [10] and tighten the three protective metals [8] in the leveling base [9] and the three flat point set screws [7] with a spanner to secure the main machine position.

8) Confirm the level with the precision level [1] again.

This completes the main machine leveling adjustment procedure.

Next, set the step. (For the step setting position  Figure 3.3)

After setting the step, instal the machine fixing tools in order to secure the main machine to the floor when equipped with a matrix magazine, pallet magazine or MMC.  "3.4 Machine Fixing Tool Installation"

Precision Levels [1]

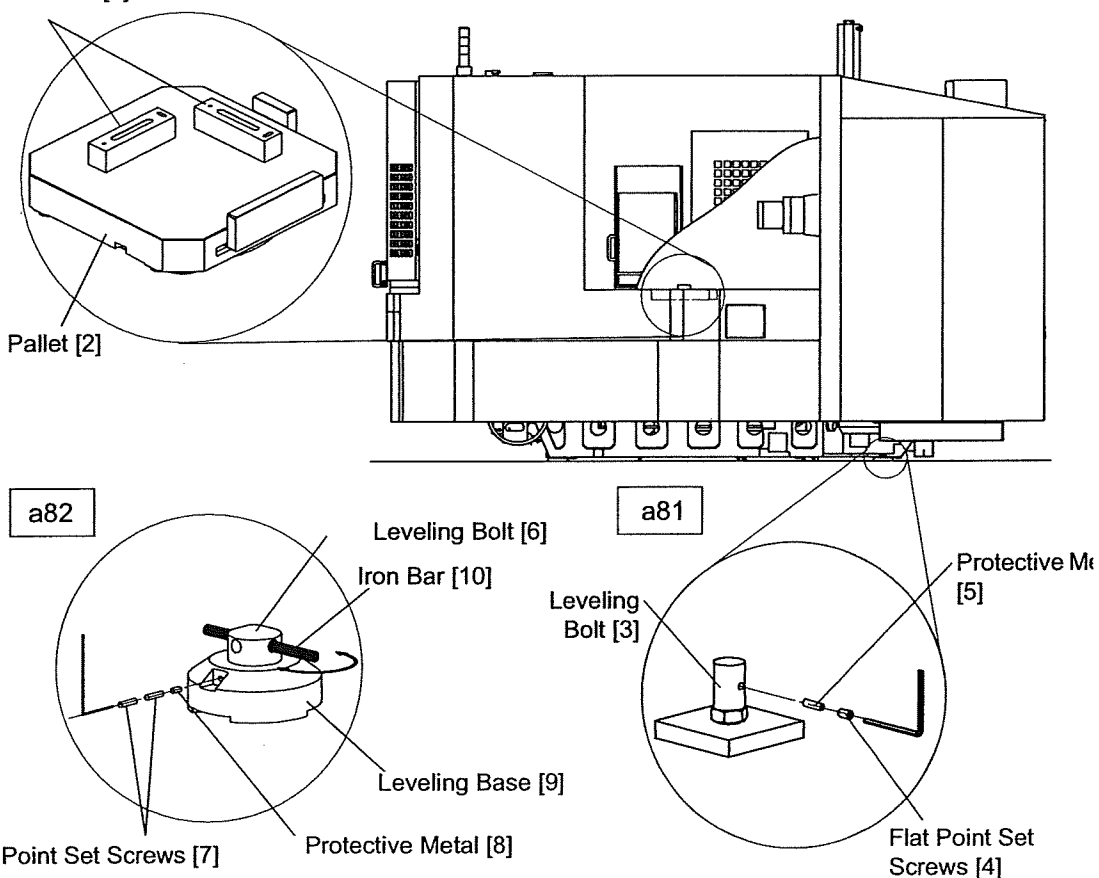


Figure 3.15 Main Machine Leveling

3.4 Machine Fixing Tool Installation

It is necessary to instal the three machine fixing tools when any of the following options is provided:

- Tool Magazine A97, A137, A186, A242 and A300 (Matrix)
- Pallet Magazine
- MMC

Secure the main machine and ground (concrete) with the anchor bolts (2 each).

a81

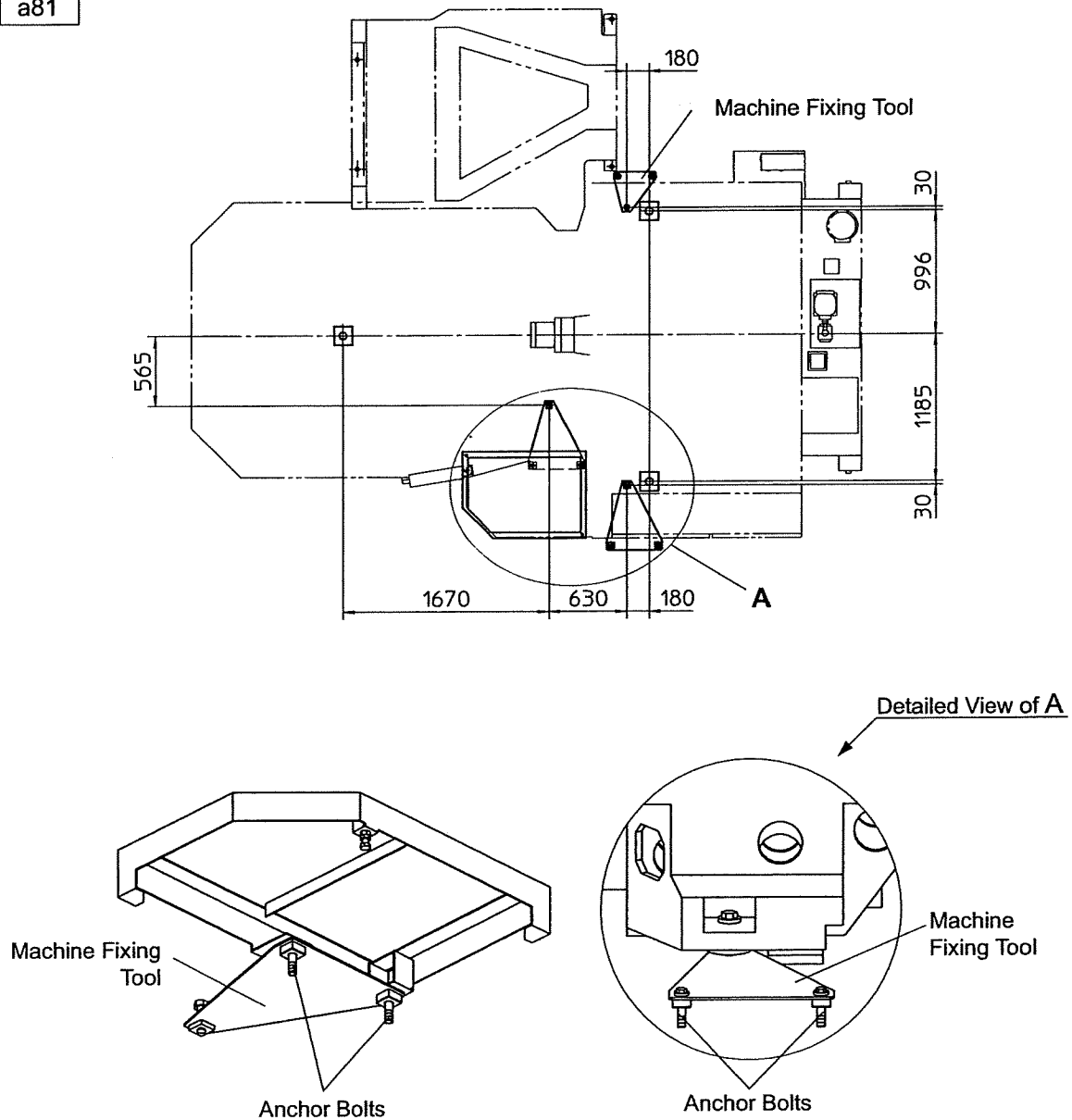


Figure 3.16 Machine Fixing Tool Installation (a81)



4 Placing of Tool Magazine/Peripheral Devices

When the main machine set-up is completed, place the tool magazine and other peripheral devices at the appropriate locations.

1 Tool Magazine Unit

- Tool Magazine A40/A60: Tool Magazine Covers, Side Cover, Oil Pan
- Tool Magazine A97/A137: Tool Magazine
- Tool Magazine A186 or Above: Tool Magazine, Sub-Arm Unit, Oil Pan

2 Peripheral Device

- Spindle Cooling Temperature Controller (for other than 20000min⁻¹ spindle spec.) or Spindle Oil Temperature Controller (for 20000min⁻¹ spindle spec.)
- Hydraulic Unit
- Coolant Tank
- Other Optional Device (Air Dryer, Cutting Fluid Temperature Controller, etc.)

Perform the following when all the accessory units are transported:

- Inspect for any machine damage.
- Check all attachments and accessory units with the shipping and packing check list.

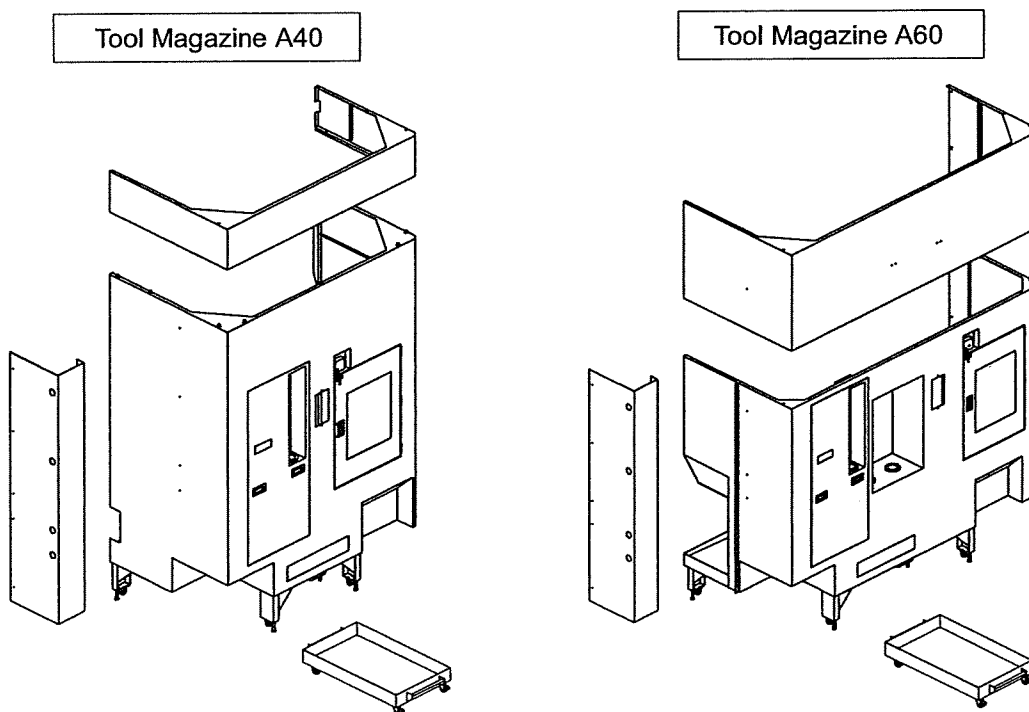
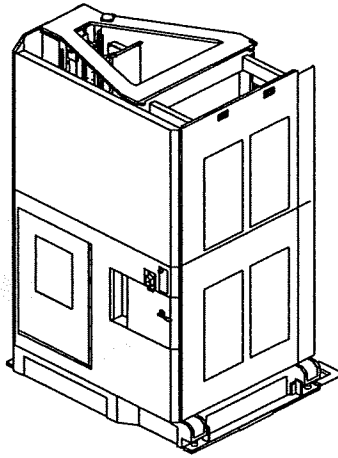
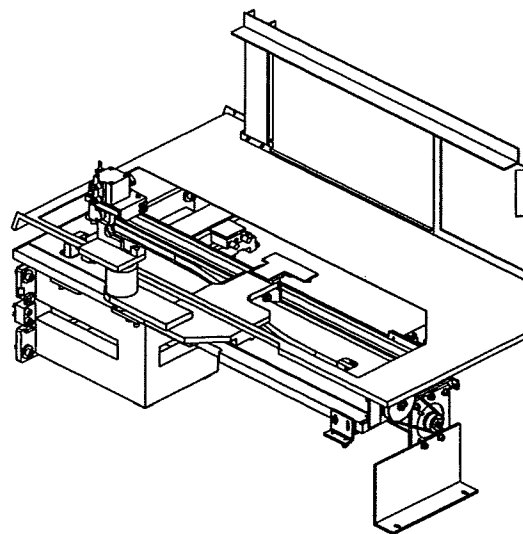
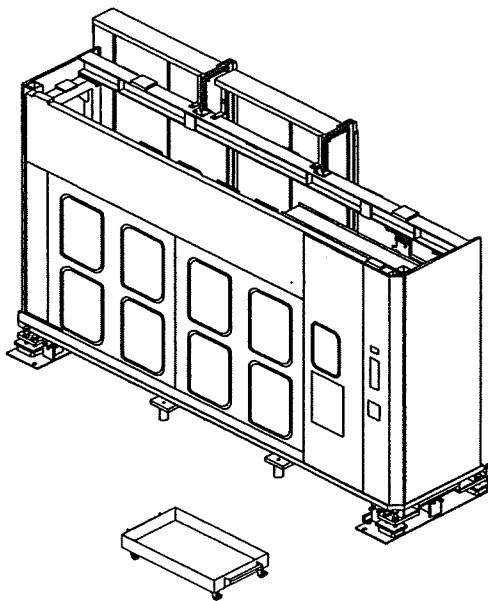


Figure 4.1 Placing of Tool Magazine: Tool Magazine A40/A60

Tool Magazine A97/A134



Tool Magazine A186/A242/A300



Sub-Arm Unit

Figure 4.2 Placing of Tool Magazine: Tool Magazine A97 and Above

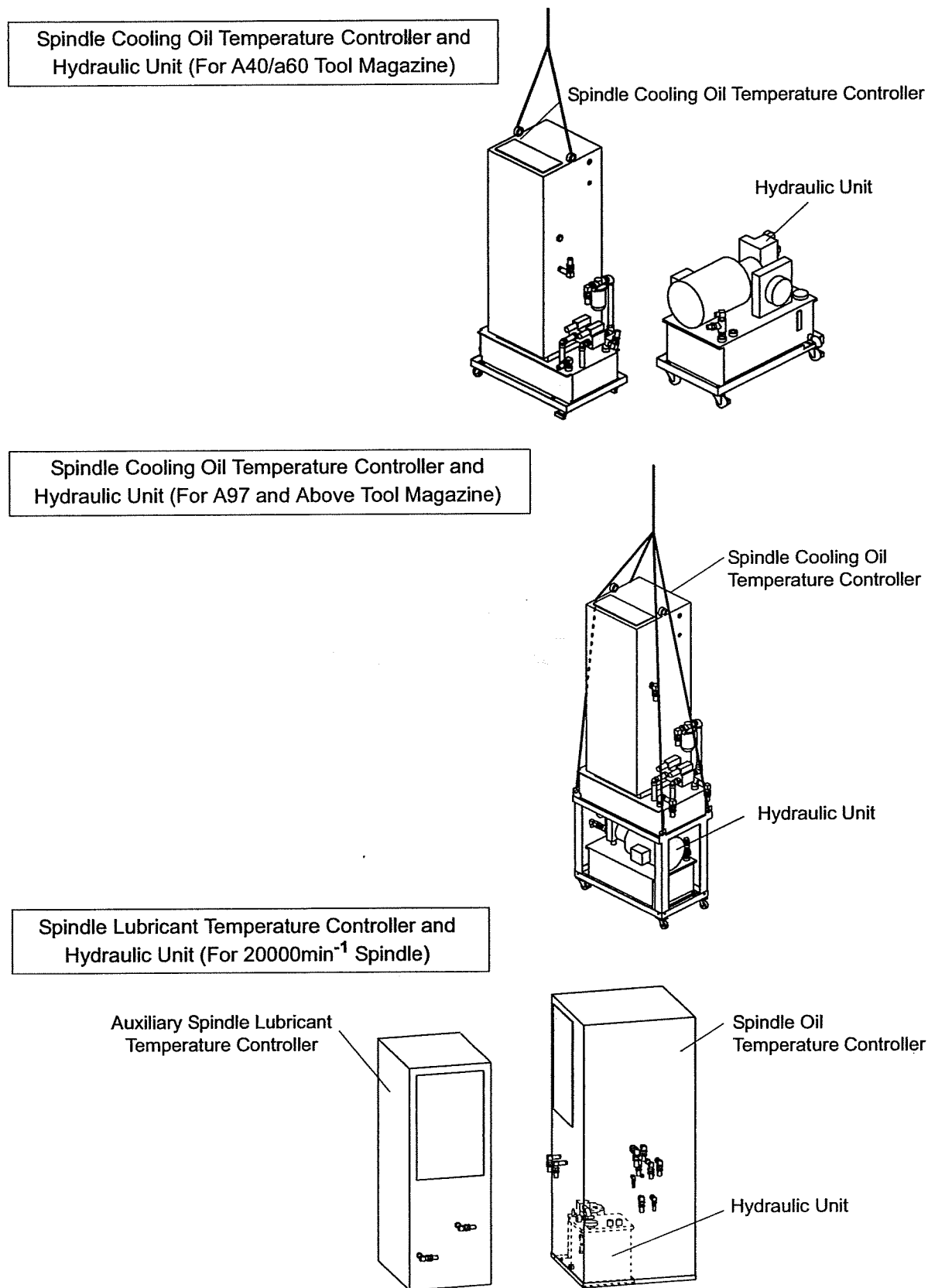


Figure 4.3 Placing of Peripheral Device: Spindle Oil Temperature Controller and Hydraulic Unit

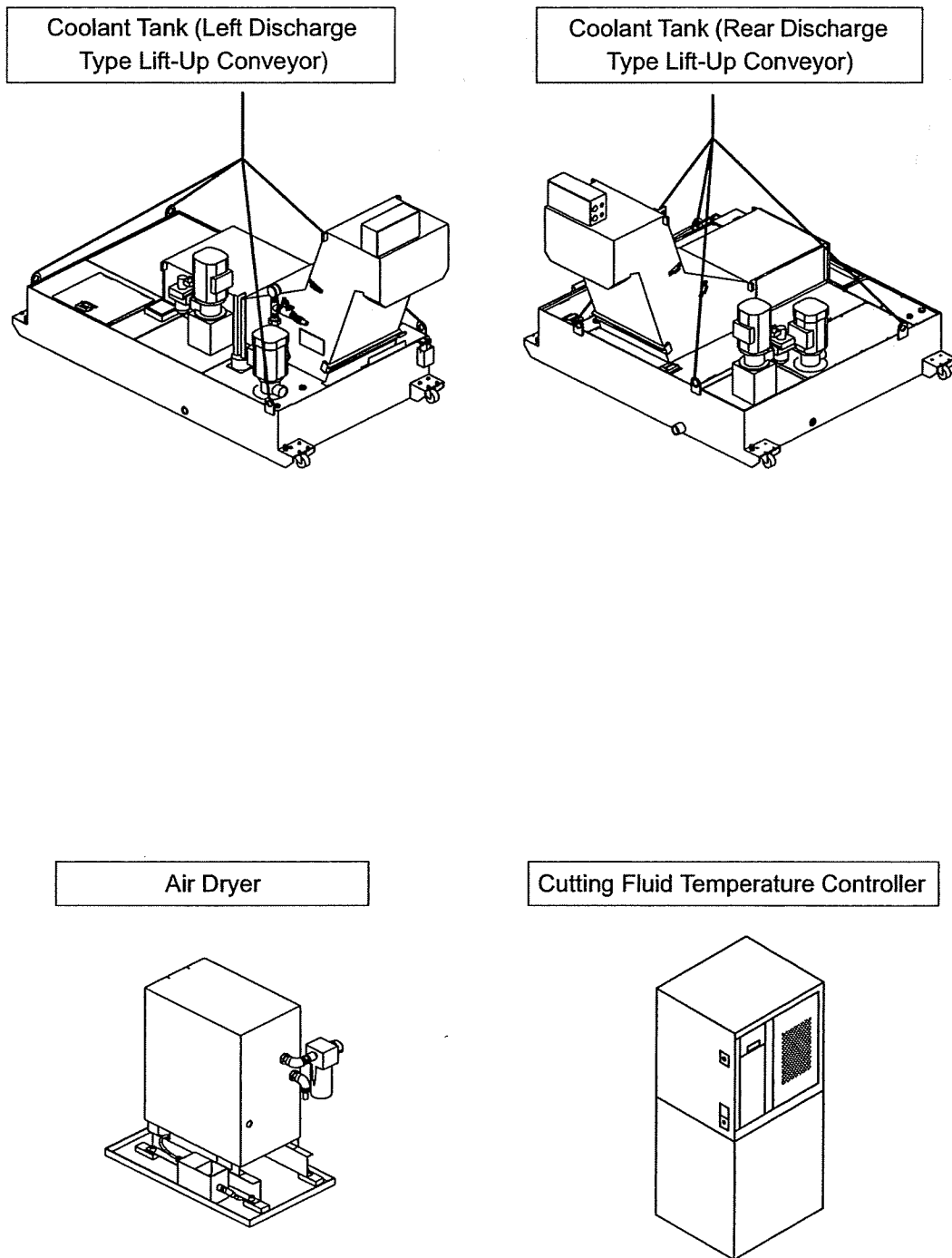






Figure 4.4 Placing of Peripheral Device: Coolant Tank, Air Dryer and Cutting Fluid Temperature Controller

5 Tool Magazine Installation

5.1 Outline

Install the tool magazine unit after installation of the main machine.

The installation procedure differs depending upon the type of tool magazine provided. Install the tool magazine according to the applicable tool magazine installation procedure.

- Tool Magazine A40 (Ring)  "5.2.1 Tool Magazine Installation (A40)"
- Tool Magazine A60 (Ring)  "5.2.2 Tool Magazine Installation (A60)"
- Tool Magazine A97/A137 (Matrix)  "5.3 Tool Magazine A97/A137 (Matrix) Installation"
- Tool Magazine A186 or Above (Matrix)  "5.4 Tool Magazine A186 or Above (Matrix) Installation"

For the tool magazine set-up position, refer to the following figures in "2.2 Preparation of Set-Up Area"

- a81 Tool Magazine A40  Figure 2.2
- a81 Tool Magazine A60  Figure 2.4
- a81 Tool Magazine A97/A137  Figure 2.6
- a81 Tool Magazine A186 or Above  Figure 2.8
- a82 Tool Magazine A40  Figure 2.10
- a82 Tool Magazine A60  Figure 2.12
- a82 Tool Magazine A97/A137  Figure 2.14
- a82 Tool Magazine A186 or Above  Figure 2.16